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The restorative effects of a plant enriched environment on employee performance in the workplace

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Chapter One: Introduction and Literature Review

1.1 Introduction

In order to design an effective working environment which enables employees to perform at optimum levels, it is important to examine the employee's workspace and how their surroundings may impact them and their performance levels (Bakker & Van Der Voordt, 2010). Three studies have been conducted within South Africa over the last few years between 2016 and 2017 regarding the impact of indoor plants on organisational outcomes such as employee well-being, work engagement and performance outcomes within South Africa. These studies have referred to the many benefits that indoor plants have had in improving employee engagement (Kalantzis, 2016), task engagement (Adamson, 2017) and air quality (Bloch, 2017). These studies provide a basis of literature conducted within South Africa and serve as a framework for the use of indoor plants for a South African population. However, it is important provide evidence which serve as a framework for the use of indoor plants in a South African organisational context on employee performance, as this has not yet been researched extensively with enough justification. The individual factors that may impact an organisation are of interest to Industrial Psychologists, with concern regarding the effect of environmental influences such as indoor plants, of increasing concern (Claudio, 2011). Therefore, the impact that indoor plants may have on organisational outcomes, such as those related to performance are important to consider. As concrete evidence for the use of indoor plants in the South African workplace may provide sufficient justification for a safe, and easy intervention to be incorporated into the organisation to increase performance, as shown in the results from Adamson (2017). Therefore, this research study will offer insight into the impact that the intervention of plants into the work environment of a South African workforce may have.

With the fourth industrial revolution, employees are having to change the way they work to accommodate new technological advances (Schwab, 2017). This reliance on technology for employees to operate may cause strain and it has been suggested that working on a computer for an extended period of time can cause mental fatigue, which increases the need for psychological restoration (Evensen, Raanaas, Hagerhall, Johansson & Patil, 2011). This is especially relevant for the current research study as the sample of participants are from a corporate organisation and form part of the Operations Consultancy (OPS) department that depend on their computers to close transactions throughout the working day. Therefore, this suggests that employees within this research study may be fatigued and stressed and in need of

psychological restoration. Contact with nature and natural elements have, according to Hartig, van den Berg, Tomalek, Bauer, Hansman and Waaseth (2011), the ability to psychologically restore employees and serves as a justification for the implementation of indoor plants in the OPS department of the organisation.

1.2 Literature Review

1.2.1 Introduction

In this literature review, concepts related to the current research will be explained and expanded upon. Theoretical frameworks for the current study will be discussed with relevance to indoor plants in the promotion of employee effectiveness while at work. Concepts that will be covered in this literature review include the *Biophilia Hypothesis* in support of indoor plants in the workplace, the psychological benefits of indoor plants in the workplace, The Attention Restoration Theory and indoor plants in the workplace, nature identity and indoor plants in the workplace, the South African context of indoor plants in the workplace, error rates, performance and indoor plants in the workplace, work engagement and indoor plants in the workplace, inconclusive results related to indoor plants in the workplace, and art pictures in the workplace. The terms for the variables used in the current study for error rates and performance, perceived performance, work engagement and nature identity will be explained and highlighted prior to exploring the research hypotheses for the current research study.

1.2.2 The Biophilia Hypothesis in support of indoor plants in the workplace

Support for enriched workplaces have been seen to be on the rise in literature with studies such as Adamson (2017) demonstrating that indoor plants, or enriched workspaces are valuable in the promotion of performance outcomes. Adamson's (2017) study established that in the presence of plants, one can increase their performance on tasks, and that overall, having indoor plants in one's place of work is beneficial to not only a person's work performance, but also their psyche while doing tasks. However, in today's society people in corporate working environments are becoming more isolated from natural environments and the multiple benefits derived from them (Campbell & Wiesen, 2011). Campbell and Wiesen (2011) suggest that there are many benefits that nature provides and that through the human desire to have contact with nature and its environment in the contemporary workplace; an interconnected attraction between nature and humanity is offered in response. This refers to the phenomena known as the *Biophilia Hypothesis* which is explained as a love of nature and is suggestive of the bond

between natural systems and humans (Wilson, 1984). This concept is indicative of the biophilic design which is the human desire to connect with nature in contemporary built environments (Wilson, 1984). From this design, Campbell and Wiesen (2011) infer the positive impact that the relationship between nature and humans may have on the success of an employee and other psychological implications, such as happiness, within their role at work.

Indoor plants have been defined by Bringslimark, Hartig and Patil (2006) as plants that are generally potted, that vary in size and are designed to grow indoors. Indoor plants are not a new concept but the benefits that they may have on people within the environment that the plants are present deserves more attention within the literature (Bringslimark et al., 2006). This is because organisations are resource efficient businesses that focus on high profit by employing skilled workers to do their job effectively to meet the organisation's bottom line. Therefore, indoor plants are not seen as economic necessities that support the investment of employee performance, but rather as unnecessary luxuries (Bringslimark et al., 2006). In order to curb the complaints by workers of small office cubicles and defined working areas that have been shown to be less effective; organisations have taken to adopting open-plan workplace designs and have attempted to make office spaces more comfortable with the addition of climate control, and other more advanced restructuring by improving technology (Bergs, 2015). However, according to Bergs (2015), the actual buildings have failed in adequately adapting to follow this trend. This is especially poignant with the introduction of the fourth industrial revolution that is blurring the lines between the physical and the technological (Schwab, 2017). The shift away from routine work to tasks that require continued concentration and a spatial workplace that is designed to incorporate additional equipment into the workspace to ensure that the organisation is in line with consumer demands is being promoted (Schwab, 2017). This demand for longer and more rigorous levels of concentration from employees in a more corporate environment might explain the desire for the biophilic design in workplaces to endorse natural elements that promote beneficial performance outcomes (Schwab, 2017).

According to Thatcher (2013) 'green ergonomics', or the interconnectedness between humans and nature, is explored through the use of natural elements within places of work to facilitate performance. This concept allows horticulturalists the opportunity to create natural settings in offices (Ellison, 2013). As a large percentage of the population spends frequent time in their industrial workplaces (Kaplan, 1993), it would be beneficial in support of biophilic design to explore the possible benefits that a natural setting may have in a corporate environment on

employee performance. Previous studies, such as the one by Conklin (1978) showed that after indoor plants were installed into the employees' place of work, morale increased. Increased morale could have relative benefits for organisational performance as happy employees are said to be more productive employees (Zelenski, Murphy & Jenkins, 2008). Studies by researchers such as Ulrich and Parsons (1992) have shown the positive influence that indoor plants had on people's stress relief after plants were installed into the participants' surroundings. Other researchers concluded that a 10-15% increase in employee performance after indoor plants was present in the workspace (Scrivens, 1980). The same was seen for a study by Lohr, Pearson-Mims and Goodwin (1996) who saw a 12% increase after the installation of indoor plants into the employees' working environment.

The promotion for indoor plants in the work environment is, according to Burchett, Torpy and Tarran (2013), a concept of importance through greening the indoors, considering that employees spend a substantial amount of time in their workplace. Studies propose that the implementation of indoor plants into the workplace significantly reduces symptoms of ill feeling such as headaches and fatigue by 23% (Fjeld, Veiersted, Sandvik, Riise & Levy, 1998). This suggests that indoor plants may be a beneficial factor in the promotion of attention restoration and in the decrease of sick leave due to ill feelings associated with Sick Building Syndrome which may reduce employee performance (Fjeld et al., 1998). Sick Building Syndrome affects employees in their working environments with ill feelings such as headaches and other physiological problems due to physically stressful factors that are present, for example, poor ventilation (Fang, Wyon, Clausen & Fanger, 2002). Once plants were included in the workplace of employees, Fjeld and colleagues (1998) found that complaints related to fatigue were significantly lessened by 30-37%. This suggests that the inclusion of indoor plants into the workspace of employees may help to improve employee health and decrease ill feelings related to discomfort and fatigue after implementation (Fjeld et al., 1998).

1.2.3 The psychological benefits of indoor plants in the workplace

Keyes (2013) suggests that the most significant form of human capital is a healthy employee. Health is defined as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (WHO, 1947, p. 1). According to Bryson, Forth and Stokes (2015), employee well-being is essential for workers to maintain their day-to-day functions while at work without fatigue and stress which inhibits their performance. Therefore,

physiological and psychological health is an important factor to consider in the promotion of an effective workforce (Bryson et al., 2015).

Sick Building Syndrome is a phenomenon which has negative connotations for employees in the workplace and was introduced when air conditioners were first installed into offices and would account for poor ventilation. This was because windows were being closed to allow for the airconditioned air to flow freely through the workspace which accounted for an increase of indoor pollutants in the air which resulted in employee's complaining of symptoms related to illness (Smith & Pitt, 2011). Ill-like symptoms related to Sick Building Syndrome include mental fatigue and headaches and are said to alleviate once an employee has left the office building (Rooley, 1997). This is an important factor to consider as well-being in an organisation may directly affect the satisfaction of the employees, leading to an impact on employee effectiveness while at work and can have relative implications for absenteeism and poor employee performance (Rooley, 1997).

The psychological well-being of employees is just as crucial for effective engagement while at work. Mental well-being can be characterised through the key indication of life satisfaction and is said to promote positive functioning according to Andrews and Whitney (1976). Mental health can be defined as "a state of well-being in which the individual realises his or her own abilities, they can cope with the normal stresses of life, they can work productively and fruitfully, and they are able to make a contribution to his or her community" (WHO, 2001, p.1). With mental health contributing to many performance factors, organisations have been seen to place more of an emphasis on the psychological well-being of employees (Wargocki, Wyon, Baik, Clausen & Fanger, 1999). There has shown to be increasing evidence for the biophilia design and the positive influence that it may have in reducing employee stress and anxiety while improving performance, presenteeism, motivation, and work engagement (Wargocki et al., 1999).

Fjeld (2000) conducted a study that measured the impact that indoor plants had on the well-being of participants in three separate environments, including one among office workers. As was done in this research study, Fjeld (2000) measured participants on a no plants condition and an implemented plants condition. Fjeld (2000) found that when plants were installed in the office, as well as the other two environments, there was an increase in participant well-being. On average, office workers in the study showed a 22% decrease in psychological symptoms (i.e. fatigue) and a 16% decrease in concentration problems (Fjeld, 2000). Therefore, this

suggested that indoor plants in the workplace were able to directly impact the psychological restoration of employees (Fjeld, 2000). Specific biophilia designs that are usually disregarded by organisations can be seen to be linked to employee well-being which can influence employee performance and overall, can have a positive impact on the organisation (Kjellgren & Buhrkall, 2010).

1.2.4 The Attention Restoration Theory and indoor plants in the workplace

According to Hartig and colleagues (2011) psychological restoration can be explained when depleted psychological resources are replenished with the aid of a natural environment due to the restorative qualities of nature. The *Stress Recovery Theory* (SRT) suggests that an interaction with a nature-like setting will decrease the amount of time it may take for an individual to recuperate from a stressful experience (Bratman, Hamilton, & Daily, 2012). The concept is that humans have spent majority of their lives on earth, in close proximity to nature (Sullivan & Kaplan, 2016). This is referred to as a "life-long camping trip" according to Sullivan and Kaplan (2016, p. 7). Therefore, given the impact that nature has had in shaping our species, "humans are predisposed to resonate with natural elements", which can decrease stress when a natural environment is occupied (Sullivan & Kaplan, 2016, p. 7). This is through contact with nature, in which humans generate a moderately fast emotion response in their brains at a subconscious level that can be evaluated through their psychological pathways (Sullivan & Kaplan, 2016). Therefore, by spending time in a green space, may help people recuperate from a demanding experience (i.e., performing a speech). The *Attention Restoration Theory* (ART) is in line with the *Stress Recovery Theory* but rather, the *Attention Restoration Theory* suggests that an interaction with nature helps individuals recover from psychological fatigue (Sullivan & Kaplan, 2016). However, an individual working in a corporate environment, may not only be subject to stress, but may also be mentally fatigued (Sullivan & Kaplan, 2016). Mental fatigue may leave a person feeling worn out, depleted and subject to burnout which may have negative consequences for the organisation with employees taking more leave days, or not producing work that is of a high standard (Sullivan & Kaplan, 2016). Therefore, the *Attention Restoration Theory* will be used as the theoretical framework for the current study as the employees within the OPS department can be characterised as subject to stress due to the organisational demands and may also be mentally fatigued due to the complexity of the problems that they resolve are subject to mental fatigue daily. This is

supported by the link among green spaces and increased performance of employees in large organisations (Sullivan, 2015).

The *Attention Restoration Theory* proposes that under amplified demands for attention, a person's capacity to direct attention may become fatigued (Tennessen & Cimprich, 1995). Psychological restoration, according to Ulrich (1984), occurs in the presence of natural environments and therefore, Tennessen and Cimprich (1995) argue that the *Attention Restoration Theory* may describe the positive impact of natural contexts on individuals. Once people experience fatigue, attentional restoration must occur in order for the individual to return to an effectively functioning state (Tennessen & Cimprich, 1995). This process refers to the renewing or refreshing of mental and physical capabilities (Ulrich, 1984). An attentional restoration experience can occur through natural environments such as an individual looking at nature (Tennessen & Cimprich, 1995; Ulrich, 1984). This gives rise to positive affect in individuals which can block the adverse effect experienced from the energy involved in restraining rival influences; therefore, as capabilities are renewed, previously depleted abilities are restored (Ulrich, 1984).

In line with this, Kaplan (1995) explains that the *Attention Restoration Theory* is understood through the cognitive benefits that are provided by nature and natural environments. Environments that are filled with plants are less complex environments and to pay attention to something, a person must be able to block out competing exterior demands (Sullivan & Kaplan, 2016). The mechanism in an individual's brain which blocks these distractions, weakens from use, and it increasingly difficult for a person to focus, make decisions, and remain at ease (Sullivan & Kaplan, 2016). However, according to the *Attention Restoration Theory*, having a view of a natural setting, or even being in a natural space for a short time, can "restore a person's capacity to focus because it provides the mechanism necessary to block distractions with the opportunity to rest, and restore" (Sullivan & Kaplan, 2016, p. 7). Several studies refer to the restorative effect of plants using the *Attention Restoration Theory.* One such study is by Larsen, Adams, Deal, Kweon and Tyler (1998); whereby participants reported higher levels of positive mood, such as positive feelings of affect. Perceived office attractiveness, as well as perceived physical comfort in the presence of plants as opposed to those in the no plants condition (Larsen et al., 1998). The *Attention Restoration Theory* argues that if a person spends time in, or views nature, their concentration should improve and mental fatigue should be reduced (Kaplan, 1995). Therefore, that concertation can be restored within nature-like settings

(Kaplan, 1995). A study by Bringslimark, Patil and Hartig (2006) found this to be true in the case of their research in that the presence of indoor plants led to restorative effects from fatigue for their participants. Lohr and colleagues (1996) found similar results in that contact with plants in their study had a restorative effect on the participants, with some claiming that the plants also had a calming effect. Raanas and colleagues (2011) found that participants who were assigned to the condition with plants present, as opposed to the no plant condition, improved their performance when plants were implemented into their environment. The participants in the plant condition had improved attention capacity which allowed for enhanced performance (Raanass et al., 2011). This was because the plants led to initial restoration from their earlier activities which allowed for their attention capacity to increase. These outcomes are described through the *Attention Restoration Theory* (Raanaas et al., 2011).

Plants may have a calming effect, as according to Kaplan (1995), natural environments do not draw attention through required effort, but rather that nature stimulates involuntary attention which, due to its aesthetic qualities, provides a fascination and an effortless distraction, which is restorative. This effect was seen in a study done by Han (2009) who found that participants in a room with the implementation of indoor plants had immediate and greater feelings of comfort, pleasantness, and preference for the plant room, than those in the no plant group. Those in the plants room experienced significantly fewer days sick leave as compared to the participants from the no plants group and fewer punishment records due to misbehaviour (Han, 2009). This may be understood by the theory as it suggests that natural environments can enable people to divert their attention elsewhere, past stressors, to concentrate and recharge attention, which is evidence that the presence of plants can lead to conclusions related to improved performance (Kaplan, 1995). A study by Fjeld (2000) demonstrated that discomfort, referred to as being uncomfortable, and the symptoms related to it such as pain and decreased concentration, were approximately 25% lower in participants in environments that were enriched with plants. Bringslimark, Patil and Hartig (2006) drew similar conclusions from their study in that indoor plants had the capability to produce health benefits within employees, such as reducing headaches and counteracting the effects of fatigue. These improved health benefits had the potential to improve performance in employees as improved health outcomes by indoor plants within the office environment means that fewer employees are taking sick leave due to health-related symptoms (Bringslimark et al., 2006). Therefore, these studies explore the restorative effects of indoor plants on employee effectiveness by creating enriched environments which generate optimal conditions for enhanced performance when doing work

tasks. The World Green Building Council (2015) suggest that the workplace is made up of factors that may influence this, as how employees perceive their workplace is important and include that biophilia and views on the outdoors, indoor plants and connectedness to nature are essential factors in employee satisfaction while at work. This is because Larsen and colleagues (1998) suggest that these factors are believed to have an impact on the attitudes of employees, their satisfaction, and ultimately, the employees performance and behaviour while doing work tasks.

The *Attention Restoration Theory*, according to Kaplan (1995), explains that people will experience improved attention after spending time in, or viewing nature. Therefore, the implementation of indoor plants into the work environment (enriched environment) of the treatment group, should, according to the theory, increase the employee's concentration and reduce the mental fatigue of employees because of their physical surroundings and consequently, should have a positive impact on their effectiveness while at work (Kaplan, 1995). This is explained through the theory as essentially, individuals in richer, more stimulating natural environments will have increased rates of cognitive functioning, leading to increased brain activity, resulting in higher concentration and better performance outcomes (Kaplan, 1996).

As employees within organisations continuously demand attention to do difficult tasks at work, the *Attention Restoration Theory* suggests that employees can restore their mental abilities in natural environments in order to improve and increase concentration to do work tasks more effectively (Kaplan, 1995). Therefore, the *Attention Restoration Theory* relies on the environment's potential to restore and on the capacity for the individual to receive the restorative effect (Van den Berg, Koole & Van der Wulp, 2003). This is done through their level of concern for the environment or how they may relate to the natural environment around them (Restall & Conrad, 2015). This may have interesting results for a nature orientated sample in South Africa regarding the level of nature identity and the impact of plants (Adamson, 2017). This is especially relevant as not everyone may have a favourable outlook towards plants and other natural elements (Adamson, 2017).

1.2.5 Nature identity and indoor plants in the workplace

Nature identity, according to Restall and Conrad (2015) is referred to as the way in which individuals relate to the natural environment around them. This also defines the importance of

the relationship that may be formed with nature. Kalantzis (2016) refers to nature identity as an "emotional affinity towards nature" (p. 27). Therefore, whether a person identifies with nature has an impact on the relationship that is formed between plants and humans (Morton, Van der Bles & Haslam, 2017). Burchett and colleagues (2008) argue that humans have an inborn need to connect with nature and therefore, environments should be designed in order to accommodate their belief. Thatcher (2013) argues that nature may facilitate well-being and performance as the design around humans and nature, referred to as "green ergonomics", or having nature contact (such as contact with plants within a workplace) does have an impact on increasing performance levels. Knight and Haslam (2010) argued that within their study, nature identity had a central influence as an extraneous variable. For this reason, nature identity was investigated in this research study, to further investigate the influence on how individuals may experience performance when plants are present. Nature identity is described as the way individuals associate with nature as well as defines the importance of the relationships that may be formed with natural environments (Restall & Conrad, 2015). However, according to Adamson (2017, p.23) "individuals may identify with these views and feel connected to nature, or they may not identify with these views, which will influence how they experience performance and related outcomes when plants are present".

Adamson (2017) argues that individuals may identify and feel connected to nature, or they may not. Therefore, as mentioned earlier, there may be distinctions within different contexts and so an individual's perceived capability to receive the restorative outcome may be influenced by their nature identity. Shibata and Suzuki (2004) argue that task performance in their study was heavily influenced by the participants' evaluation about the plants (Shibata & Suzuki, 2004). The participants who had a positive reaction to the implementation showed higher levels of task performance as opposed to those who had a negative reaction to the presence of plants in their work environment (Shibata & Suzuki, 2004). Therefore, participants in this research study who have a high nature identity may identify with the indoor plants in a more positive way than those who have a low nature identity. This means that they may allow the restorative effects of the plants to restore their mental capability as they are more open to its benefits. This may influence the results as a person with a high nature identity may be more open to having the plants in their workspace, hence they would have a positive response to the plants in their work environment (Sullivan, 2015). Therefore, the people with high nature identity would have increased positive affect or more positive feelings towards the plants than those with a low

nature identity who may see the plants as distracting, and this could influence their performance outcomes (Adamson, 2017).

Just seeing a plant or viewing nature has been found by Knight and Haslam (2010) to increase well-being. Knight and Haslam (2010) found that instead of lean offices, which are devoid of distractions, it is rather an enriched workspace, with plants or art, that boosts performance and happiness. The desire for increased performance within the workplace through enriching employee's workspaces through plants or natural elements such as pictures of plants, is increasing worldwide (Evensen, Raanaas, Hagerhall, Johansson & Patil, 2015). The reason for this is because literature suggests that plants increase the performance of individuals within an organisation (Bringslimark, Patil & Hartig, 2006).

A one-dimensional scale was developed by Mayer and Franz (2004) referred to as the *Connectedness to Nature Scale* (CNS) which measures how individuals relate to the natural environment. Nature identity and connectedness to nature will be treated synonymously within this study as they both emphasise an individual's relation to the natural environment. A study in support of this theory was completed by the scale developers Mayer and Franz (2004). They found that participants who had a high connectedness to nature, were more content in the presence of nature and were more likely to feel satisfied with life (Mayer & Franz, 2004). This is understood by Restall and Conrad (2015), who argue that individuals may benefit from exposure to nature, as humans have an intrinsic need to connect and feel connected to the natural environment around them. Therefore, it is expected that nature identity will have an influence on the outcomes that the indoor plants may have within this study (Adamson, 2017). Adamson (2017, p.24) suggests that "it is predicted that nature identity will amplify the relationship between the presence of plants and performance when nature identity is high and have the opposite effect when nature identity is low". However, in Adamson's (2017) study, it was found that nature identity did not moderate the relationship between the indoor plants and the different outcome variables.

Han (2009) argues that in addition to the aesthetic and psychological mechanisms that contribute to the restoration of the participants in the plants group, that there may be other factors at work. Han (2009) reported that restorative potential differs, based on the natural environment that is presented to the individual. This suggests that because of the high level of stressors evident in the workplace, employees are likely to have attention fatigue and depleted mood states, which in turn, may have adverse effects on their performance. Therefore, when

an employees' restorative potential is low, the influence of the natural environment to restore their mental capability is dependent or influenced by the employee's preference towards the natural environment, which is mediated by psychological states such as mood and attention (Purani & Kumar, 2018). This suggests that employees will be more open to the restorative effects of the natural environment when they are more responsive to it, especially in contexts where they may seek the value of the restorative effect when their mood states are depleted (Purani & Kumar, 2018).

The literature that has been conducted on the human-nature relationship is mostly interested in the way people identify with nature and the relationship that may be formed (Restall & Conrad, 2015). This suggests that a relationship with nature is understood to influence the physical, mental, and overall well-being of an individual as nature is beneficial when exposed to it (Tauber, 2012). Therefore, understanding the relationship an individual has with nature and how this may influence a person's values and attitudes may offer insights into how nature and natural elements may influence a person and their behaviour (Restall & Conrad, 2015). These feelings towards nature may underlie a person's reaction to their workplace setting and have an influence of their feelings of their community and the work they do (Schultz, 2002).

For this research study, the types of indoor plants were carefully selected by horticulturalists at Execuflora to ensure that they were suitable for the context of the organisation used in the study. This was with regards to the quantity of plants, types of plants that were used, and the positioning of the plants within the workspace. This was done to meet the requirements of indoor plants that are non-flowering as they are believed to have the restorative potential to benefit the employees in their performance outcomes once installed. This will be discussed further in the materials section of this paper. Connectedness to nature has been added in the current study as a moderator variable to evaluate the relationship between the presence, or absence of indoor plants, and how this may influence the dependent variables within the current study. The variable was added due to the evidence provided by Atchley, Strayer and Atchley (2012) that explain that nature has an important role in how people feel, think and ultimately, behave.

1.2.6 The South African context of indoor plants in the workplace

South Africa is a diverse population filled with different languages and cultures and a workforce that consists of employees that share commonalities between Ubuntu, to individual

differences such as personality (Webster & Von Holdt, 2005). With such a varied workforce and with every employee being a unique individual within the organisation, it would be beneficial to design a workplace that meets the needs of every employee, especially if that intervention is designed to suit the needs of the South African employee, compared to those of the European and American workforce. South Africa is home to a 'rainbow nation' and has a culture that is known for its ethnic and cultural diversity, including many different religions and cultures and is a nation that is embedded in history and heritage (Adamson, 2017). From the cultural diversity evident in South African organisations, South African employees engage with a variety of different people each day. This urges people within the workforce to become adaptable to many contexts of people (Webster & Von Holdt, 2005). This is especially true since the transformation of the country after the abolishment of Apartheid in 1994, whereby the integration of languages, cultures and notions for how businesses should be designed to cater to every individual became evident (Webster & Von Holdt, 2005). Understanding that South Africa is comprised of all these different influences is essential for helping South African businesses understand the best way to promote an organisational environment that is beneficial to both the employer and the employee.

South Africa is a unique country, bursting with natural surroundings. This may have an impact on the way that South African employees perceive natural elements, such as plants, in their work environment as they have been predisposed to these natural environments on a regular basis (Borel-Saladin & Turok, 2013). The nature identity of a South African employee may be unique because of their background, culture, and surroundings. This could have an impact on the level of nature identity that individuals experience within South Africa, as nature identity is interested in how people relate to nature (Mayer & Franz, 2004). Leopold, Sewell and Brower (1949) explain that humans have an important relationship with the land that they inhabit and that there is an intrinsic desire by humans to connect to their natural world and therefore, may benefit from nature exposure.

Han (2009) argues that the natural environment may differ in the quantity and type of the plants that are presented and the positioning of those plants within the environment which impacts on the restorative potential on the individual. Therefore, Han (2009) argues that the details of the plants such as placement, number of plants and the type of plants implemented is important in the outcome of the restorative effect. This may also play a vital role in the broader context as the current study is situated in a South African organisation which may lead to different

outcomes, as discussed above; the South African work context is a unique environment. Therefore, there may be distinctions within different contexts, therefore the impact of nature identity will be explored to investigate participants' level of concern for the environment and whether this may influence the outcomes within this study. This is seen in Knight and Haslam's (2017) study which suggested that for future research, an individual's nature identity would be a variable of interest. If this is achieved, there will be supportive evidence aimed at South African organisations for the use of indoor plants within the workplace environment to improve the performance of their employees.

Recently, in South Africa, there has been a transition of many corporate companies 'going green' by including features like indoor plants into the work environment of their employees (Adamson, 2017). Therefore, it is important to understand the relationship between plants, humans and performance to better provide a foundation for the use of indoor plants in the South African work environment. The study is one of the first attempts to empirically investigate the impact of indoor plants on employee performance in a South African work environment of an organisation and its employees.

1.2.7 Error rates, performance and indoor plants in the workplace

Coetzee and Rothmann (2005) argue that employees at higher educational institutions in South Africa spend a substantial amount of time at work; approximately eight hours a day, five days a week (Coetzee & Rothmann, 2005). Therefore, the environment in which employees work has an impact on their well-being and performance. Performance is defined as how well an individual can perform a task measured by specific performance criteria (Adamson, 2017). In order to analyse performance, it is important to consider the environment in which employees operate and the quality of their workspace as this is where employees are expected to be productive (Kamarulzman, Saleh, Hashim, Hashim & Abdul-Ghani, 2011). However, people may have diverse ways of responding to the presence of plants in their work environment due to their background, culture, or early learning experiences (Ulrich, 1984). Therefore, in order to design an effective working environment which enables employees to perform at optimum levels, it is important to examine the employee's work environment and how their surroundings may impact the employees and their performance levels (Bakker & Van Der Voordt, 2010). There has been extensive research conducted in the American and European contexts regarding the effects of indoor plants on performance-based outcomes (Keniger, Gaston, Irvine & Fuller, 2013). However, within the South African context, there is little literature regarding the impact

of indoor plants on the improvement of performance. However, some recent studies have tackled the relationship between indoor plants and performance outcomes in a South African context.

Three studies have been conducted within South Africa over the last few years between 2016 and 2017 regarding the impact of indoor plants on organisational outcomes such as employee well-being, work engagement and performance outcomes. One such study conducted by Bloch (2017) investigated the impact that the presence of indoor plants had on a sample of 34 employees at an organisation within South Africa. The study by Bloch (2017) investigated the relationship between the introduction of indoor plants and the effects that the plants had on the psychological perceptions of the employees such as work engagement, psychological and physical well-being and aesthetics. Environmental factors were also studied such as the effect of the indoor plants on Total Volatile Organic Compounds (TVOCs) which is a grouping of a range of organic chemical compounds present in the ambient air or emissions of the building; e.g. Benzene, and Xylene. Carbon Dioxide levels (CO^2), temperature, and relative humidity were also investigated as to whether the indoor plants had an impact on these factors.

The findings by Bloch (2017) showed that there were no significant differences found for the psychological perceptions from Time 1 (before the implementation of the indoor plants into the work environment) and Time 2 (13 weeks after the implementation). However, the indoor plants were found to have an effect on the environmental quality of the workspace to an extent (Bloch, 2017). Therefore, the research by Bloch (2017) indicates that although the results were not entirely favourable, they did show that the indoor plants had a positive impact on the environmental air quality. These results may provide possible validation for the well-being argument made that ill-related symptoms of fatigue and headaches felt by employees due to indoor air pollutants may be counteracted by the implementation of indoor plants which in turn has relative consequences for the effectiveness of employees while at work.

Kalantzis (2016) conducted research similar to Bloch (2017) with the study conducted in a South African context. The study by Kalantzis (2016) examined the impact that indoor plants had on employee physical and psychological well-being, work engagement and employee's overall perception of their work environment on a sample of 32 employees at an organisation within South Africa. The study by Kalantzis (2016) examined the relationship between plants in the organisation and their outcomes and whether these relationships were moderated by the participants' level of concern for the environment. Air quality such as CO^2 levels, temperature,

relative humidity and TVOCs were also examined to identify whether the plants had an impact on these factors (Kalantzis, 2016). The moderating role of the participants level of concern for the environment was found to not have any effect on the relationship among the presence of the plants and the employees' well-being, engagement and the perception of their work environment (Kalantzis, 2016).

According to the results of the study conducted by Kalantzis (2016), the relationship among the absence and presence of plants and employee engagement was the only relationship that produced statistically significant results. The results showed that the presence of plants within the employees work environment had a negative impact on employee engagement (Kalantzis, 2016). However, as noted, several previous studies have shown that employee performance does improve when indoor plants are present in the workspace (Conklin, 1972, 1978; Jaeger, 1969; Marchant, 1982; Rogers, 1968; Scrivens, 1980; Snyder, 1995; Tresch, 1971; Zandardelli, 1969). Furthermore, Fjeld and colleagues (1998) suggest that as employee engagement increases, so too does their performance. However, it is important to recognise that the study was conducted in a call centre, which has been regarded as a 'toxic' work environment and is not regarded as the 'normal' working conditions among different departments within an organisation (Kalantzis, 2016).

Therefore, upon investigation into the reasoning a statistically significant negative result it was suggested that the time period of the study proved to be a substantial factor in these results (Kalantzis, 2016). The study was conducted over a relatively short period of 12 weeks and was shown to be sensitive to external factors such as a merger that was taking place and issues with management during the time that the study was being conducted (Kalantzis, 2016). It is believed that these occurrences played a role in the overall morale and well-being of the employees and that future research should take into consideration any influential occurrences that may impact the results (Kalantzis, 2016). Also, further research to investigate whether these results are long-term and remain constant over time by conducting a longitudinal study should be considered (Kalantzis, 2016). Length of time the study is an important factor to be considered and therefore, in this research study, a settling period of six months was included after the installation of the indoor plants into the work environment of the employees in order to try and mitigate these concerns.

The third study found was conducted by Adamson (2017) which explored the effect of plants on perceptions of Indoor Environmental Quality (IEQ) as well as the effect of plants on

employee work engagement and the psychological and physical well-being of a sample of 120 participants. These participants were randomly assigned to one of three conditions namely: no plants or pictures of plants, only plants and thirdly, only canvas pictures of plants (Adamson, 2017). The study's design led to increased control as the rooms were standardised, there was IV manipulation and there was a comparison group which strengthened the causal claims made by the study (Adamson, 2017). However, Adamson (2017) suggests that further research within the physical office environment should be done in order to investigate whether the same results are upheld.

Participants in the Adamson (2017) study had to complete two tasks, a card sorting task and a reading task. The results indicated a reduction of participant errors as well as a reduction in task completion time and an increase of positive affect toward the given task. The results also demonstrated a statistically significant positive effect on performance in the plants conditions which was shown to have the greatest impact (Adamson, 2017). In the Adamson (2017) study, nature identity was explored as a possible moderator of this relationship, however, the results demonstrated that nature identity did not affect the relationship of indoor plants and performance. Therefore, in the presence of plants, there was an improvement in the task performance of the South African sample of participants, regardless of their nature identity (Adamson, 2017). Adamson (2017) argued that nature identity was not a moderator variable as nature is a multidimensional construct that incorporates many factors and therefore, it is a challenge to measure every aspect. Adamson (2017) argued that South Africans may have an inherent nature identity due to the culture of the South African population spending time outdoors. Adamson (2017) argued that this may have played a role as the nature identity across all conditions was found to be equal and could have had an impact on the result as nature identity was argued to pre-exist.

These studies provide a basis of literature conducted within South Africa and serve as a framework for the use of indoor plants and the impact that they may have on organisational outcomes, such as those related to performance. Therefore, the research that has been conducted in South Africa provides insight into the perceptions and outcomes related to performance that may prove to be useful when organisations wish to improve the performance output of their employees. This literature is valuable to South African organisations as the research from these studies provides insight into the South African working population. These studies may also provide information around a safe and easy intervention that can be

implemented into the organisation to increase performance, as shown in the results from Adamson (2017). Therefore, this research study hopes to offer insight into the impact that the intervention of plants into the work environment of a South African workforce may have.

The current study, therefore, is essentially a replication of Adamson's (2017). However, the current study differs in that it investigated the actual performance outcomes of employees as well as investigating this in the actual work environment, as opposed to the simulated tasks (i.e. a card sorting task and a reading task) and the laboratory conditions in Adamson's (2017) study. Performance in the current study were operationalised by measured performance outcomes through data provided by the organisation, as well as a self-perceived performance survey which aimed to assess the employees perceived performance over the last month in relation to their full capacity. The measured performance data gained from the organisation were taken from the organisation's performance data six months prior to instalment on the 28th of June 2018. This was compared with performance data taken by the organisation six months after the implementation of the indoor plants and art pictures into the work environment of the employees. Performance data were requested from the organisation over the year of 2018 for each employee on the two floors of: (a) the performance score calculated for the employee each month from January 2018 to December 2018, as well as the (b) error rate for each employee. Performance in the current study is operationalised as the performance score for each employee over each month and were calculated differently by the organisation between the two observed floors. For the first-floor consultants, the performance score was calculated as how much time a consultant should be taking to close the transaction, against a benchmark time which the organisation has previously tracked. For the second floor, for the unit trust consultants, performance is made up of a weighted monthly performance score which was characterised as how many transactions were closed by the consultant for the month. Along with their performance scores, the employees' error rates were also obtained. Error rates are regarded in this research study as the number of total requests an OPS consultant receives, against the number of errors that are made per request.

The exact characteristics that constitute the performance, and error rate scores, and how they were calculated, were not able to be disclosed to the researcher. However, a breakdown and explanation received from the organisation is discussed in the instruments section of this study (See Chapter 2, Section 2.5). When referencing the performance variable in the current study, it will include both the performance, as well as the error rate characteristic even though they

were treated as separate datasets for the purpose of analysis. This study was conducted in the real work context of the Operations Consultant (OPS) department within the organisation, making the performance outcomes of the current research more generalisable to the actual South African work environment. Adamson's (2017) study provided evidence for indoor plants positively affecting performance, with the effect of the presence of indoor plants being statistically significant ($p = 0.000$).

Knight and Haslam's (2010) study obtained similar results to Adamson (2017) in that environments that are enriched with plants can lead to positive outcomes. These include increased performance, improved employee well-being, and enhanced organisational identity (Knight & Haslam, 2010). However, Knight and Haslam's (2010) study did not look at the specific impact that the plants had on the outcomes, as their enriched condition had both plants and pictures of plants and therefore, the independent influence of the plants on the outcomes were difficult to identify. Therefore, further research is needed in this area of the independent effect of plants on improved performance. Adamson (2017) replicated the Knight and Haslam (2010) study and isolated the plant and picture of plants condition to observe their independent influence on the outcomes. Adamson's study found a significant effect on performance in the presence of plants and that the plants condition was significantly different from that of the pictures of plants, and the control condition, with regards to the performance outcomes (2017). In comparison to the lean condition, the plant condition had the greatest impact on performance (Adamson, 2017).

Adamson's (2017) study did show the beneficial outcomes of having indoor plants within an environment on individuals, however, the study was a laboratory-based study and therefore it would be beneficial to essentially replicate the study in an actual office environment as this could add valuable insight into the effects of indoor plants on performance outcomes within a real work context. In Adamson's (2017) study, participants engaged in simulated tasks; a card sorting task and a reading task with each individual working in isolation. Therefore, it would be beneficial to investigate the impact of indoor plants on performance outcomes of multiple employees in their actual work environment, performing their work tasks, as opposed to simulated tasks like those in the Adamson (2017) study.

This is especially relevant as Keniger, Gaston and Fuller (2013) reviewed 57 research studies that have been conducted on the effects of plants and the multiple possible outcomes associated with an enriched environment and found that the majority of the papers that were found on the

subject, were conducted in North American and European contexts. In addition, they argue that there are little to no studies found in Africa about plants and the possible outcomes that plants may have in an office environment on individuals with regards to actual performance ratings (Keniger, Gaston & Fuller, 2013). Within South Africa there have been three studies conducted as mentioned above. It would still however, be beneficial to conduct research in this area especially if the enriched condition is isolated from any other alternative explanations to provide further evidence for the impact of plants on performance outcomes.

Performance is an important factor in any company and improving the performance of employees has beneficial outcomes for the organisation by translating better services into higher profits (Bakker & Van Der Voordt, 2010). Increased performance is beneficial for the employee too, as the higher the performance levels, the higher the likelihood that the organisation will grow and the less the likelihood the organisation will be forced to terminate employment of their employees in order to downsize or to meet their depleted income or quota. This means increased stability for the employee's working in the organisation (Bakker & Van Der Voordt, 2010). This is especially evident as there has been an increase in the drive for organisations to reduce their costs while improving the performance of the overall organisation (Claudio, 2011). Therefore, including indoor plants into the workplace may be a more cost-effective alternative in the promotion of employee effectiveness.

This is propelled by evidence which explains that work-based performance has been seen to increase in the presence of indoor plants (Knight & Haslam, 2010). Mood has also been shown to become more positive in the presence of indoor plants (Shibata & Suzuki, 2004). Therefore, with the numerous benefits shown from previous studies, like improvement of mood, increased engagement and performance outcomes (See Knight & Haslam, 2010; Bakker & Van Der Voordt, 2010; Lohr, Pearson-Mims & Goodwin, 1996; Keniger, Gaston, Irvine & Fuller, 2013) it would be interesting to examine the beneficial outcomes of workplace design for indoor plants within the South African work environment to support these claims. Especially with regards to an environment like South Africa, where every employee is unique and would offer a different insight into the formation of workplace design by including indoor plants into the workspace.

With regards to an employee's perception of their own effectiveness while at work, perceived performance is a valuable variable of interest, however, there are multiple definitions of perceived performance that are present and therefore the current study will be utilising a broad

working definition that is in line with this research. Perceived performance is understood as the extent to which employees appraise the physical environment of the office as supporting their performance (Maarleveld & De Been, 2011). Larsen et al. (1998) found that participants in the plant condition of their research study had increased self-reported perceptions of performance when plants were present in the office space. Perceived performance in this study was examined through a single-item, subjective performing rating that the employees themselves answered in a survey. There are many perceived performance rating batteries that are available, however the one chosen for this research study was developed by Thatcher and Milner (2012). The perceived performance item by Thatcher and Milner (2012) was chosen as the one item scale is believed to capture the same underlying criteria that other longer questionnaires on perceived performance do, but in one question. This is a short, easy and reliable questionnaire that offered perceived performance ratings from the employees at the organisation as to whether the indoor plants had a positive or negative impact on the way that the employees perceived their performance after the implementation and in the presence of the plants.

Knight and Haslam (2010) also argue that performance is a difficult construct to measure. In each study that has been discussed above, there were diverse ways that performance had been assessed. Additionally, there is no standardised method to access performance (Adamson, 2017). This is due to the fact that the aspect of performance that is measured often differs across studies and is reliant on the task under investigation (Neely, Gregory & Platts, 1995). Performance in this research study was done through comparison of superior-rated performance and error rate data received in 2018 from the organisation six months prior to implementation of the indoor plants and compared to performance and error rate data received six months after the implementation. This offered an objective performance review in relation to the influence of the indoor plants on the employee's performance as number of service requests of each employee was requested from the organisation, as well as the employees error rates.

Error rates were included as a study done by Samaranayake and De Silva (2013) provided validation in their research study. Samaranayake and De Silva (2013) studied the perceptions of employees regarding their green workplace environment and its impact on their performance. The study was the first of its kind in Sri Lanka and examined 60 employees overall from two groups: 30 employees from one factory, and 30 employees from a different

factory that had won the platinum award for Leadership in Energy and Environmental Design (LEED) (Samaranayake & De Silva, 2013). LEED is a green building rating system and provides a framework for organisations, homes, and communities to create healthy and highly efficient green buildings (Council, 2011). According to Samaranayake and De Silva (2013), the majority of the employees (70%) had a good understanding of LEED and its practices, although these were mostly from the group of workers whose organisation had won the LEED award. Nevertheless, the employees within the study believed that the introduction of the green environments into the workplace had a good impact on their lives while at work (Samaranayake and De Silva, 2013).

This was seen by the results, as 86% of the employees perceived that their performance had improved once the green building had been established (Samaranayake & De Silva, 2013). Along with this, errors made by the employees were also perceived to be reduced after moving to the LEED building (Samaranayake & De Silva, 2013). This was due to the natural environment and the indoor plants which employees stated had a major impact in reducing their stress levels, while improving their concentration while at work. This consequently reduced the amount of errors made by the employees (Samaranayake & De Silva, 2013). This is perpetuated by the fact that 93% of the employees from each group suggested that their performance had improved after the implementation of the green workplace environment (Samaranayake & De Silva, 2013). More than half of the employees also felt that their absenteeism rate had decreased (Samaranayake & De Silva, 2013). These results are in line with Heath (2006) who argued that an employee's workplace environment has a significant impact on the employee's error rates, level of innovation, absenteeism, and in the reduction of turnover.

1.2.8 Work engagement and indoor plants in the workplace

In order to see whether employees felt more engaged at work after the indoor plants had been installed, their perceived work engagement was investigated to explore whether an enriched environment with indoor plans was shown to increase the employees' work engagement. Work engagement is defined by Robinson, Perryman and Hayday (2004) as "a positive attitude held by the employee towards the organisation and its values. Therefore, an engaged employee is said to be aware of the business context and able to work with colleagues to improve performance within the job for the benefit of the organisation" (p. 6). According to Maslach, Schaufeli and Leiter (2010), a lack of work engagement is likely to cause employees to waste

time on tasks that are irrelevant while putting minimum effort into tasks that are of importance. Therefore, work engagement can be described as the positive demonstration of a person's mental, physical, and emotional state with the outward behaviour of these energies on all levels (Zhang, Gan, & Cham, 2007). Work engagement, according to Schaufeli and Salanova (2007), is "a positive work-related state of fulfilment that is characterised by vigour, dedication and absorption" (p. 701).

Vigour is one of the three sub-constructs of work engagement which is defined as elevated levels of cognitive strength, drive, and vitality an individual has when doing work (Gonzalez-Roma, Schaufeli, Bakker & Lloret (2006). If an individual's levels of vigour are high, they will designate a great deal of energy into completing a challenging task (Schaufeli et al., 2006). Vigour could be seen to be related to performance in that employees will continue to do their work and engage in difficult tasks, even when faced with setbacks.

Dedication in the work context is defined as an individual's high level of importance, pride, passion and motivation when approaching their work (Schaufeli et al., 2006). Dedication is explained as the effective level of involvement whereby an individual is able to express their belief state into an action that will result in a positive outcome and be favourable for the individual (Schaufeli et al., 2006). An example of this is when an employee is proud of their career and the effort that they put into their work. This could be related to performance in that an employee is strongly involved in the work that they engage in as well as in their commitment to the organisation.

Absorption is defined as the level at which an employee is engaged in their work (Schaufeli et al., 2006). In this regard, absorption is described as a state of time passing without notice when an individual is immersed in their work and whereby it is difficult to detach from their work tasks (Schaufeli et al., 2006). Absorption has been represented in literature as a "flow" whereby an employee functions at top concentration levels and is not distracted by anything other than their work (Schaufeli et al., 2006). This is true in the organisational context with employees, as if an employee is engrossed in their work and the work they should do for their job, they are not as easily distracted by external factors which may influence their work performance (Schaufeli et al., 2006). As discussed, work engagement can be defined as a positive and fulfilling state of mind that is characteristic of a work state of vigour, dedication and absorption.

A study by Sonnentag (2003) examined performance outcomes through the use of the UWES and found that the level of work engagement is positively associated with the degree to which employees recovered from their previous day of work. The significance that work engagement can have in an organisation is evident through the positive attitude employees display at work towards their work tasks as well as towards the organisation (Schaufeli & Bakker, 2003). High levels of work engagement can be seen to increase employees job satisfaction at work while increasing levels of employee's commitment to the organisation, which in turn lowers the levels of turnover (Schaufeli & Bakker, 2003).

With the positive organisational behaviour from work engagement, employees are able to demonstrate a more personal initiative which shows an increased desire to learn and illustrates proactive behaviour at work (Schaufeli & Bakker, 2003). It is this proactive behaviour of work engagement that, according to Schaufeli and Bakker (2003), is argued to be positively related to job performance. This was demonstrated in a study conducted by Salanova, Agut and Peiro (2003). The study was conducted using the UWES to explore the work engagement perceptions of 100 hotels and restaurants and their employees in Spain (Salanova et al., 2003). The results from the study showed that increased levels of work engagement had a positive impact on the performance output of the employees which was demonstrated through increased service satisfaction by interviewed customers. This, in turn, had a positive impact on customer satisfaction leading to increased bookings (Salanova, Agut & Peiro, 2003).

Similar results were found in Knight and Haslam's (2010) study. In their study it was found that in the enriched condition, tasks were performed quicker by participants with no reduction in accuracy (Knight & Haslam, 2010). Therefore, Knight and Haslam (2010) argued that in the presence of plants, work performance is increased. Therefore, according to Bringslimark, Patil and Hartig (2006), plants have positive benefits. Adamson (2017) suggests that indoor plants are a "portable, flexible, beautiful, useful and relatively low cost" (p. 431) intervention which can be used in organisations to improve the quality of the environment for employees to increase performance outcomes and other organisational factors through assessing employee's engagement while at work. Therefore, work engagement is a relevant variable to be discussed in this research study with regards to employee's performance outcomes.

1.2.9 Inconclusive results relating to indoor plants in the workplace

Although the literature shows that there are many positive implications for the implementation of indoor plants in employee workplaces, inconsistencies within the literature are still evident. This is since performance is firstly, difficult to measure, and secondly, is measured in a different way for each research study and therefore, to come to a conclusive agreement is challenging. For instance, Adamson's (2017) study demonstrated the impact of the *Attention Restoration Theory* which is being used in this research study and advocates for its use as the participants in the plant's conditions were left alone for five minutes before completion of the simulated tasks. The *Attention Restoration Theory* argues that spending time in, or viewing nature, will lead to an increase in the mental capacity of the person (Kaplan, 1995) and the findings for Adamson's (2017) study advocate for the theoretical reasoning of the theory as the results demonstrated that the time the participants had in the enriched (plants and pictures of plants) conditions, led to initial restoration from their previous activities. Restoration was attained before completion of the simulated tasks conducted for the research study (Adamson, 2017).

Although this evidence points towards a positive impact, other findings show a stark contradiction with literature advocating for lean or empty workplaces which is argued to increase performance (Louis, 2007; Pruijt, 2003; Tapping & Dunn, 2006). It is argued that these spaces do not integrate any distractions that could cause the employees focus to shift (Larsen et al., 1998). This lean workspace would be regarded as the control room with no plants or pictures of plants in the Adamson (2017) study. The results from the Adamson (2017) study however negates the argument made that lean office spaces result in increased performance levels as the findings support the necessity of an enriched environment (plants and pictures of plants conditions), specifically within the presence of plants condition.

Other theories, such as the *Biophilia Hypothesis* by Wilson (1984) have been used to explain the effect of indoor plants on individuals. However, this theory has been critiqued by Joye and De Block (2011) who argue that the evolutionary reasoning behind the *Biophilia Hypothesis* is often unclear and sometimes even inaccurate. They also argue that the findings that do validate the *Biophilia Hypothesis*, can often be accounted for by alternative hypotheses or theories (Joye & De Block, 2011). Therefore, the *Biophilia Hypothesis* lacks a direct explanation for the possible positive effects expected from the presence of plants (Joye & De Block, 2011). The current study will therefore be utilising the *Attention Restoration Theory* to investigate whether

plants in an office context provide restorative effects that enable employees to improve performance (Kaplan, 1995). This theory is able to give a holistic explanation for the impact of plants on humans as there is an emphasis on an accurate explanation for the impact of a natural environment on human capabilities, developed through previous theories (Berman, Jonides & Kaplan, 2008). Therefore, the attention restoration concept of the impact of viewing, or spending time in natural environments is an important element of the current study.

In line with this, indoor plants and the impact that they have in an environment have been seen to produce a multitude of outcomes, from the reduction of stress, to increasing employee morale and performance (Bakker & van der Voordt, 2010). However, there are many contradictory findings that are observed when investigating the human, plant and performance relationship. For example, Lohr, Pearson-Mims and Goodwin's (1996) study found that due to the introduction of foliage plants into the workplace, the performance of employees increased by 12%. However, in Larsen et al. (1998) it was found that although the plants had aesthetic qualities in the plants condition, the performance levels were the lowest of all conditions. Therefore, more information regarding this topic is needed for a comprehensive argument to be made.

Along the same line, when analysing work engagement, the studies that have been done on indoor plants and the impact on work engagement have suggested that work engagement is positively related to performance outcomes with the study by Kalantzis (2016) showing the results within a South African context. The study done by Kalantzis (2016) showed the direct effect of the presence of indoor plants on work engagement in South Africa. The study however found that the presence of indoor plants led to a decrease in work engagement (Kalantzis, 2016). An explanation for this outcome was the length of the research intervention and problems within the organisation that could have resulted in this negative outcome (Kalantzis, 2016). However, in a separate study done by Raanaas et al. (2011) it was seen that improved work engagement was found in the plant condition as opposed to the participants in the no plant condition.

For performance, in Smith and Pitt's (2009) study it was found that there was a general preference for plants in offices. They also found that employees within enriched environments (offices with plants), felt more comfortable, healthier, and creative as well as feeling more productive and feeling less pressure than occupants in non-planted offices, or lean workspaces (Smith & Pitt, 2009). This is because plants in the office environment, according to Shibata

and Suzuki (2004), have increased psychological benefits such as enhancing moods. In contradiction however, a study done by Miyake (2001) explained that 48 out of 120 participants stated that the plants disrupted their work. However, in the same sample, 72 participants stated that they felt rejuvenated by the plants (Miyake, 2001). Therefore, nature identity may be a possible explanation for these findings (Knight & Haslam, 2010). Similarly, a study by Adachi, Rohde and Kendle (2000) found that participants were annoyed by the presence of plants and reported negative effects such as an increase in temper and yet, in another study done by Tennessen and Cimprich (1995), it was found that plants have the ability to restore attention. This is argued within Tennessen and Cimprich's (1995) study as within the plant condition, participant's speed and accuracy in performing the task improved. However, these outcomes may also have been affected by the person's nature identity.

Even though the literature has demonstrated inconsistencies regarding indoor plants on performance outcomes, many of these studies, excluding the Kalantzis (2016) and Adamson (2017) study, were conducted in foreign countries. The Kalantzis (2016) and Adamson (2017) study were conducted in South Africa and therefore, it would not be reasonable to compare the study results from the research conducted in other countries with the results found in the South African context. Therefore, the literature around the topic of indoor plants on performance outcomes should be increased within South Africa so that adequate comparisons are able to be made.

1.2.10 Art pictures in the workplace

In many of the studies that have analysed indoor plants, art pictures or pictures of plants have been included. This is based on the principle that art has aesthetically pleasing qualities that can promote well-being by reducing stress in the workplace (Kweon, Ulrich, Walker, & Tassinary, 2008). This was seen in the study conducted by Kweon and colleagues (2008) who found that a sample of 210 participants were argued to have lower levels of stress when art pictures were present due to a reduction in feelings of anger. It was found in the study that male participants responded with lower levels of anger in comparison to females when the art pictures were present (Kweon et al., 2008).

This can be attributed to the relationship that is evident between visual access to art pictures and the positive attitude that is apparent when art pictures are present (Kweon et al., 2008). Lottrup, Grahn and Stigsdotter (2013) credit these positive feelings to the reduction in stress

levels. A similar study was conducted by Knight and Haslam (2010) who found that when art pictures and indoor plants were combined within the employee's work environment, performance was increased. Although performance was shown to increase, Knight and Haslam (2010) did not asses the individual contribution the art pictures and indoor plants separately so it would be difficult to explain the impact of each independently.

Although art pictures have been shown to be beneficial in the workplace, Bringslimark, Hartig and Patil (2011) found that employees who do not have a view of a natural setting, are more likely to bring plants into their workspace. This can be argued to be due to the desire for people to feel connected to nature (Restall & Conrad, 2015). However, based on the *Attention Restoration Theory* it can be argued that indoor plants have more of a positive impact on individuals than art pictures. This is because art pictures are beneficial more for their aesthetic quality than their ability to cognitively restore, whereas indoor plants are beneficial for their aesthetic as well as their ability to improve the quality of the air, improve concentration, and cognitively restore an employee to perform better on tasks while at work (Adamson, 2017).

However, the creation of enriched environments through indoor plants or art pictures in workplaces could assist companies to create workplace environments that make employees more satisfied while at work. This could create conditions for organisational success. Therefore, this research is important as it was conducted in a real work environment in South Africa, which should lead to beneficial knowledge on the subject. In line with this, the research aims drawn from the rationale for this research study are presented.

1.3 Research Aims

The four main aims of this research were to investigate:

a) The effect of indoor plants on employee performance,
b) The effect of indoor plants on employee's perceived performance,
c) The effect of indoor plants on employee's work engagement and;
d) If nature identity moderates these relationships.

The next section focuses on the hypotheses that are representative of the aims of this research study.

1.4 Hypotheses

1.4.1 Main Hypothesis

1. Indoor plants in the employee's workplace will increase the employee's performance.

1.4.2 Subsequent Hypothesis

2. Indoor plants in the employee's workplace will increase their perceived performance.

3. Indoor plants in the employee's workplace will increase their perceived work engagement.

4. Nature identity moderates the relationship between the experimental condition and performance.

5. Nature identity moderates the relationship between the experimental condition and perceived performance.

6. Nature identity moderates the relationship between the experimental condition and work engagement.

Chapter Two: Methodology

2.1 Introduction

Chapter two introduces the methods that were taken to investigate the relationship between the different variables in the current study. This will include the research design that was undertaken in the current study that will be expanded upon, which will be followed by the description of the sample used for the study, as well as the procedures that were undertaken. The different forms of instruments used to measure the variables and that different types of analyses done to answer the hypotheses will be discussed. The ethical considerations for the current study will also be outlined.

2.2 Research Design

A quantitative quasi-experimental design (Mouton & Babbie, 2001) was conducted to examine the effect of indoor plants on error rates and performance, perceived performance and work engagement on a group of operations consultations within an organisation. Nature identity, as a moderator was examined to identify whether it moderated the relationship between indoor plants and the performance outcomes. There was a treatment group which had indoor plants implemented into their work environment and a contrast group on another floor of the department which had a placebo of pictures of urban and industrial settings placed into their work environment to counter for possible Hawthorne effects. The Hawthorne effect stipulates that due to awareness of being observed, participants may alter their behaviour which may distort the research findings unsuspectingly (Stand, 2000).

These participants were selected since they were housed in an organisation whereby employee performance data from six months prior to the implementation of indoor plants in 2018 could be contrasted with performance data six months after the implementation of the indoor plants in the same year. This was done in order to identify whether the intervention of the plants made an impact on the employee's performance. The organisation was available and willing to offer their employees to volunteer to participate and were interested in the nature of plants in the workplace. Therefore, they were the viable option for inclusion in the current study.

The data was analysed using inferential statistics to investigate associations and differences between the two groups. The research design for this study is descriptive and exploratory in nature as it attempts to describe the impact of indoor plants on employee performance in the workplace (Stangor, 2014). The study is a quasi-experimental longitudinal research design as there was a contrast group and there was manipulation of the independent variable. This is due to the fact that indoor plants were added to one floor to determine whether they had an impact on the performance outcomes of the employees. However, there was no random assignment of participants to conditions as this was not possible within the organisation (Leedy & Ormond, 2005). The treatment group was characteristic of a set of employees from one floor of the department, with the comparison group characteristic of a set of employees from a different floor of the same department within the organisation. Therefore, random assignment was not possible as the researcher was not able to randomise the employees to different groups. The intervention was longitudinal in nature as the performance data was analysed over a year.

There was a settling period of three months after the plants were installed before the survey was administered. This was for the initial stimuli from the plants to reduce so that the focus was not on whether the employees noticed the implementation, but rather if the plants had a definite impact on their perceived performance, and work engagement, or not. After three months a short survey was administered to both groups in which information was asked regarding their perceived performance, work engagement and nature identity. Some biographical information was also asked for descriptive purposes. Performance data were requested from the organisation over the year of 2018 for each employee in the two areas of: (a) error rate for each employee, as well as (b) the performance score calculated for the employee each month from January 2018 to December 2018. This design therefore allowed the type of questions given for this research study to be answered effectively and was aimed at examining whether there were relationships that exist between the variables that were investigated. The sample used for the current research will be discussed in the next section.

2.3 Sample and Sampling

The sampling technique for the current study was non-probability, convenience sampling as the organisation selected the department to be used for the current research. The department that the study was conducted in was the Operations Consultants (OPS) department within the organisation. The sample was taken from two floors of the OPS department at the organisation. The OPS department consists of operations consultants that handle queries from customers and capture data requests. The department is made up of two subdivisions, namely the products floor which had the inclusion of the indoor plants, and the unit trust floor which had the inclusion of the placebo of art pictures. Essentially the OPS department functions as a call centre environment with consultants handling client queries through the processing and authorisation of transactions from clients which are logged onto the system. There are approximately 240 employees that work in the OPS department of the organisation.

Floor one, which is the products floor of the organisation, was characterised as the treatment group with the inclusion of the indoor plants into the work environment of the employees. The second floor characterised the contrast group with the addition of a placebo to counteract possible Hawthorne effects with the implementation of art pictures of industrial settings into their workspace.

150-200 participants is an appropriate sample size from the OPS department (Van Voorhis & Morgan, 2007). The aim of the current study was to have 30 or more participants per group to strengthen the results as this is in line with the Central Limit Theory which argues that a representative sample size should be above 30 per group (Howell, 2016). The sample size for this research study was expected to be approximately 240 employees overall; 120 employees from the first floor of the OPS department as the treatment group and 120 employees from the second floor of the OPS department as the contrast group. However, as participation was voluntary, the researcher was unable to control the amount of survey responses that were completed by the employees. Due to this, only 60 responses to the survey were received from a sample of 240 and after assessing the data, 40 completed surveys were able to be used for analysis. 20 surveys could not be used in the dataset as they were at least 80% incomplete and therefore the total number of surveys considered for analysis was 40.

Demographic data such as age, gender, racial category and years of service in the organisation were obtained from the participants using biographical detail questions. This information was only used for descriptive purposes between the two floors of employees. Participants were invited to participate in the current research study through a Participant Information Sheet (See Appendix A and B) which was presented to the employees within the OPS department. This was through an e-mail which was sent to the employees where a link to the survey was included (See Appendix D).

2.4 Procedure

The procedure to obtain the sample and the data was as follows. Ethical clearance to conduct the research was obtained from the Human Research Ethics Committee of the University of the Witwatersrand prior to the commencement of the study (See Appendix P). Once ethical clearance had been obtained, the researcher approached the relevant organisational gatekeepers to request permission to access the employees at the organisation (See Appendix C). Once permission was granted from the relevant gatekeepers, the researcher provided a proposal of the project plan for the current study to the representatives of the organisation and once approved by the relevant gatekeepers, the researcher collaborated with horticulturalists at Bidvest Execuflora on the choice, number and placement of the indoor plants for implementation on the first floor. Art consultants at Bidvest Execuflora, as well as the organisation and the researcher collaborated to agree on the choice, size, and placement of art pictures on the second floor. These were finalised by both the organisation, the researcher, and

Bidvest Execuflora. Wrapping of the columns on the second floor with pictures of the building was agreed upon to form part of the industrial setting placebo implemented on the second floor. These two floors of the organisation were therefore treated as separate areas for the purpose of the current study.

On the 28th of June 2018, the indoor plants were implemented by Bidvest Execuflora into the work environment of the first floor. The placement of the indoor plants can be seen in the first-floor floor plan of Appendix L. On the same evening, the columns were wrapped with the art pictures on the second floor of the organisation. The placement of the columns that were wrapped with the art pictures are evident in Appendix M. The plants and art pictures were installed during the evening when no employees were present. After a three-month settling period, on the 3rd of October 2018 at 9:00am, the researcher requested the employee's participation in the survey and distributed an e-mail to all employees from both floors in the OPS department inviting them to participate and providing a link through which to complete the survey (See Appendix D). The survey took employees approximately 10 minutes to complete and the procedure for return of the electronic survey was done through the Survey Monkey portal to which only the researcher and research supervisor had access. The survey was made up of all scales from Appendix E-H in which the following information was asked: perceived performance, work engagement and nature identity, with the only exception being that floor one received the Plants in the Workplace Scale (See Appendix I), while the second floor received the Art Pictures in the Workplace Scale (See Appendix J).

Participants were informed of any ethical matters pertaining to the study in the Participant Information Sheet (See Appendix A and B) that was emailed to the employees prior to administering the survey through the link provided. The Participant Information Sheet explained the scope of the study and notified the employees that their employee numbers were requested for the current research. Participants were asked to participate voluntarily in the survey. Employees that chose to participate in this study were asked to complete the distributed electronic scales. To consent to participate in this research study, a consent button was placed before access to the survey was granted on the survey portal. This was done through "Do you agree to these terms." Whereby the participants were asked to click 'yes' or 'no.' If 'yes,' the participant was taken to the survey to be completed. Once complete, participants were asked to submit through the 'submit' button placed at the end of the survey.

The participants informed consent to participate in this research study was deemed to have been given once the 'yes' button was activated and granted them access to the survey to complete on Survey Monkey's portal. In addition, once pushing the 'yes' button, participants that had given consent to participate also gave consent for the anonymised data to be stored for possible use in future studies. This was outlined in the e-mail sent to employees, as well as in the Participant Information Sheet (See Appendix A and B). Once the survey had been accessed by the participant, some biographical information was also asked, but only for describing the sample as a whole. Participants were asked to indicate their employee number which could allow for the performance data collected by the organisation to be linked to the survey data. Only grouped data were reported on in the current study and therefore the participants' responses remained anonymous to the organisation. After the survey data was received, it was exported into Excel where it was cleaned in order to be more appropriate for analyses. Once cleaned, the data was exported into SPSS to begin data analysis.

Performance data of service requests processed per day and error rates per number of service requests were also requested for consultants on both floors. This performance data was requested from the organisation for the full 2018 year so that the researcher could identify the impact the indoor plants had on the employees. The six months prior to implementation of the indoor plants was characterised as the before period (January-June) as the plants were installed on the 28th of June. The six months after installation (July-December) was characterised as the after period. This was done so that the researcher could identify the performance and error rates before implementation and compare it with after to see what impact the plants had made. However, the performance data gained from the organisation was not able to be matched to the surveys that were received from the employees, as the organisation removed employee numbers to conceal the identity of the employees and rather provided a unique participant ID so that the researcher could match employees to their performance data for each month. Therefore, the survey data and performance data gained from the organisation were treated as separate datasets in the current research. The performance data that was received was information that was already held by the organisation. Therefore, performance scores were already known to the organisation as it was used to do their yearly performance reviews. The data were anonymous to the researcher using the unique participant ID's and therefore, the employee performance score was not able to be traced back to any individual employee. The researcher and research supervisor were the only two people who had access to this information, along with the supervisor at the organisation who compiled the data.

The performance data from the organisation was received in Excel format of a performance score and error rate score per employee. However, the information was cleaned by the researcher in order to be more appropriate for analyses. This was to sift out any employees who had been terminated during the study period, along with employees that had too many missing scores each month and could therefore, could not be used in the dataset. The cut off was characterised as at least three data inputs in the before period, and at least three data inputs in the after period to ensure appropriate comparison. This cut off characteristic was used for the performance data and the error rate data which was analysed separately but characterise the overall performance variable. Once cleaned, the data was exported into SPSS to begin data analysis. The scales that were used in the current study will be reported on in the next section.

2.5 Instrumentation

The current study made use of existing scales to assist in the collection of data from the employees. The current study also made use of two self-developed scales, namely the plants in the workplace, and art pictures in the workplace scales. These scales were used in the survey that was sent out to the employees at the organisation three months after the indoor plants and art pictures were implemented. In total, five scales were used in this research study to collect data from the employees at the organisation. For floor one, the participants were asked to complete a survey made up of a biographical detail questions, a perceived performance scale (Thatcher & Milner, 2012), a work engagement scale (Schaufeli et al., 2006), a connectedness to nature scale (Mayer & Franz, 2004), and plants in the workplace scale. For the second floor, the same scales were included in the survey apart from the plants in the workplace scale as the second floor had art pictures implemented on their floor and therefore received the art pictures in the workplace scale. These five scales characterised the survey that was sent to the employees and were chosen in order to assist the researcher in gathering the appropriate data for this research study.

i. Biographical Details Questions (Appendix E)

A set of self-developed questions was included in the survey that was given to the participants. This was done to capture the demographic details that made up the sample. The questions were made up of close-ended questions which requested information about the participant. This included age, gender, ethnicity, employment type and years working in the current organisation. Employee numbers were also asked in order for the researcher to match the

survey data with the performance data provided by the organisation. However, as discussed, this was not able to be done as the organisation provided unique participant ID's for each employee for the performance data and so the survey data was not able to be matched to the performance data. Therefore, in this study the survey and performance data were treated as separate datasets.

ii. Perceived Performance Scale (Appendix F)

The *Perceived Performance Scale* was taken from Thatcher and Milner (2012) who developed the scale. The "scale" is comprised of a single item which assesses perceived performance over the month. This was analysed through a single-item asking: "On a scale of 0-100 percent (where 100% is full capacity), rate how well you have been working over the last month in relation to your full capacity".

iii. Utrecht Work Engagement Scale – Shortened Version (UWES-9) (Appendix G)

The Utretch Work Engagement Scale (UWES-9) was utilised for the current study and is a 9-item work engagement scale that was developed by Schaufeli, Bakker and Salanova in 2006. It is a revised scale of the previously developed 17 item Utretch Work Engagement Scale (UWES) developed by Schaufeli and Bakker (2003). The UWES-9 is characteristic of the same three subscales as the 17-item scale, namely vigour, dedication and absorption and aims to assess the work engagement of employees in an organisation at an individual and group level (Schaufeli & Bakker, 2003). The study by Schaufeli and Bakker (2003) provided useful findings that were able to contribute towards standardising the scale and allowing comparisons to be made. The findings from the UWES-9 scale in this research study will allow managers within organisations, to make better and more informed decisions regarding the use of indoor plants on the effect of work engagement, through the data received.

Work engagement was measured using the *Utrecht Work Engagement Scale – Shortened Version* (UWES-9) which is a self-report scale consisting of 9 items with three subscales namely: vigour (3 items), dedication (3 items) and absorption (3 items) (Schaufeli, Bakker & Salanova, 2006). These items are asked on a 7-point Likert type scale with rating scales that range from 0 (never) to 6 (always) with 0=never, 1=almost never, 2=rarely, 3=sometimes, 4=often, 5=very often, and 6=always. Originally the UWES consisted of 17 items, however, after research was conducted on the validity of the scale, it was found that several of the items

on the scale were unreliable and were therefore excluded (Schaufeli et al., 2006). Therefore, this research study utilised the revised 9 item shortened version of the UWES. All the items within the scale are positively worded and therefore, positively scored so no items had to be reversed scored for the scale. Using a large international database, Schaufeli, Bakker and Salanova (2006) demonstrated that the UWES-9 has psychometric properties similar to those of the original version of the scale with 17 items, with a Cronbach alpha higher than 0.80 across 10 countries, including Norway and Australia (Balducci, Fraccaroli & Shaufeli, 2010).

For the subscales, vigour is represented by three items in the UWES-9 scale, namely: item (1) "At my work, I feel like I am bursting with energy;" item (2) "At my job, I feel strong and vigorous;" and item (5) "When I get up in the morning, I feel like going to work." Dedication is represented by three items in the UWES-9 scale, namely: Item (3) "I am enthusiastic about my job; item (4) "My job inspires me;" and item (7) "I am proud of the work that I do." Absorption is represented by three items in the UWES-9 scale, namely: item (6) "I feel happy when I am working intensely;" item (8) "I am immersed in my job;" and item (9) "I get carried away when I am working." The vigour, dedication and absorption subscales therefore enable an understanding of the underlying dimensions of an employee's work engagement (Schaufeli et al., 2006). Therefore, this scale is important in measuring the work engagement of employees in relation to their performance at work. Internal consistencies were examined in several countries including South Africa and the results showed that the Cronbach Alpha's for these studies were between 0.70 and 0.80 in two of the investigated countries, namely Norway and Australia (Schaufeli et al., 2006). Schaufeli and Bakker (2010) report that the Cronbach Alpha for the shortened version of the UWES including all 9 items varies from 0.89 to 0.97.

iv. Connectedness to Nature Scale (Appendix H)

A revised version of the 14-item *Connectedness to Nature Scale* by Mayer and Frantz (2004) was utilised for this research study to measure whether nature identity moderated the above relationships. This scale is intended to examine the emotional and observed connection that participants have with nature. The response of the scale is done on a 5-point Likert type scale between 1 and 5 where 1=strongly disagree, 2= disagree a little, 3=neutral, 4= agree a little, and 5 = strongly agree. An example of an item from this scale includes: "I often feel a sense of oneness with the natural world around me." The Cronbach Alpha for the original 14 item scale was 0.84 according to Mayer and Franz (2004).

The scale, however, was modified for use in this study as some of the wording of the items in the original scale were found to be too complicated, especially for people who may not be first language English speaking participants. Example items that were removed from the *Connectedness to Nature Scale* include: "I often feel like I am only a small part of the natural world around me, and that I am no more important than the grass on the ground or the birds in the trees" and "I feel that all inhabitants of Earth, human, and nonhuman, share a common life force" with another item that was removed being "I often feel a kinship with animals and plants." After these items were removed, the modified scale that was used in this study contained four items. These were all positively worded, except for item number three which reads: "I often feel disconnected from nature" and was therefore, reversed scored.

Some self-developed items were added by the researcher of questions that directly relate to the plants being implemented and the participants' feeling related to the indoor plants (See Appendix I). This forms the *Plants in the Workplace Scale*.

v. Plants in the Workplace Scale (Appendix I)

This scale was developed for the first floor with the indoor plants implemented into their workspace and includes five questions that look at the impact of plants with one item which served as a manipulation check. This item was: "I notice the plants in my workplace" and served as a manipulation check. A pilot study was conducted which took place in Johannesburg over the course of two weeks in August 2018. The pilot study was conduced at the University of the Witwatersrand in Johannesburg and was selected due to the ease in access to many different scholars and professors and therefore, selection procedures were based on convenience. A total of 13 students and 2 professors participated in the pilot phase of the *Plants in the Workplace Scale*, in which questions related to the plants were included. This was done to ensure that the participants that were selected were representative of various dimensions regarding age, gender, professional experience and qualification. The pilot phase was conducted to develop the instrument *Plants in the Workplace*, for the plant elements that were implemented into the organisation. This was done in order to measure this key variable within the study and to test the scale for use as a manipulation check.

One technique was used in the pilot phase to test the scale, namely a paper and pen survey that was handed out to students and professors within the Humanities Faculty at the University of the Witwatersrand. The *Plants in the Workplace* pilot scale (See Appendix N) were then

collected. The results from the pilot study showed that majority of the participants found the items to be very to somewhat representative of the construct of plants in the workplace with only 2 respondents stating that they found question 2 “I like plants in the workplace because they bring the natural world, inside” only somewhat representative. However, due to the low number of ‘somewhat’ and ‘not’ representative feedback scores, no items were excluded from the scale. Face and content validity were regarded, with majority of the answers given a rating of 5 representing that the overall survey measures reflect the behaviour it intends. Lack of ambiguity and double-barrelled statements were looked at as well as reverse meaning and there seemed to be no problems with any of the items from the scale. Social desirability was regarded with no indication that the scale would be harmful in any way and offensiveness was seen to be very low with a unanimous vote of 1 representing “no harm”. Repetition was taken into account with 4 respondents indicating that question 1: “Plants in the workplace are dirty because they collect dust on their leaves” and question 2: “I dislike plants in the workplace because they bring in insects” to be similar, however as the majority indicated that repetition was low, rating repetition as a 1, these items were not excluded or altered.

The same was done for the art pictures scale to serve as a manipulation check for the second floor. Therefore, an *Art Pictures in the Workplace Scale* was self-developed and piloted for use in this study.

vi. Art Pictures in the Workplace Scale (Appendix J)

The same was done for the art pictures scale to serve as a manipulation check for the second floor which had the art pictures implemented. The *Art Pictures in the Workplace Scale* was self-developed and piloted for use in this study. One of the items added include: “I notice the art pictures in my workplace” and served as a manipulation check. The scale was piloted (See Appendix O) in connection with the *Plants in the Workplace Scale* and therefore, the procedure to pilot the scale is the same as the procedure for the *Plants in the Workplace Scale* above. As in line with the above procedure, 13 students and 2 professors participated in the pilot phase. The same format to assess the items of the scale was used to assess the *Plants in the Workplace Scale*. For the *Art Pictures in the Workplace Scale*, no discrepancies were found in that all 15 participants felt that the scale represented the construct it aimed to measure and therefore, no items were excluded.

vii. Performance

Performance in the current study was operationalised by measured performance outcomes through data provided by the organisation. This included performance data before the implementation of the study taken from the organisation's performance data six months prior to instalment on the 28th of June 2018. This was compared with performance data taken by the organisation six months after the implementation of the indoor plants and art pictures into the work environment of the employees. Performance data were requested from the organisation over the year of 2018 of performance data for each employee on the two floors of: (a) error rate for each employee, as well as (b) the performance score calculated for the employee each month from January 2018 to December 2018. This performance data was requested from the organisation for the full 2018 year so that the researcher could identify the impact the indoor plants had on the employees after the plants and art pictures were installed into the employees work environment. The six months before implementation of the indoor plants and art pictures was characterised as the 'before' period (January-June) as the plants and art pictures were installed on the 28th of June. The six months after installation (July-December) was characterised as the 'after' period.

The survey data and performance data gained from the organisation were treated as separate datasets in the current research as matching of the data was unable to be done by the researcher. Firstly, the low response rate on the 40 survey's received provided inadequate data to perform the matching as there are approximately 240 employees in the OPS department which would have made for inconsistent matching. Secondly, the performance data that was received from the organisation did not include employee numbers but rather unique participant ID's for each employee created by the organisation over the months of 2018. This was done by the organisation to preserve the identities of the employees, although employee numbers would have been anonymous to the researcher and would not have been able to be traced back to any individual within the organisation. Performance in the current study is operationalised as the performance score for each employee, along with their error rate. Therefore, when referencing the performance variable in the current study, it will include both the performance, as well as the error rate characteristic even though they were treated as separate datasets for the purpose of analysis.

Performance for the two floors was calculated differently by the organisation. The performance score for the first floor for the life consultants was made up of a percentage score for the

employee's productivity over the month, as well as an error rate score per percentage of service requests. Floor one has many products, unlike floor two which only has the unit trust product. Therefore, the performance score for floor one consultants is characterised by many different features. These include:

- Number of calls made to clients
- Number of e-mails made to clients
- Time the consultant took to process a request
- Number of received service requests
- Number of transactions closed
- Hours in the office spent processing, or on projects, or spent in meetings

Therefore, the performance score was calculated as how much time a consultant should be taking to close the transaction, against a benchmark time which the organisation has previously tracked. This benchmark is regarded as the ideal time to spend in order to close a transaction, along with how many service request's a consultant should be processing within that time period, and then compares this to the actual consultant. Therefore, it looked at when the consultant received the transaction and how long it took them to close the request and compared this to the benchmark. This is then added up every day for each consultant for that month in which an average percentage for performance is then calculated. For the error rate score, this is calculated as the error rate per percentage of service requests for each consultant for the month.

For the second floor, for the unit trust consultants, performance is made up of a weighted monthly performance score which was characterised as how many transactions were closed by the consultant for the month. This is because floor one, unlike floor two, has only one product. The error rate number was characterised as how many service requests were received by the consultant for the month, along with how many errors were made per request. This then gives a number of errors made per service request. The performance score for the second-floor consultants was more streamlined as they only service requests made from clients for the unit trust product. Therefore, each consultant was given a "weighted" performance score which was characterised as the number of service requests that were received versus the number of cases that were closed. Error rates were also calculated differently for floor one and floor two. For floor one, the error rate was calculated as a percentage and for floor two it was calculated as a

value which is characterised as the number of errors that were made per each request. This is done on an individual level which is calculated per month.

However, there were many different factors to consider which influenced the employee's performance for each floor. The volumes of work flow throughout the year spike at different times. Therefore, volumes per month was not a constant variable. January to March shows spikes in the volumes of work. The number of available consultants that were available to process the work also varied. Consultant availability varied based on annual leave, sick leave, skill level, resignations, and transfers, just to name a few. Change in the system used, as well as a change in management may also have influenced employee performance. Turnout time for each transaction also took longer for floor one than for floor two. This was due to the fact that floor one had many products that consultants needed to process, as well as having less capacity to process these requests which consequently increase the turnaround time to process the transactions. Performance was also shown to increase around May as this was when the organisation did their performance reviews related to bonuses and therefore, a spike in performance was shown. It is therefore important to keep these factors in mind when analysing the performance variable.

Error rates are regarded in this research study as the number of total requests an OPS consultant receives, against the number of errors that are made per request. Error rates provide a more stable form of inquiry about an employee's performance as they are less influenced by exterior factors that affect the performance variable such as sick leave, management, and system issues and are rather dependent upon a request versus error basis. Therefore, there is a difference in error rating in that if a consultant receives for example, eleven requests and only made one error their error rate would show to be low, but if a consultant only received one request and subsequently made one error; the error rate would show to be high. This may provide a more accurate representation of the employee's performance as the way performance is measured at the organisational level in the current study is dependent upon many different factors. For example, skill level is an important prerequisite in the performance variable as a less skilled worker may not receive as many requests, but a more skilled worker would then be overloaded which could lead to factors such as burnout and could affect their performance score. System issues may also show to influence the performance score of an employee as if there is a change in management, or a change in the system used to service the requests, turnaround time may be longer which would affect the employee's performance score for the month but would not

have any absolute effect on the employee's error rates. Error rates within the current study form part of the performance measure and are used to provide a second reference of observation for the outcome that the indoor plants had on performance. This information was gained from the organisation in this current study. The next section will outline the materials used in this research study.

2.6 Materials

This section outlines the materials used in this research study with regards to the indoor plants chosen for the treatment group on floor one, as well as the art pictures chosen for the comparison group on the second floor.

i. Plant Type and Specifications

Horticulturalists at Bidvest Execuflora carefully selected the type of indoor plants best suited for use in this research study. A total of 102 plants were installed into the treatment group's work environment on the first floor of the building. These 102 plants were made up of 34 trough planters, each with 3 plants. A trough planter is a pot unit that is used to house plants, equivalent to that of a large rectangular vase. The plants selected were chosen so as to move away from monotone planting and rather encourage, mixed planting, with one of each plant within the troughs (Figure 1). This was the arrangement that was decided upon for the first floor of the organisation and was done to contrast the hard, structured and industrial nature of the organisation's building to create a warm, welcoming and fun feel from the presence of the plants. The horticulturalists examined the office space beforehand and chose the best fit they believed would benefit the environment that the plants were installed into. The plants that were chosen, were specifically selected from a preapproved list that has been shown to scientifically provide substantial benefits to the environment in which they are installed, such as having an impact on air quality (Kalantzis, 2016).



Figure 1: Sample pictures of troughs with the plants selected for the current study

The selection of the following plants was utilised for the current study (Figure 2):

1. *Aglaonema*, or more commonly known as the silver queen. This plant was selected for its ability to handle low light conditions as well as for its aesthetic qualities (Image 1 in Figure 2).
2. *Monstera deliciosa*, or more commonly known as the swiss cheese plant. This plant was selected for its aesthetics and for its suitability to the environment of the workplace (Image 2 in Figure 2).
3. *Sanserveria trifasciata*, also known as mother in law's tongue. This plant was chosen for its ability to produce oxygen, regardless of light and for its striking and playful appearance (Image 3 in Figure 2).



Figure 2: Selection of plants to be utilised in the current study

A total of 34 aglaonema, 34 monstera deliciosa and 34 sanserveria trifasciata were installed into the first floor of the organisation, resulting in a total of 102 plants with three plant varieties in each trough that were installed on the treatment group's floor. The 34 troughs were 640mm in length x 160mm in height x 300mm in width.

The positioning of the trough planters was done to ensure that the employees did not feel overwhelmed by the plants but rather that it was an inviting space. Therefore, a comfortable balance was pursued in order to satisfy the plant-to-employee ratio. Images of the work environment of the first floor before the indoor plants were

installed (See Appendix Q), along with images of the first floor's work environment after the indoor plants were installed (See Appendix R) are provided in the appendices.

The layout in which the indoor plants were positioned is included in the floor plan of the first floor provided in the appendix (See Appendix L) with plants being positioned as close to the employees as possible. This was done so the employees could reap the benefits provided from the indoor plants due to the close proximity, without them interfering with the employee's workspace. The planter troughs were placed on the top of the cupboards around the office of the first floor (See Appendix R) so as to not restrict the employee with planters being placed on their desks.

ii. Art Picture Type and Specifications

For the second floor of the organisation, industrial type pictures were installed (Figure 3). These pictures were used to counteract the possible Hawthorne effects. These pictures were chosen as they had no association with natural environments and did not include natural elements such as plants. They were finalised by Bidvest Execuflora and the organisation before implementation. Implementation was done by Bidvest Execuflora the same evening that the indoor plants were installed on the first floor. This was on the 28th of June 2018. The images seen in Figure 3 below are pictures of the organisation which characterised the art pictures that were used in the current study.

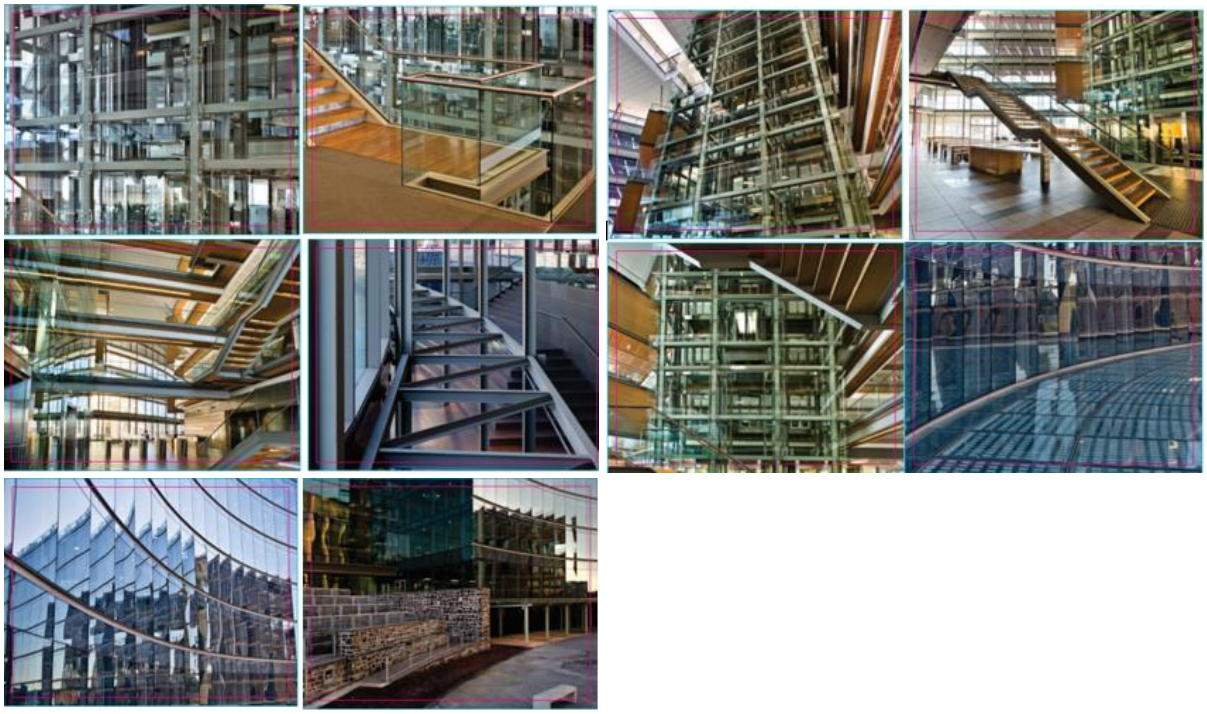

Figure 3: Selection of pictures to be utilised in the current study

A total of ten canvas pictures of industrial and structured type areas were used in this research study. Each canvas picture was measured at 1930mm x 1471mm in dimension. The art pictures were printed on canvas and wrapped around the pillars on the second floor. Images of the second floor before installation of the art pictures can be found in the appendices (See Appendix S) with images post installation also provided (See Appendix T).

2.7 Data Analyses

Once the surveys had been completed, the data obtained from the questionnaires were captured into an excel spreadsheet, the coded spreadsheet was then imported into IBM SPSS 24 for statistical analysis. The performance data obtained was captured in excel and imported into SPSS ready for statistical analysis. Due to the quantitative nature of the study, descriptive statistics were run to obtain the frequencies, means, standard deviations, and the minimum and maximum scores of the variables. The descriptive statistics that were done were used for summarising and categorising information in order to describe the sample and the data collected. Reliability analyses were conducted to produce the Cronbach Alpha's of the scales for this research study. Tests to assess normality were also run which guided the researcher as to which statistical test should be used in relation to parametric versus non-parametric alternatives.

The assumptions to test for use of parametric versus non-parametric alternatives were run by the researcher and are believed to be common to all techniques used in the current research study. These assumptions include:

i. Measurement Level

This assumption requires that the DV's are measured on at least an interval or ratio scale of measurement for statistical analyses to be done (Pallant, 2013).

ii. Random Sampling

This assumption involves that all data that is received is made up from a random sample from the population (Mouton & Babbie, 2011). However, this was unable to be achieved as the organisation chose the department for which the study was to be conducted and random sampling is often not able to be achieved in "real-life research" according to Pallant (2013, p. 213). Even though the organisation chose the department, the floor on which the indoor plants were implemented, was random.

iii. Independence of Observations

This assumption entails that all observations from the data be independent from one another (Pallant, 2013). This explains that each participant within the study may only be counted once and cannot be in more than one category. Stevens (1996) discloses that several circumstances may violate this, which is true for the case of the current study in that the participants were measured at two different points in time within the study on the performance variable (before and after implementation).

iv. Normal Distribution

This assumption requires that the population which the sample is received is distributed normally and follows the normal spread for central tendency (Pallant, 2013). It is argued however, that when researching in the context of the real-world, it may not always be possible to meet the requirements for this assumption (Pallant, 2013). Although, Pallant (2013) argues that if the sample size is large enough, with more than 30 participants per group, that it may be able to tolerate some violation from the normal distribution. This should be considered carefully as there are non-parametric alternatives that can be used instead, which is the case for

the current research study as the survey only received 40 usable responses overall from both floors. For the performance data that was gained from the organisation, this was not an issue.

v. Homogeneity of Variance

This assumption entails that there be equal variance in any comparison groups of the sample (Pallant, 2013). This suggests that the variability for each group's score be similar.

- ✓ Manipulation Check

The researcher included a manipulation check to establish whether there was manipulation of the IV (indoor plants) on the first floor using the scale*: Plants in the Workplace* (See Appendix I). The inclusion of the item: "I notice the plants in my workplace" tested whether the employees noticed the manipulated variable of indoor plants in their working environment. A higher score is the indication that the IV was successfully manipulated. The same was done for the second floor with the *Art Pictures in the Workplace* scale and the inclusion of the manipulation check item of: "I noticed the art pictures in my workplace" (See Appendix J).

2.7.1 Indoor plants (IV) and performance (DV)

The above assumptions were tested to assess whether the parametric or non-parametric test should be used to analyse the main hypothesis of: **(1)** Indoor plants in the employee's workplace will increase the employee's *performance (performance scores and error rates).* All the assumptions for the use of the parametric test were met, except for the independence of observations assumption, as the employee's performance was measured pre (January-June 2018) and post implementation (July-December 2018) to assess the impact that the indoor plants had on the employee's performance. A paired samples t-test is used to compare two means from the same individual within a sample on the same continuous, dependent variable (Field, 2009). Therefore, a **paired samples t-test** was conducted to assess the *performance* (DV) of the first floor pre and post implementation of the indoor plants. The error rates for the first floor were also analysed using a paired samples t-test to assess the impact the indoor plants had on the employee's error rates pre and post implementation. The error rates are characterised as part of the performance variable within the current study even though they were analysed as two separate datasets.

Additional Analyses:

Art pictures and performance

Additional analyses were conducted to assess whether there was a difference in the *performance (performance scores and error rates)* of the employees pre (January-June 2018) and post (July-December 2018) installation of the art pictures on the second floor which characterised the absence of plants group. The error rates for the second floor pre and post implementation of the art pictures were also analysed using a paired samples t-test to assess the impact that the art pictures had on the employee's error rate.

Indoor plants, art pictures and performance

A standardised change score was performed on the performance scores and error rates of each employee on floor one. This is explained as a pre-post change score with the score being the difference between the score before treatment (January-June 2018), and the score after treatment (July-December 2018). The score is calculated so that a positive score is identified as a change in the desired direction (Pallant, 2013). The same was done for the performance scores, and error rates of each employee on floor two.

Once a standardised change score was calculated for the first and second floor on *performance*, an independent sample t-test was conducted comparing floor one to floor two. The same was done for the error rates of the two floors. This was done to assess the difference in performance scores (and error rates) of the two floors.

Therefore, in summary the following analyses were done:

- Standardised change score for performance scores and error rates of floor one for each consultant
- Standardised change score for performance scores and error rates of floor two for each consultant
- Independent sample t-test on the standardised change score of floor one performance, compared with the standardised change score of floor two performance scores
- Independent sample t-test on standardised change score of floor one error rates, compared with the standardised change score of floor two error rates

2.7.2 Indoor plants (IV), perceived performance, and perceived work engagement (DV's)

Once the researcher had tested the research assumptions to verify whether parametric or non-parametric alternatives should be used, the researcher acknowledged that the sample size for the survey was small and that this may violate the homogeneity of variance assumption in which non-parametric alternatives should be used instead. However, the skewness and kurtosis co-efficients demonstrated a normal distribution for the perceived productivity, and work engagement variables as seen in Chapter 3, Section 3.3 of this research study and the histograms (See Appendix U, Figure 1-2). As the low response rate on the survey of 40 participants is assumed to deviate from the homogeneity of variance assumption with an unequal sample size of 14 participants from floor one, and 24 from the second floor, a Levene's test for homogeneity of variance was conducted to verify this assumption. A Levene's test for homogeneity of variance was run for perceived performance, and work engagement. The variables demonstrated F statistic's that were >0.05 with perceived productivity (F=1.06) and employee work engagement (F=.44) suggesting that this assumption is not violated.

Therefore, it was decided by the researcher that the parametric analyses of two separate **independent samples t-tests** be used. Consequently, to test the subsequent hypotheses **(2)** Indoor plants in the employee's workplace will increase their perceived performance; and **(3)** Indoor plants in the employee's workplace will increase their perceived work engagement; two separate independent samples t-tests were run to assess whether the presence of indoor plants in the employees work environment had an impact on their perceived performance, and work engagement.

An independent samples t-test according to Field (2009), is used to compare the means of two groups to determine whether there is a statistically significant difference between them. The survey was administered post-implementation and measured the *Perceived Performance, and Work Engagement* of the first and second floor. This was administered three months after the indoor plants were installed and therefore does not violate the independence of observations assumption as the participants were only measured once, at one point in time for these variables.

2.7.3 Indoor plants (IV), performance (DV), and nature identity (moderator)

With regards to the subsequent fourth hypothesis of: **(4)** Nature identity moderates the relationship between experimental condition and performance; a one-way Analyses of Co-variance (ANCOVA) was expected to be run. This was theoretically meant to investigate the impact that *Nature Identity (Connectedness to Nature, Plants in the Workplace, and Art Pictures in the Workplace Scales)* had on the IV/DV relationship for the performance and error rate scores.

An ANCOVA is a statistical test that is related to the ANOVA. It aims to test whether there is a significant difference between groups after controlling for variance explained by the covariate (Pallant, 2013). A covariate is a continuous variable that correlates with the dependent variable (Pallant, 2013). In the case of the current study, the covariate is characterised as the nature identity variable, with the dependent variable being the performance and error rate scores that were received from the organisation.

However, the researcher was unable to conduct the ANCOVA to analyse this hypothesis as the dataset that was obtained from the organisation with the performance and error rates for each consultant was unable to be matched to the survey data to analyse the nature identity component provided by the participants. The dataset provided by the organisation did not include employee numbers, unlike the survey, in which the employee number was requested from the participant. Rather, unique ID's were provided per consultant on each floor for the performance data to be matched for each month of 2018. Therefore, the dataset provided was inadequate for the use of matching with the survey data. The survey that was completed by the 40 participants from both floors, did provide data for the nature identity variable through the *Connectedness to Nature Scale,* as well as the *Art in the Workplace,* and *Plants in the Workplace Scales,* but since the employee numbers from the survey were unable to be matched with the unique participant ID's provided from the performance dataset, this hypothesis was unable to be tested. However, analyses were able to be run to test whether one's nature identity impacts the relationship between the indoor plants and perceived performance, and work engagement.

2.7.4 Indoor plants (IV), perceived performance, perceived work engagement (DV's), and nature identity (moderator)

With regards to the subsequent fifth and sixth hypothesis of: **(5)** Nature identity moderates the relationship between experimental condition and perceived performance; and **(6)** Nature identity moderates the relationship between experimental condition and perceived work engagement; two separate one-way ANCOVA's were expected to be run. This was going to be done on the *Nature Identity (Connectedness to Nature, and Plants in the Workplace Scales)* variable in the survey. The homogeneity of variance assumption was presumed to be violated by the small sample size received from the survey, and consequently, a non-parametric alternative would have been more suited. However, A Levene's test for homogeneity of variance was run and reported on in Subsection 2.7.2 of this chapter using two, one-way Analysis of Variance (ANOVA's) tests for perceived performance, and work engagement. The results of the ANOVA's demonstrated that there was no statistically significant difference between the treatment and contrast group on perceived performance (p=.30), and work engagement (p=.51), suggesting that the variability in the two conditions were about the same. Therefore, even though the survey yielded a small sample size, the variables demonstrated normal distributions, with homogeneity of variance, and consequently, **two separate one-way ANCOVA's** were run to test the impact that the covariate of *Connectedness to Nature* had on the IV/DV relationships for perceived performance, and work engagement as the assumptions for the test were seen not to be violated.

Therefore, with regards to whether nature identity moderates the relationship between the employee's perceived performance and work engagement; the impact of nature identity on the IV/DV relationships which are being measured, two separate one-way ANCOVA's were run.

2.8 Ethical Considerations

The current study was done with ethical considerations in mind by the researcher. Ethical issues were anticipated to arise during the period of the study and have been outlined and discussed below. As the current research study was quasi-experimental in nature, the researcher was unable to inform the employees of the study's purpose prior to data collection. Employees were informed of the true nature of the study prior to data collection. In line with this, a Participant Information Sheet (See Appendix A and B) was given to all employees on both floors of the OPS department within the organisation via the e-mail sent and was included before the survey

was able to be accessed by participants. This informed employees of the broad overview of the study which explained that the research study was interested in the design of the work environment and the impact that this may have on employees. Any ethical considerations known prior to the commencement of the study such as anonymity, confidentiality and informed consent were included in the Participant Information Sheet. This was attached to the e-mail sent to the employees asking for their voluntary participation in the research study.

In this research study, employee numbers were requested in the survey from the participants in order to match the survey data to the data provided by the organisation. Therefore, for the participants that disclosed their employee numbers, total anonymity was not assured. This was not for use in the analyses and was merely to match the data from the survey to the organisation's performance data. However, anonymity of the participants' responses can be guaranteed in this research report as only grouped data were reported on. At no point were any identifying characteristics known by the researcher, such as the names of the participants who responded and no information regarding the individual responses of the participants was given to the organisation. The employee numbers provided were only seen by the researcher and the research supervisor who had no means to make meaning of the employee numbers. The employee numbers could not be traced back to any individual within the organisation, and the file with the employee numbers was stored on a password protected computer that only the researcher had access to. The organisation did not have access to the marking key at any point in order to make sensible meaning of the data and any communication about the survey data was made in group trends, ensuring the anonymity of the participants' responses from the organisation.

The performance data that was provided by the organisation for the two floors, was initially meant to include the employee numbers of each consultant on each floor of the department. This was to be matched with the survey data. However, the dataset with the performance and error rate scores that was given to the researcher had employee numbers removed by the organisation prior to the data set being provided to the researcher. The employee numbers were replaced with anonymous, unidentifiable unique participant ID's such as employee1/2/3 etc., for the researcher to match the employee performance data on the two floors for each month of 2018. Due to this, the researcher could not match the survey data to the performance data. Therefore, once the researcher gained knowledge of this, the employee numbers from the survey data were removed from the dataset and replaced with unidentifiable participant

numbers chosen by the researcher. These had no connection or relevance to the participant ID's provided by the organisation, or individual employee characteristics and was done to ensure anonymity of the data for possible future use.

The current study ensured confidentiality in that only the researcher and the research supervisor of the current study had access to all the data and data responses that were provided by participants, and the organisation. All data was analysed at the group level, so no individual responses were tracked or reported on. All data that was collected for the current study has been stored in a secure electronic location, on a password protected computer with no identifying characteristics included with the only persons having access being the researcher and research supervisor.

The participants' informed consent to participate in the research study was deemed to have been given once the 'yes' button was activated and had given the participant access to the survey to complete. If the participant agreed to the terms of the study, they were able to access the survey. This was done through: "Do you agree to these terms?" with a 'yes' or 'no' button. In addition, their consent to participate was also taken as consent for the anonymised data to be stored for possible use in future studies. This was outlined in the Participant Information Sheet prior to choice of agreement or disagreement with these terms.

There was no benefit nor negative consequence to any employee who chose to participate in this study (or who chose not to participate) and participation was entirely voluntary for the survey. Therefore, if employees chose not to participate in the survey, it did not disadvantage them in any way. The performance data that the researcher received from the organisation does not impact any individual employee in any way as only group trends were analysed and reported on. Along with this, the dataset provided from the organisation is information that is accessible to the employees, ensuring that there was no deception used in receiving this data.

No identifying information has been included in the final report and the responses were only looked at in relation to all other responses ensuring confidentiality of the participants. Any descriptors that were required such as age, race and gender were used in this research study only to describe the sample as a whole. No deception or coercion was used when conducting this study and participation in the survey was strictly volunteer in nature. The participants that chose to participate consented to the abovementioned information and gave permission for all data collected throughout the study to be used for analyses, reporting and possible publication.

The researcher deemed the study to show no harm or foreseeable risks to those who chose to participate. Participants were able to withdraw from the study at any point, up until submission of their completed questionnaire on the Survey Monkey portal. This was outlined in the Participant Information Sheet.

Individual feedback is not possible due to the confidential nature of the study. Feedback has been given to the organisation in the form of a summary report of the findings. The next chapter will present the results from the analyses.

Chapter Three: Results

3.1 Introduction

This chapter provides a comprehensive analysis of the results that were obtained from the statistical tests that were run on the survey, and performance dataset in SPSS version 24. The aspects that will be covered in this chapter include **descriptive statistics** that describe the sample for the current study. **Reliability co-efficients** that were established using internal consistency analyses for the instruments used in the current study will be outlined and discussed. **Normality** tests were conducted to assess the assumptions that were outlined in Chapter 2, Section 2.7 to guide the researcher in the type of analysis to conduct for the hypotheses listed in Chapter 1, Section 1.4. The associated findings from the analyses that were conducted are reported on.

As mentioned in Chapter two, three main analyses were run to aid the researcher in answering the main, and subsequent hypotheses for this research study. Before analyses were conducted, the manipulation check was evaluated. This was included in the *Plants in the Workplace* and *Art Pictures in the Workplace* Scales as "I notice the plants/art pictures in my workplace" to assess whether the employees noticed the manipulated variable of the indoor plants into the workplace. The placebo of art pictures was included to remove the possibility of the Hawthorne effect. This will be explained further in this chapter. With regards to the hypotheses, firstly, two separate **paired samples t-tests** were run to analyse the main hypothesis for the indoor plants (IV) impact on employee's performance (*performance, and error rate* as DV). Additional analyses were run to assess the performance of the employees from the second floor and the impact that was made by the presence of the art pictures. Additional analyses were also run to analyse the difference in performance scores for floor one (indoor plants) and floor two

(art pictures) using two **independent samples t-tests**. Secondly, to test the subsequent second and third hypotheses of the impact that the indoor plants (IV) had on the perceived performance (DV), and perceived work engagement (DV) of the employees; two separate **independent samples t-test** were conducted. This will be explored further in the next chapter of this research report.

Thirdly, to assess the subsequent fourth, fifth, and sixth hypotheses of nature identity (*Connectedness to Nature Scale, and Plants in the Workplace*) as a covariate or moderator variable; two separate **one-way ANCOVA's** were run. These were conducted using two separate **one-way ANCOVA's** as the performance (*performance scores, and error rates*) variable was unable to be analysed.

Please note: An alpha of 0.05 was used when conducting all statistical analyses. Significance is characterised as p<a.

To ensure that the reader has a clear understanding of the statistical analyses that were performed and explained in this chapter, it is important to verify that all statistical abbreviations used are understood. For the reader's convenience, the list below outlines all relevant statistical abbreviations used in this chapter.

Table 1: Table of Abbreviations for Key Variables

ABBREVIATIONS OF STATISTICAL ANALYSES	
Variable	**Abbreviation**
Indoor plants on the first-floor	Indoor plants
Art pictures on the second-floor	Art pictures
Performance	Performance score and error rate
Connectedness to Nature/Nature Identity and Plants in the Workplace	CNS1
Connectedness to Nature/Nature Identity and Art Pictures in the Workplace	CNS2
Independent Variable	IV
Dependent Variable	DV
Number of items/participants	n

3.2 Descriptive Statistics

In order to define the nature of the sample for the current study, descriptive statistics were run in SPSS. According to Stangor (2011), this is a common technique used by researchers to determine the characteristics of the sample used. The descriptive statistics that were run included frequencies, means, standard deviations, percentages, as well as minimum and maximum scores. The results of these are represented below. The demographic information that was attained for the survey by the *Biographical Details Question's* which included: gender, age in years, ethnicity, employment type, as well as tenure. For the performance data that was received from the organisation, the demographic information that was attained included: gender, age, and ethnicity. The results will be presented in this chapter and will be separated according to the sample obtained from the survey, and the additional sample that was attained from the performance data. The descriptive statistics for the sample from the performance dataset is reported on first in this chapter, with the performance, and error rate sample explained. Secondly, the descriptive statistics from the sample attained from the survey is then reported on in this chapter.

PERFORMANCE DATA

3.2.1 Descriptive Statistics for Overall Performance Data

The descriptive statistics for the sample from the performance data of the department is reported on below. The information provided for the sample is the dataset after it was cleaned and readied for analysis. This was done to ensure that only the appropriate data were included pertaining to the cut-off characteristic explained in Chapter 2, Section 2.4 of this research study. To reiterate, the cut off characteristic included all employees with at least three performance data inputs in the before period (January-June 2018), and at least three performance data inputs in the after period (July-December 2018). Any employee data that had less than three data inputs in the before, and after period, were removed to ensure appropriate comparison. The descriptive statistics reported on are at a department level, with the inclusion of both floors.

Table 2: Sample breakdown for Performance Data

Floor	**Frequency**	**Percentage**
One (Indoor plants)	64	49.2
Two (Art pictures)	66	50.8
Total	130	100

Table 2 above demonstrates that for the performance data a total of 130 employees within the department made up the sample. With 64 employees (49.2%) from the first floor, and 66 (50.8%) employees from the second floor.

Table 3: Sample demographic characteristic for performance data: Gender

Gender	**Frequency**	**Percentage**
Female	80	61.5
Male	40	30.8
Missing	10	7.7
Total	130	100

Table 3 represents the break-down of the gender characteristic for the performance data sample. From the table above, it is evident that majority of the total 130 employees were female (61.5%) with 80 participants. Male employees made up 30.8% of the sample.

Table 4: Sample demographic characteristic for performance data: Age in years

Age	**Valid**	**Missing**	**Mean**	**SD**	**Minimum**	**Maximum**
	120	10	27.94	4.418	21	47

Table 4 represents the age for the participants for the performance data in the current study. The age range for the sample is between 21 to 47 years old (M=27.94; SD=4.418).

Table 5: Sample demographic characteristic for performance data: Ethnicity

Ethnicity	**Frequency**	**Percentage**
Black	58	44.6
White	25	19.2
Coloured	30	23.1
Indian	7	5.4
Missing	10	7.7
Total	130	100

Table 5 provides the ethnicity of the 130 participants that made up the performance data sample for the current study. The table represents the diverse make-up of the employees within the department with 58 Black participants (44.6%), 25 White participants (19.2%), 30 Coloured participants (23.1%), and 7 Indian participants (5.4%).

Overall, the second-floor had two more participants than floor one. It is important to mention that all employees, apart from two, are South African, and therefore represent a true South African sample for the current research study. This was represented as nationality in the dataset with majority South African, and two employees that were represented as 'non-SA' in the dataset.

3.2.2 Descriptive Statistics for Floor One Performance Data

The number of employees that were included in the performance dataset was determined by the cut-off characteristic that was mentioned above. Therefore, even though the performance variable is characterised by the performance, and error rates of the employee, they were analysed as separate datasets to ensure that the cut-off characteristic was enforced for each employee on their performance scores and error rate scores. This was done to ensure effective comparison pre and post-test on these factors of performance. The same employees from the first floor were used in the performance, and error rate datasets, however for the error rate dataset, some employees had too many missing values and were therefore removed.

Table 6: Sample breakdown for the first floor on performance

Factor	**Frequency**
Performance	64
Error Rate	63

Performance:

The first floor made up 49.2% of the overall survey sample with 64 participants. Th majority of the first-floor participants were female with 42 employees (65.6%), with 16 male employees (25.6%) making up the remainder of the 64 participants. Six values for gender were missing and therefore, these were unable to be reported. The age range for the 64 participants from the first-floor performance data was 22 to 41 years of age, with the mean age of participants being 28 years old (M=28.62; SD=4.460). Six values for age were missing from the dataset. The majority of the sample from the first floor were Black employees making up 30 (49.6%) of the 64 participants, with 10 White participants (15.6%), 14 Coloured participants (21.9%), and 4 Indian participants (6.3%). Six values for age were not included in the dataset (6.3%).

Error Rate:

One less participant was included in the error rate dataset from the first floor as the data demonstrated too many missing values. Additionally, the removed participant from the error rate dataset did not have demographic details included. Therefore, in total, 63 employee error rates were analysed on the performance variable. Of those 63 employees, 42 were female (66.7%), 16 were male (25.4%) and the remainder 5 participants gender were unspecified. The majority of the participants in the error rate dataset were Black employees (47.6%), with 14 Coloured employees (22.2%), 10 White employees (15.9%), and 4 Indian employees (6.3%). The age range for the error rate participants 22 to 41 (M=28.62; SD=4.460) which is the same as the performance dataset.

3.2.3 Descriptive Statistics for Floor Two Performance Data

Table 7: Sample breakdown for the second floor on performance

Factor	**Frequency**
Performance	66
Error Rate	52

Performance:

The second-floor performance sample was made up of 66 participants (50.8%) from the total of 130. More female employees (57.6%) than male employees (36.4%) were included, with the mean age for the sample being 27.31 years old (SD=4.318). Black employees made up the majority of the sample with 28 participants (42.4%). Coloured employees were second with 16 participants (24.2%), and the rest of the sample was made up of 15 White employees (22.7%), and 3 Indian employees (4.5%).

Error Rate:

From table 7 above, it is evident that 52 employees were included in the error rate dataset for the second floor to preserve the cut-off characteristic. Of the 52 employees included, 30 were female (57.7%), and 19 were male (36.5%) with the mean age 26.80 (SD=3.272) in the age range of 21 to 38 years old. The majority were Black employees (46.2%), with 12 White employees (23.1%), 11 Coloured employees (21.2%), and 2 Indian employees (3.8%). Values for gender, ethnicity, and age were missing for three employees in the dataset.

Overall, for the error rate dataset, 15 employees were excluded due to the cut-off characteristic. Therefore, for the error rate data the total number of participants for the first and second floor were 115 employees. The difference in sample size for the performance factor, and error rate factor of the performance variable is reported on in table 8 below.

Table 8: Sample breakdown for performance overall

Factor	Frequency
Performance	130
Error Rate	115

3.2.4 Descriptive Statistics for Overall Survey Data

The descriptive statistics from the survey data that was obtained from the employees within the department on the two floors is presented in the table below. This is the sample after the received data had been cleaned prior to analysis.

Table 9: Sample breakdown for Survey Data

Floor	Frequency	Percentage
One (Indoor plants)	16	40.0
Two (Art pictures)	24	60.0
Total	40	100

From table 9 above, a total of 40 employees completed the survey with 16 (40%) participants from the first floor, and 24 (60%) participants from the second floor.

Table 10: Sample demographic characteristic for survey data: Gender

Gender	Frequency	Percentage
Female	25	62.5
Male	15	37.5
Total	40	100

From table 10 above, the majority of the total 40 participants were female (62.5%) with 25 participants. Male employees made up 37.5% of the sample with 15 participants.

Table 11: Sample demographic characteristic for survey data: Age in years

Age	**Valid**	**Missing**	**Mean**	**SD**	**Minimum**	**Maximum**
	39	1	33.28	9.265	21	58

Table 11 represents the age for the participants in the current study. The age range for the sample is between 21 to 58 years old with a mean age of 33.28 (SD: 9.265). As age was not a compulsory requirement, one participant chose to not answer.

Table 12: Sample demographic characteristic for survey data: Ethnicity

Ethnicity	**Frequency**	**Percentage**
Black	5	12.5
White	8	20.0
Coloured	22	55.0
Indian	4	10.0
Other	1	22.5
Total	40	100

Table 12 provides the ethnicity of the 40 participants that made up the sample for the current study. The table represents the diverse make-up of the sample with 5 Black participants (12.5%), 8 White participants (20%), 22 Coloured participants (55%), 4 Indian participants (10%), and one participant who characterised themselves as “other”. All 40 participants in the sample were shown to be full-time employees of the organisation.

Table 13: Sample demographic characteristic for survey data: Tenure

Tenure	**Frequency**	**Percentage**
6 months-1 year	3	7.7
1-5 years	20	51.3
5-10 years	8	20.5
10+ years	8	20.5
Missing	1	2.5
Total	40	100

Table 13 represents the tenure for the 40 participants of the sample from the current research study. Tenure was represented as categories between 6 months, and more than 10 years at the current organisation. As tenure was not a compulsory requirement, one participant from the sample did not provide their tenure. Of the 39 participants that did provide tenure, 3 participants (7.7%) included that they had been employed by the organisation for 6 months to 1 year at the point of study. The remainder of the sample included 20 employees (51.3%) who had been at the organisation for 1 to 5 years, 8 employees (20.5%) who had been at the organisation for 5 to 10 years, and 8 employees (20.5%) who had been at the organisation for more than 10 years at the point of study.

For the overall survey data, it is apparent to the researcher that there was slightly skewed data evident in the gender, race, and age characteristics captured for the sample. However, according to Pallant (2013), it is quite common to find variables that are non-normally distributed and whereby the data is distributed in an irregular shape. As the descriptive statistics of the overall survey data have been discussed, a further breakdown of the sample on the biographical details per floor will be reported on a summary level.

3.2.5 Descriptive Statistics of First-Floor Survey Data

The first floor made up 40% of overall survey sample, with 16 participants. The majority of the first-floor participants were female with 9 employees (56.3%), with 7 male employees (43.8%) making up the remainder of the 16 participants. The age range for the 16 participants was 23 to 58 years of age, with the mean age 35.56 (SD=10.702). The majority of the sample from the first floor were Coloured employees making up 11 (68.8%) participants, with 2 Black participants (12.5%), 1 White participant (6.3%), 1 Indian participant (6.3%), and one participant that identified as other (6.3%). The majority (50%) of participants had worked in the organisation for 1 to 5 years. Four participants indicated that they had been at the organisation for more than 10 years (25%).

- ✓ Manipulation Check

A manipulation check for item number 5 was added into the survey for the *Plants in the Workplace* survey of: “I notice the plants in my workplace” (See Appendix I). **Descriptive statistics** were run to calculate the mean for the scores on this item. This was done to test whether the employees on the first floor noticed the manipulated variable of indoor plants in

their work environment. The scores were presented on a 1-5 Likert-type scale with high scores indicating that the indoor plants in the workplace were noticed by the majority of the employees on the first floor. A higher score for this item indicates that the IV was successfully manipulated. The scores are tabulated in the table below.

Table 14: Descriptive Statistics for Plants in the Workplace Questionnaire Item 5

Variable	n	Mean	Min	Max
Item number 5	16	4.75	4	5

From table 14 above, the IV (indoor plants) was successfully manipulated with 75% of the sample providing a value of 5 which is 'strongly agree' in answer to the manipulation item. There were no scores less than 4, with only 25% of the sample from the first floor providing a value of 4 which is 'agree a little.' Therefore, indicating that with a mean of 4.75, the majority of the employees on the first floor noticed the indoor plants.

3.2.6 Descriptive Statistics of Second-Floor Survey Data

The second-floor survey sample was made up of 24 participants (60%). More female employees (66.7%) than male employees (33.3) participated, with the mean age of 31.70 (SD=7.985). Coloured employees made up the majority of the sample with 11 participants (45.8%). White employees were second with 7 participants (29.2%), and the rest of the sample was made up of 3 Black employees (12.5%), and 3 Indian employees (12.5%). The majority of the participants indicated that they had worked for the organisation for 1 to 5 years (50%) at the point of study.

- ✓ Manipulation Check

A manipulation check was done for item number 5 in the *Art Pictures in the Workplace* survey of: "I notice the art pictures in my workplace" (See Appendix J). The findings from the descriptive statistics show that the mean score was 4 with 33% of the 24 participants from the second floor suggesting that they 'agree a little.' However, 38% of the sample suggested that they 'strongly agree' and only one participant stated they did not notice the art pictures in their workplace. Therefore, in summary, due to the mean of 4, it can be suggested that the 24 second-floor employees noticed the art pictures.

3.3 Reliability Tests

This section describes the reliability co-efficients of the scales that were utilised in the current study. According to Huck (2012) a Cronbach Alpha is an analysis which is utilised to measure the internal consistency or reliability of a test in a versatile manner. A Cronbach Alpha may range from 0.00 to + 1, with values that exceed 0.7 regarded as acceptable reliability values. All values below 0.4, according to Gravetter and Forzano (2011) are regarded as unacceptable. George and Mallery (2003) expand on this and provide a general rule of thumb when analysing the Cronbach Alpha co-efficient. George and Mallery (2003) explain that a Cronbach Alpha value above 0.9 is regarded as excellent reliability, good reliability is above 0.8, acceptable above 0.7, questionable above 0.6, 0.5 and lower is poor reliability and values that are less than 0.5 are regarded as unacceptable. The reliability values that were obtained for the scales used in the current study are presented in the table below and will be expanded upon.

Table 15: Cronbach Alpha's for all scales used in the current research study

Scale	**N of items**	**Cronbach Alpha (α)**
UWES-9	9	.93
Vigour	3	.86
Dedication	3	.86
Absorption	3	.74
Connectedness to Nature Scale*	4	.41
Revised CNS with 5 self-developed items from Plants in the Workplace Scale	9	.56
Plants in the Workplace Scale	5	.79
Art Pictures in the Workplace Scale	5	.42

*Revised CNS scale with items removed

The Cronbach Alpha for the *Perceived Performance Questionnaire* by Thatcher and Milner (2012) was unable to be calculated as this scale only contains one item. The *Utrecht Work Engagement Scale – Shortened Version (UWES-9)* yielded a reliability co-efficient well above 0.7, which George and Mallery (2003) regard as excellent reliability with a Cronbach Alpha of α= 0.93. The subscales for the UWES-9 all yielded reliability co-efficients above 0.7 with vigour (α= 0.86), and dedication (α= 0.86) indicating good internal consistencies, and

absorption (α = 0.74) yielding acceptable results. The revised *Connectedness to Nature Scale* yielded a Cronbach Alpha of α= 0.41 which is regarded as poor reliability by George and Mallery (2003) standards. The Cronbach Alpha for the revised *Connectedness to Nature Scale* increases to α= .75 when item 3 is deleted of "I often feel disconnected from nature." However, when the reliability of the scale is done in connection with the added self-developed items from the Plants in the Workplace questionnaire that were developed to be included with the CNS scale, the Cronbach Alpha that is yielded increases the reliability for the combined scale to α= 0.56. However, according to George and Mallery (2003) this is still regarded as a weak reliability co-efficient. The *Plants in the Workplace Scale* when reviewed in isolation, yielded a Cronbach Alpha of α= 0.79 which is regarded as acceptable, to good reliability according to George and Mallery (2003). The *Art Pictures in the Workplace Scale* did not yield an acceptable Cronbach Alpha at α=0.42 and with the combined CNS and Plants in the Workplace scale yielding a Cronbach Alpha of α= 0.50 which according to Gravetter and Forzano (2011) is still above 'unacceptable' standards. However, it is important to note that only the UWES-9, Perceived Productivity Scale, and the combined CNS revised scale with the five self-developed items in the Plants in the Workplace Scale were used to analyse the hypotheses for the current study. The supplementary scales were only used to analyse any additional analyses that were conducted to inform the main, and subsequent hypotheses for the study using the three scales mentioned.

3.4 Test of Normality

For parametric analyses to be run, a normally distributed dataset is required. Data may also be explained as normally distributed when the skewness and kurtosis co-efficients are between -2 and +2 (Field, 2009). For datasets with large sample sizes, skewness is seen to not make a vast difference. In the case of the current study however, sample size has been identified as an issue. Therefore, normality tests were run in order to point the researcher in which analysis was appropriate to answer to each of the hypotheses listed in Chapter 1, Section 1.4. As the study is made up of a small sample for the survey data with 40 participants, the Shapiro-Wilk normality test was run. Skewness and kurtosis co-efficients were also analysed to assess whether they were in the acceptable range of -2 and + 2. These were analysed to assess the performance data with 130 participants. The null hypothesis is that the variables in the study are normally distributed, with the alternative hypothesis being that the variables are non-normally distributed. If the significance value is shown to be <0.05, the null hypothesis is

rejected, indicating non-normality in the distribution for the variable. The results of the Shapiro-Wilk normality tests are provided in the table below, as well as the skewness and kurtosis co-efficients for the variables.

Table 16: Tests of normality, skewness and kurtosis

	Kolmogorov-Smirnov [a.]			Shapiro-Wilk				
Variable	**Stat.**	**df**	**Sig.**	**Stat.**	**df**	**Sig.**	**Skewness**	**Kurtosis**
Total Performance	.34	130	.00	.75	130	.00	.52	-1.56
Total Error Rate	.27	115	.00	.80	115	.00	.97	-.15
Performance (Plants)	.09	64	.20	.97	64	.13	-.14	.30
Error Rate (Plants)	.13	63	.01	.81	63	.00	1.98	6.32
Performance (No plants)	.24	66	.00	.80	66	.00	-1.08	-.21
Error Rate (No plants)	.06	52	.20	.98	52	.56	.22	.43
Total Perceived Performance	.10	40	.20	.95	40	.06	-.48	-.16
Total Work Engagement	.09	40	.20	.97	40	.41	.29	-.63
Combined CNS Scale	.18	40	.00	.96	40	.15	.09	-.01

According to table 16 above, the performance data on total performance ($W_{(130)}$= .75, $p < 0.05$), total error rate ($W_{(130)}$= .80, $p < 0.05$), error rate [plants] ($W_{(63)}$= .81, $p < 0.05$), and performance [no plants] ($W_{(66)}$= .80, $p < 0.05$) reported statistically significant results which indicates that the researcher rejects the null hypothesis in favour of the alternative which stipulates that there is enough evidence to suggest non-normality. However, as the sample size is large with 130 participants in the performance data, and 115 participants in the error rate dataset, Razali and Wah (2011) indicate that the Shapiro-Wilk test of normality is restricted for sample sizes that

are below 50. Therefore, the skewness and kurtosis co-efficients were used to analyse normality for these two variables. The skewness and kurtosis co-efficients for all the performance, and error rate variables, except error rate (plants), demonstrate that the data met the requirements for normality as they were within the acceptable -2 to +2 range. Error rate for plants condition exceeded the +2 range for kurtosis, according to George and Mallery (2003), however, according to Posten (1984) kurtosis co-efficients must be < 9.0 to be acceptable.

All the variables pertaining to the survey data were found to be statistically significant, with total perceived performance ($W_{(40)}$= .95, p > 0.05); total work engagement ($W_{(40)}$= .97, p > 0.05); and the combined CNS scale (*Connectedness to Nature, and Plants in the Workplace*) ($W_{(40)}$= .96, > 0.05) indicating that the researcher rejects the null hypothesis in that normal distributions are not assumed. For all perceived performance, work engagement and combined CNS scale, all skewness and kurtosis co-efficients fall within the -2 to +2 acceptance range. Therefore, for all analyses pertaining to the survey data, the variables [perceived performance, work engagement, and the combined CNS scale] are assumed to be not normal.

Once the researcher completed the assumption tests for normality, it was discovered that although the assumption for normality was not met for the survey data, the researcher acknowledges that the sample was small with 40 participants may have been the problem. This was suspected to compromise the homogeneity of variance assumption, although, as explained in Chapter 2, Section 2.7, Subsection 2.7.2, the Levene's test for homogeneity of variance assumes that the variances are homogenous between the treatment and contrast group and therefore, homogeneity of variances assumptions are met, and parametric analyses could be conducted. Therefore, two independent samples t-tests to test the subsequent second and third hypotheses of the indoor plants impact on the employee's perceived productivity, and work engagement were run. In line with this, to test the subsequent fifth and sixth hypotheses of the impact that the covariate (*CNS)* had on the IV/DV relationships for perceived performance, and work engagement; parametric assumptions were met and therefore two separate one-way ANCOVA's were run. Histograms for the distribution of the variables are attached in the appendices (See Appendix V, Figures 3-11).

3.5 Analyses

3.5.1 Paired samples t-test

In order to analyse whether there was a difference in employee's performance before, and after implementation of the indoor plants, a paired samples t-test was conducted utilising the *performance* (performance scores, and error rates) as the DV, and the two related groups as the performance values "pre" (January-June 2018) and "post" (July-December 2018) implementation of the indoor plants. Performance was assessed by two measures, namely: (1) performance scores, and (2) error rates. The paired samples t-test results for each performance outcome is reported below. Using the dataset provided, the test will determine whether there is a significant change in employee performance at the $\alpha = 0.05$ level.

Main Hypothesis:

1. *Indoor plants in the employee's workplace will increase the employee's performance.*

Table 17: Paired samples t-test descriptive statistics for performance

Condition	**n**	**Mean**	**Std. Deviation**
Performance before	64	62.21	14.90
Performance after	64	46.66	10.69
Total	128	15.56	16.08

Table 18: Paired samples t-test results for performance

Mean	**Std. Deviation**	**Std. Error Mean**	**t**	**df**	**Sig.**
15.56	16.08	2.01	7.738	63	.000

To test the hypothesis that pre-implementation (M= 62.21, SD= 14.90) and post-implementation (M= 46.66, SD= 10.69) performance means [for performance variable] were equal, a paired samples t-test was performed. It is also noted that the correlation between the two conditions was estimated at r= .24, p = .05, suggesting that the paired samples t-test is appropriate in this case. The null hypothesis of equal performance means [on the performance

variable] was rejected t(63)=7.738, p < 0.05. Thus, the pre-performance mean was statistically significantly higher than the post-performance mean. Cohen's *d* was estimated at 1.19 which is a large effect size based on Cohen's guidelines (Gignac & Szodorai, 2016). The paired samples t-test results that were calculated for this data suggest that performance decreased after the implementation of the indoor plants. A graphical representation of the means is displayed in Figure 12 and 13 (See Appendix W).

Table 19: Paired samples t-test descriptive statistics for error rate

Condition	**n**	**Mean**	**Std. Deviation**
Error rate before	63	1.14	.75
Error rate after	63	1.03	.58
Total	126	.10	.53

Table 20: Paired samples t-test results for error rate

Mean	**Std. Deviation**	**Std. Error Mean**	**t**	**df**	**Sig.**
.10	.53	.07	1.550	62	.126

To test the hypothesis that pre-implementation (M= 1.14, SD= .75) and post-implementation (M= 1.03, SD= .58) performance means [for error rate variable] were equal, a paired samples t-test was performed. It is also noted that the correlation between the two conditions was estimated at *r*= .71, *p* = < 0.001, suggesting that the paired samples t-test is appropriate in this case. The null hypothesis of equal performance means [on the error rate variable] failed to be rejected t(62)=1.550, p= .126. Thus, the pre-performance mean was not statistically significantly different from the post-performance mean. Simple main effects analysis is therefore not necessary. The paired samples t-test results that were calculated for this data suggest that the error rates were unaffected by the indoor plants. A graphical representation of the means is displayed in Figure 14 and 15 (See Appendix W).

In conclusion, to answer the main hypothesis above, indoor plants in the employee's workplace did not increase the employee's performance.

Additional Analyses: Paired samples t-test

Additional analyses were conducted to assess whether the performance in the contrast group [no plants condition] was affected pre and post implementation of the placebo added of the art pictures. This was done to inform the main hypothesis findings from the paired samples t-tests conducted. A paired samples t-test was conducted utilising the *performance* (performance scores, and error rates) as the DV, and the two related groups from the contrast floor as the performance values "pre" (January-June 2018) and "post" (July-December 2018) implementation of the placebo art pictures. Performance was assessed by the same two measures as the treatment group, namely: (1) performance scores, and (2) error rates. The paired samples t-test results for each performance outcome is reported below.

Table 21: Paired samples t-test descriptive statistics for performance – contrast group

Condition	**n**	**Mean**	**Std. Deviation**
Performance before	66	706.34	376.85
Performance after	66	662.03	361.88
Total	132	44.31	231.42

Table 22: Paired samples t-test results for performance – contrast group

Mean	**Std. Deviation**	**Std. Error Mean**	**t**	**df**	**Sig.**
44.31	231.42	28.49	1.556	65	.125

There was no statistically significant difference in the scores for the contrast group on the performance before (M= 706.34, SD= 376.85) and performance after (M= 662.03, SD= 361.88) conditions; t(65)=1.556, p= .125.

Table 23: Paired samples t-test descriptive statistics for error rate – contrast group

Condition	**n**	**Mean**	**Std. Deviation**
Error rate before	52	13.83	6.54
Error rate after	52	13.14	6.85
Total	104	.68	6.14

Table 24: Paired samples t-test results for error rate – contrast group

Mean	**Std. Deviation**	**Std. Error Mean**	**t**	**df**	**Sig.**
.68	6.14	.85	.80	51	.426

There was no statistically significant difference in the scores for the contrast group on the error rate before (M= 13.83, SD= 6.54) and error rate after (M= 13.14, SD= 6.85) conditions; t(51)= .80, p = .426.

In conclusion, for the contrast group, the absence of indoor plants into the employee's workplace did not have a statistically significant impact on the employee's performance.

Additional Analyses: Independent samples t-test

Additional analyses were performed looking at whether the performance scores differ between the groups.

As the scores for the two floors within the department are calculated differently by the organisation, a standardised change score was calculated for both the performance, and error rate variables. The standardised change score is explained as a pre-post change score with the score being the difference between the score before treatment (January-June 2018), and the score after treatment (July-December 2018). The standardised change score is calculated so that a positive score is identified as a change in the desired direction (Pallant, 2013). Once a standardised change score was calculated for floor one and floor two on *performance*, an independent sample t-test was conducted.

Performance

Table 25: Independent samples t-test descriptive statistics - performance

Group	**n**	**Mean**	**Std. Deviation**	**Std. Error Mean**
Treatment (floor 1)	64	-1.04	1.08	.13
Control (floor 2)	66	-.12	.61	.08

Table 26: Levene's test for homogeneity of variance - performance

Variable	**df**	**F Statistic**	**Sig.**
Performance	128	16.193	.000

Table 27: Independent samples t-test results - performance

Independent samples t-test			
Variable	**df**	**T Statistic**	**Sig. (2-tailed)**
Performance	128	6.038	.000

As can be seen from table 26 above, as well as table 16 in Section 3.3, the distributions were sufficiently normal for the purpose of an independent samples t-test (i.e., skewness < 2.0 and kurtosis < 9.0; Schmider, Ziegler, Danay, Beyer, & Buhner, 2010). Additionally, the assumption of homogeneity of variance was satisfied via the Levene's F statistic, F(128) = 16.19. The independent samples t-test was associated with a statistically significant effect t(128)= 6.04, p = < 0.05 indicating that there is a difference in performance scores between the treatment and contrast group. The standardised change scores are calculated so that a positive score is identified as a change in the desired direction (Pallant, 2013). The treatment groups mean (M= -1.04; SD= 1.08) and the contrast floors mean (M= .12; SD= .61) show negative scores which indicate a change in the undesired direction. Therefore overall, the scores indicate that performance was higher in the contrast group. The Cohen's *d* is estimated at 1.10 with an effect size of 0.5 which demonstrates a medium to noticeable effect between the treatment group (floor 1) and the contrast group (floor 2) performance scores.

Error Rate

Table 28: Independent samples t-test descriptive statistics – error rate

Group	**n**	**Mean**	**Std. Deviation**	**Std. Error Mean**
Treatment (floor 1)	63	-.14	.71	.09
Control (floor 2)	52	-.10	.94	.13

Table 29: Levene's test for homogeneity of variance – error rate

Variable	**df**	**F Statistic**	**Sig.**
Performance	113	4.15	.04

Table 30: Independent samples t-test results – error rate

Independent samples t-test			
Variable	**df**	**T Statistic**	**Sig. (2-tailed)**
Performance	113	.22	.04

As can be seen from table 29 above, as well as table 16 in Section 3.3, the distributions were sufficiently normal for the purpose of an independent samples t-test (i.e., skewness < 2.0 and kurtosis < 9.0; Schmider, Ziegler, Danay, Beyer, & Buhner, 2010). Additionally, the assumption of homogeneity of variance was satisfied via the Levene's F statistic, F(113) = 4.15. The independent samples t-test was associated with a statistically significant effect t(113)= .22, p = < 0.05 indicating that there is a difference in error rate scores between the treatment and contrast group. The standardised change scores are calculated so that a positive score is identified as a change in the desired direction (Pallant, 2013). The treatment group's mean (M= -.14; SD= .71) and the contrast floor's mean (M= -.10; SD= .94) show negative scores which indicate a change in the undesired direction. Therefore overall, the scores indicate that error rates were lower in the contrast group. The Cohen's *d* is estimated at 0.29 with an effect size of 0.1 which demonstrates very small, to no effect between treatment group (floor 1) and the contrast group (floor 2) on error rate scores.

3.5.2 Independent samples t-test on perceived performance and work engagement

In order to analyse whether the presence of indoor plants in the employees' work environment had an impact on their perceived performance, and work engagement, two separate independent samples t-tests were run. Perceived performance, and work engagement characterised the DV's, with the presence (treatment) or absence (contrast) of the indoor plants as the IV. The independent samples t-test results for perceived performance, and work engagement is reported below.

Perceived Performance

Subsequent Hypothesis:

2. *Indoor plants in the employee's workplace will increase their perceived performance.*

Table 31: Independent samples t-test descriptive statistics – perceived performance

Group	**n**	**Mean**	**Std. Deviation**	**Std. Error Mean**
Treatment (floor 1)	16	71.38	19.55	4.89
Contrast (floor 2)	24	77.33	16.78	3.42

Table 32: Levene's test for homogeneity of variance - perceived performance

Variable	**df**	**F Statistic**	**Sig.**
Performance	38	.40	.53

Table 33: Independent samples t-test results – perceived performance

Independent samples t-test			
Variable	**df**	**T Statistic**	**Sig. (2-tailed)**
Performance	38	-1.03	.31

Overall, both the treatment and contrast floor showed an average of 74.95% for perceived performance, and with the range from 0% to 100%, this suggests a reasonably high rate of

perceived performance. The treatment group (N= 16) was associated with a perceived performance of M= 71.38 (SD= 19.55). By comparison, the contrast group (N= 24) was associated with a numerically higher perceived performance (M= 77.33; SD= 16.78). To test the hypothesis that the treatment group and contrast group were associated with statistically significant different mean perceived performance scores, an independent samples t-test was performed. As can be seen in Section 3.3 of this chapter, the treatment and contrast group distributions for perceived performance were sufficiently normal for the purpose of conducting a t-test. Additionally, the assumption of homogeneity of variances was tested and satisfied. The independent samples t-test indicated that there was no statistically significant difference between the treatment and contrast group on perceived performance, t(38),= -1.03, p= .31. This result explains that indoor plants did not increase the employees' perceived performance.

Work Engagement

Subsequent Hypothesis:

3. *Indoor plants in the employee's workplace will increase their perceived work engagement.*

Table 34: Independent samples t-test descriptive statistics – work engagement

Group	**n**	**Mean**	**Std. Deviation**	**Std. Error Mean**
Treatment (floor 1)	16	3.90	1.21	.30
Contrast (floor 2)	24	3.66	1.06	.22

Table 35: Levene's test for homogeneity of variance – work engagement

Variable	**df**	**F Statistic**	**Sig.**
Performance	38	.38	.54

Table 36: Independent samples t-test results – work engagement

Independent samples t-test			
Variable	**df**	**T Statistic**	**Sig. (2-tailed)**
Performance	38	.67	.51

The scale is divided into three subscales namely vigour, dedication, absorption.

- Vigour for both floors showed a mean of 3.20 which is "sometimes"
- Dedication for both floors showed a mean of 4.02 which is "often"
- Absorption for both floors showed a mean of 4.06 which is "often"

Overall Work Engagement inclusive of the three subscales showed a score of **3.76** and therefore, employees from the sample "often" feel engaged: vigorous, dedicated and absorbed in their work. Employees from both floors within the sample perceive themselves to have a moderate to high level of work engagement.

The treatment group (N= 16) was associated with a work engagement mean of M= 3.90 (SD= 1.21). By comparison, the contrast group (N= 24) was associated with a numerically lower work engagement mean (M= 3.66; SD= 1.06). To test the hypothesis that the treatment group and contrast group were associated with statistically significant different mean work engagement scores, an independent samples t-test was performed. As can be seen in Section 3.3 of this chapter, the treatment and contrast group distributions for work engagement were sufficiently normal for the purpose of conducting a t-test. Additionally, the assumption of homogeneity of variances was tested and satisfied. The independent samples t-test indicated that there was no statistically significant difference between the treatment and contrast group on work engagement, t(38)= .67, p= .51. This result concludes that the indoor plants did not increase the employee's perceived work engagement.

3.5.3 Analysis of Covariance (ANCOVA)

In order to assess the subsequent fourth, fifth and sixth hypotheses, multiple one-way ANCOVA's were conducted to examine the relationship between the conditions *(plants, no plants)* and the moderator of CNS (*Connectedness to Nature Scale, and Plants in the Workplace*) to: (1) performance, (2) perceived performance, and (3) work engagement. Using the dataset provided, the test will determine whether CNS moderates the relationship between

the experimental condition, and performance, and work engagement at the $\alpha = 0.05$ level of significance.

Performance

Subsequent Hypotheses:

4 *Nature identity moderates the relationship between experimental condition and performance.*

This hypothesis was unable to be tested as the researcher was unable to match the performance data to the survey data for analysis to be conducted.

Perceived Performance

Subsequent Hypotheses:

5 *Nature identity moderates the relationship between experimental condition and perceived performance.*

Table 37: Descriptive statistics for ANCOVA – perceived performance

Group	Mean	Std. Deviation	n
Treatment (floor 1)	71.38	19.55	16
Contrast (floor 2)	77.33	16.75	24
Total	74.95	17.92	40

Table 38: Levene's test for homogeneity of variance – perceived performance

Variable	F	df1	df2	Sig.
Perceived Performance	.84	1	38	.37

Table 39: ANCOVA for group and CNS to work engagement

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1857.55	3	619.18	2.09	.12
Intercept	1502.85	1	1502.85	5.07	.03
Group	10.80	1	10.80	.04	.85
CNS	1248.98	1	1248.98	4.22	.47
Group*NI	4.31	1	5.31	.02	.91
Error	10668.35	36	296.34		
Total	237226.00	40			
Corrected Total	12525.90	39			

A one-way ANCOVA was conducted to examine the group (plants, and no plants) and nature identity on perceived performance. The predicted main effect of group was not significant, $F_{(1, 36)}$= .04, p= .85, nor was the predicted main effect nature identity, $F_{(1, 36)}$= .4.22, p= .05. The interaction between group and nature identity was also not significant $F_{(1, 36)}$= .02, p= .91. Simple main effects are therefore not necessary.

Work Engagement

Subsequent Hypotheses:

6 *Nature identity moderates the relationship between experimental condition and perceived work engagement.*

Table 40: Descriptive statistics for ANCOVA - work engagement

Group	Mean	Std. Deviation	n
Treatment (floor 1)	3.90	1.21	16
Contrast (floor 2)	3.66	1.10	24
Total	3.76	1.11	40

Table 41: Levene's test for homogeneity of variance – work engagement

Variable	F	df1	df2	Sig.
Perceived Performance	.38	1	38	.54

Table 42: ANCOVA for group and CNS to work engagement

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	5.59	3	1.87	1.57	.21
Intercept	2.20	1	2.20	1.85	.18
Group	1.18	1	1.18	.99	.33
CNS	4.95	1	4.95	4.16	.05
Group*NI	1.20	1	1.20	1.01	.32
Error	42.83	36	1.20		
Total	613.42	40			
Corrected Total	48.42	39			

An ANCOVA [between-subjects factor: group (treatment, control); covariate: Nature Identity] revealed no main effects of group, $F_{(1, 36)}$= .99, p= .33, or Nature Identity, $F_{(1, 36)}$= 4.16, p= .05, and no interaction between group and nature identity, $F_{(1, 36)}$= .1.01, p= .32. As the interaction between group and nature identity is non-significant, this suggests that nature identity did not moderate the relationship between the indoor plants and the employee's work engagement. Therefore, nature identity did not moderate the relationship between the absence or presence of plants and work engagement.

Chapter Four: Discussion

4.1 Introduction

This chapter aims to analytically interpret the results found in Chapter 3 and address these in relation to the conceptual framework that was explored previously by the researcher. The objectives that were explored include: 1) The relationship between the absence and presence of indoor plants on the employee's performance (*performance, and error rates),* (2) their perceived performance, and (3) their perceived work engagement. Additionally, Connectedness to Nature was assessed as a possible moderator for these results. The analyses in Chapter 3 demonstrated that the main hypothesised result was not met with performance for the participants in the treatment group showing a decrease in performance scores following the implementation of the indoor plants. However, this was an unusual result which deviates from previous studies. Therefore, an explanation for this result will be provided in this chapter. For the subsequent hypotheses regarding perceived performance, and perceived work engagement, the analyses demonstrated that the indoor plants made no impact. Nature identity was hypothesised to have an effect on the relationships described, however, the results unexpectantly demonstrated that Connectedness to Nature had no moderating impact on the relationships between perceived performance, and perceived work engagement, and indoor plants. The following chapter will expand on the results found and will support the findings with previous literature. This discussion hopes to assist the reader to understand the relevance of the current study findings pertinent to the work environment of indoor plants in the production of a more effective workforce. The structure of this chapter will present the results and discussion for each hypothesis and is divided into four subsections to ensure a clear, and coherent explanation. The chapter, moreover, will address the strengths and limitations of this research study, and will provide recommendations for future research. The chapter will conclude by reflecting on the theoretical, as well as practical implications of this research study.

4.2 Discussion of Results

4.2.1 The relationship between the presence of indoor plants on performance (performance, and error rates)

Main Hypothesis:

1. *Indoor plants in the employee's workplace will increase the employee's performance.*

Performance

Performance in the current study was operationalised as the performance score for each employee. The findings for the relationship between the presence of indoor plants on employee performance demonstrated significant results. However, the hypothesis was not supported as the results from the analyses revealed the performance of the treatment group was significantly better before the implementation of the indoor plants into the employee's work environment. A significant difference was found between the pre and post-implementation of indoor plants for the treatment group. The analyses indicated that participants on the first floor performed worse, with lower performance scores, after the indoor plants were implemented. Contrary to the hypothesised result, the presence of plants within the employee's work environment demonstrated declined performance. This finding, however, is contrary to previous literature within the field (Knight & Haslam, 2010; Adamson, 2017). There are several issues that need to be highlighted with regard to this variable. Once the researcher had completed the analyses on the performance data, a meeting was arranged with the management team of the organisation for the OPS department to discuss the unexpected finding for the decline in performance. The researcher discovered during this meeting that there were three main instances which could account for the decline in performance.

Before these are discussed, it important to note that performance for the two floors was calculated differently by the organisation. The performance score for the first floor, characterised by life consultants, is made up of a percentage score for the employee's performance over the month, as well as an error rate score per percentage of service requests. Floor one has many products, unlike floor two which only has the unit trust product. Therefore, the performance score for the first-floor consultants is characterised of many different features. These include the number of received service requests, along with the number of transactions

closed, to name a few. The full list, which is not exhaustive, but provides a basic outline of the factors that contribute to the employee's monthly performance score is provided in Chapter 2, Section 2.5. The researcher was not able to attain the actual calculation for how performance was calculated but it is important to consider how these factors may play a role. Essentially, the performance score is calculated as how much time a consultant should be taking to close the transaction, against a benchmark time which the organisation has previously tracked. This is then added up each day for that month, in which an average percentage for performance is then calculated for each consultant. On the second floor, for the unit trust consultants, performance is made up of a weighted monthly performance score which is characterised by how many transactions were closed by the consultant for the month. This is because floor two, unlike floor one, has only one product. Therefore, a standardised change score was calculated and only the pre and post scores on performance for the first floor were measured to attain a more appropriate result to test this hypothesis. However, due to the issues that were expressed by the managers, the performance scores were possibly inappropriate in measuring the actual impact that the indoor plants made on the employee's performance, and therefore, only the error rates are directly comparable.

What was discovered was that the organisation went through a system change in the OPS department during the month of August. August corresponds within the 'post' characteristic of the implementation period, being two months after the indoor plants were installed as the indoor plants were installed on the 28th June 2018. The system change was said by the managers to have an influence on the individuals within the department, but that the first floor had been especially impacted. Therefore, the system change provided a substantial reason for the hindrance on employee performance in the treatment group. Consequently, the first floor demonstrated a decrease in performance as consultants on the first floor had to equip themselves with the new system, and the process of closing transactions. As mentioned earlier, the first-floor deals with several products unlike the second floor which deals only with service requests made from clients on a single product. Therefore, the consultants on the first floor had to acquaint themselves with the new system procedure and do so for each product that they process. The managers informed the researcher that they received a lot of backlash from the first-floor consultants regarding the implementation of the new system. Ultimately, the new system was identified as unsuccessful and after the research period had concluded, the department reverted to the old system as it was deemed to be more effective.

The day-to-day functions of the first-floor were heavily affected by the implementation of the new system as the method that the consultants used to process requests required multiple, and more complex requests that were encoded into the system due to the various products with which they transact. In contrast, the second-floor consultants process requests for one product and therefore the turnaround time for each transaction was faster than for the first-floor consultants. As the change in system was not effective, performance was demonstrated to decrease on the first-floor. This meant that there was a decrease in consultants able to process the transactions after familiarising themselves with how to navigate the new system. Therefore, as there was a change in the system, the weighting for the requests per consultant was altered, which had an impact on the performance levels of the consultants. Additionally, the system change-over made the process less streamlined and a much longer turnout time on requests, against the benchmark, was observed. Such a major change on the employee in their day-to-day operations is suggested to have a large impact on the employee and their well-being (Cartwright & Cooper, 1993). This would have been a significant source of anxiety for the consultants and cause them to question their skill and place within the organisation (Seo & Hill, 2005). This anxiety may have impacted the employee performance scores within the current study with a decrease in morale, and a lack of optimism about the employee's future within the organisation.

According to Jalagat (2016), the change in a system could be regarded as a discontinuous, and radical change which is marked by a rapid shift in the strategy of the organisation and is considered the most difficult to attain because it has a tendency to threaten the administrative confidence, disadvantage the workforce, and hinder the employee's lives in general. The result of this could lead to several outcomes such as decreased performance and a lack of motivation (Rentsch & Schneider, 1991). The change in system would be regarded as subsystem change, according to Jalagat (2016), which institutes fear and confusion into the workforce. It could be argued that due to the rapid shift in the change of the system, the organisation was not equipped to manage the shift and consequently the negative effects of change were apparent (Jalagat, 2016). The drive by the organisation to improve the employee's performance through the system changeover may have lost its significance for the employees as there was new unwanted learning in how to work the new system. Therefore, as the change may not have promoted the interests of the employee, this change may have been resented, resulting in a loss of productivity. According to Jalagat (2016), employees may ignore the importance of change for the welfare of the organisation as it was seen to have a direct impact on their personal goals

and objectives (Jalagat, 2016). A lack of information may have also been the source of the decrease in performance as if the change was not communicated effectively to the workforce, its effectiveness is questionable, and employees are less likely to participate to the change efforts (Jalagat, 2016). The performance score means for the first floor are tabulated in the appendices (See Appendix W).

Secondly, the managers informed the researcher that there was a change in line-management during the period of study on the first floor. This change in line management occurred in September, after the implementation of the indoor plants with the total error rates for the first-floor increasing, relative to the previous months (See Appendix AA). This change in management was found to have implications on performance as the consultants had to adjust to a new management style and procedure. The relationship between the employee and management is an important area of well-being which may impact the performance of the employee while at work (Mason, 2007). Since the relationship with prior line-management was terminated, and with the introduction of new-line management; the change could be demonstrated to impact performance. A change in management is regarded as an internal factor of change, which requires careful planning and execution to achieve competitive advantage for the organisation (Jalagat, 2016). A change in management impacts both the management and the workforce (Jalagat, 2016). As previous professional relationships were terminated due to the change in management, some employees may have become resistant at an individual level, with the inability to process the organisational objectives for the change (Jalagat, 2016). This is because the change may have contradicted their personal interests and as a defensive stand, an employee could have hindered the change though a 'go-slow' (Jalagat, 2016) which ultimately would have implications on their performance score.

Thirdly, the volumes of work flow throughout the year spike at different times which means that volumes per month is not a constant variable. January to March shows spikes in the volumes of work (See Appendix W) with a particular increase in the month of February as this is described by the organisation as the general period in which consultants are back from leave and are more refreshed and able to transact more requests. February is the organisation's busiest month as it is the end of the tax season, therefore there is wider preparation within the department to deal with larger numbers of requests. This can be seen in the graph (in Appendix Y). The number of available consultants that are able to process the requests also vary.

Consultant availability varies based on annual leave, sick leave, skill level, resignations, and transfers, just to name a few.

A trend in performance scores for the OPS department is apparent. Performance is shown to increase around May as this is when the organisation does their performance reviews related to bonuses and therefore, a spike in performance is shown (See Appendix X). This could account for the higher performance scores that were attained before installation. The researcher was told that many consultants take leave during December, which means that there are fewer consultants available to process requests, which consequently indicates that performance decreases. This would explain the low performance score mean for the month of December (See Appendix X) and ultimately would have an impact on the overall performance score of the first floor for this month. This could account for the decrease in performance that was reported in the analyses in Chapter 3, Section 3.4.1.

From the explanation above, it is apparent that the performance data received from the organisation had too many external factors at play which could have influenced the performance scores for the consultants. The performance data received is therefore characterised as unreliable in yielding dependable results for conclusion of the above stated hypothesis. The error rate data, however, is more stable as it is calculated as a proportion of the number of requests.

Error Rate

As one method of measuring performance was possibly an unreliable measure, the error rates were analysed as a possible more reliable measure of performance, especially of the employees on the first floor. The error rate score is characterised as the error rate per percentage of service requests for each consultant for the month. Therefore, the error rate score is calculated as how many service requests a consultant received in the month, and how many errors were made per request. The error rate score can be argued to be more streamlined than the performance score as there are not as many variables that contribute to the overall score, other than the number of errors made per request for that month.

The results of the error rate dataset for the first floor yielded non-significant results for the relationship between the presence of indoor plants and performance on the error rate variable. A non-significant result was found indicating that the pre-performance mean was not

statistically different from the post-performance mean on the error rate variable, suggesting that the error rate scores of the employees were unaffected by the indoor plants. The current study demonstrates findings similar to that of Larsen et al. (1998). It was found that although the plants had aesthetic qualities in the plants condition, the performance levels were the lowest of all conditions (Larsen et al., 1998).

This result is however unexpected and dissimilar to that of Samaranayake and De Silva (2013) in that the error rates were perceived to decrease after the implementation of the indoor plants into the factory workers' environment through improved concentration, and reduced stress levels. The results of the current study deviate from Heath (2006) which suggests that an employee's workplace environment has a significant impact in the reduction of error rates. However, it is important to note that the error rate data obtained for the current study was based on rated scores of the number of requests received, and the number of errors made per transaction. Therefore, the current study's data, unlike that of Samaranayake and De Silva (2013) was based on a measurement of errors, and not the employee's perception of errors made. Therefore, it may be invalid to compare the error rate results from the current study with literature that relied on whether the individual perceived their errors to decrease.

The primary objective of an organisation is to increase their organisational effectiveness and improve the ability of the organisation to deliver on services (Neely et al., 1995). Performance at the employee level for the current study involved statistical quality control in the form of error rates. However, factors such as skill level, and leave, are not considered when the scores are calculated. They may be considered during the performance review meeting between the manager and employee, but these factors are not accounted for in the measure. Therefore, if a new employee was hired by the organisation, their error rate score would possibly be higher than employees that are more qualified and knowledgeable about the system. Alternatively, more skilled employees receive more requests which suggests that their volume of work is more than the average employee and more errors could be made as the employee is unable to handle the volume against the benchmark time allocated. However, there is no way to track this within the dataset and this may be a possible factor to consider in the results, especially as the descriptive statistics show that the mean age for employees in the OPS department was calculated at M= 27.94 for the performance dataset. This suggest that the majority of employees within the department may not be experts within their field and may be relatively new to the work environment. Leave is another factor which is not accounted for in the error rate score

and this may affect the month-to-month score variation found for an individual employee. As discussed earlier, employees are said by the managers within the department to be more refreshed after they return from leave, which could account for less errors being made by an employee as they could be argued to be mentally refreshed. In conclusion, to answer the main hypothesis above, indoor plants in the employee's workplace did not increase the employee's performance. As performance was characterised by the performance, and error rate scores, the error rate result discussed above will be analysed in relation to previous studies of indoor plants and performance outcomes.

The result of the error rate findings for the current study are different from that of Adamson (2017). In Adamson's (2017) study the plants and performance relationship yielded significant results. Therefore, unlike the current study, participants demonstrated fewer errors in the plants condition (Adamson, 2017). As Adamson's (2017) study was conducted in the South African context, these results may be generalisable to the South African population. However, as Adamson's (2017) study was conducted as a randomised trial with participant performance measured on a simulated task, it can be argued that there is a concern for ecological validity as the laboratory experiment of Adamson's (2017) study cannot be easily generalised to the workplace environment (Babbie, 2013). The result of the current study does differ from that of Knight and Haslam's (2010) study, as well as Shibata and Suzuki (2004), Lohr, Pearson-Mims and Goodwin (1996), and Smith and Pitt (2009) where performance was shown to increase in the presence of indoor plants. However, these studies were conducted in the European and American contexts, and therefore it can be argued that there are contextual concerns related to differences in the South African population. South Africa is a unique country, bursting with natural surroundings. This may have an impact on the way that South African employees perceive natural elements, such as plants, in their work environment as they have been predisposed to these natural environments on a regular basis (Borel-Saladin & Turok, 2013). Bringslimark, Hartig and Patil (2009) suggest that plants may be perceived differently in different settings and as South Africans have been argued to be predisposed to natural environments, this may have an impact on the way that indoor plants are perceived. Therefore, the result for the error rate analyses for the employees in the treatment group of the current study could be argued to be a result of the employees being accustomed to the plants. The long exposure of the indoor plants may have entailed habituation to the presence of the plants and in doing so, attenuation of the effect (Bringslimark, Hartig, & Patil, 2009).

It was expected that the indoor plants would lead to performance based on Kaplan's (1995) *Attention Restoration Theory.* The theory suggests that the plants lead to a break in demanding tasks which allow a person to psychologically rejuvenate in order to perform better on work tasks. In the current study however, this effect was not demonstrated, as the employees' error rate scores were unaffected by the presence of the indoor plants. Kaplan (1995) argues that viewing nature, or spending time in a natural environment, leads to increased mental capability. However, the current study suggests that this theoretical reasoning is unsupported as the results demonstrated that the indoor plants made no impact on the error rate scores. However, it is argued that the selection of indoor plants used in the current study may have been the issue as Bringslimark, Hartig and Patil (2009) suggest flowering plants have a greater impact on stress reduction, compared to foliage plants which were used in this research study. Another possible explanation is that the current organisation is situated in an environment that is surrounded by views of nature, the ocean, and mountains. Therefore, it can be argued that the indoor plants made no impact as the 'presence' of nature was already evident.

More generally however, it is argued that the species of plants used has implications for the amount of greenery that is actually seen. Han (2009) argues that the natural environment may differ in the quantity and type of the plants that are presented and the positioning of those plants within the environment which impacts on the restorative potential on the individual. Therefore, Han (2009) argues that the details of the plants such as placement, number of plants, and the type of plants implemented is important in the outcome of the restorative effect. In the current study, the type of plants used, and the amount were perceived to be sufficient for the first floor. This was investigated by horticulturalists prior to the implementation of the indoor plants. However, it can be argued that the indoor plants were not visually salient to every employee on the floor as they were placed around the office on cupboards so as to not interfere with normal work operations. The researcher believes that this may have been a factor which could have implications for the amount of greenery that was seen by each employee. For employees that were in close proximity to the plant troughs, this may have not been a factor, but for employees that were further away from the troughs, this could have resulted in an incomplete visual effect. Appendix Z, Figure 26 provides a short-range proximity of what an employee close to a trough would see. Figure 25 provides a long-range proximity of what an employee that was further from the troughs would see (See Appendix Z). Therefore, even though Kaplan (1995) suggests that just spending time in nature may increase an individual's mental capacity, it could be argued that the proximity to which the employees are to the indoor plants could

have an impact on how much restoration is achieved. Bringslimark et al. (2009) argue that "plants are effective as visual features of the environment that evoke aesthetic experiences and hold attention, thereby supporting psychological restoration" (p. 429) but if the employee was not able to view the plants as a visual feature due to proximity to the plants, the psychological restoration could have been impacted.

This argument is supported by Bringslimark, Hartig and Patil (2009) who suggest that visual exposure depends on the placement of the plants with respect to the individual and that one small plant close to the person (as seen in Appendix Z, Figure 26) and in their visual angle, may have more visual prominence than a large plant far away in the periphery (as seen in Appendix Z, Figure 25). Shibata and Suzuki (2002) investigated in their study whether the impact of the indoor plant was dependent on how much of it an individual could see. Therefore, this may be a factor which could have played a role in the effect of the indoor plants on the employees within the current study.

The current study, like that of Adamson (2017), allowed the plant enriched group to be analysed independently from the absence of plants group which allows for clarity on the impact that indoor plants may have on employees within an organisation. For the absence of plants group on the second floor, the results demonstrated that there was no statistically significant difference in the performance scores, and error rates after implementation of the placebo art pictures. This can be argued to be due to the fact that the art pictures only offered an aesthetic benefit which had no impact on the employee's performance (Restall & Conrad, 2015). In many of the studies that have analysed indoor plants, art pictures or pictures of plants have been included. Based on the *Attention Restoration Theory* it can be argued that indoor plants have more of a positive impact on individuals than art pictures. This is because art pictures are beneficial more for their aesthetic quality than their ability to cognitively restore, whereas indoor plants are beneficial for their aesthetic and their ability to improve the quality of the air, improve concentration, and cognitively restore an employee to perform better on tasks while at work (Adamson, 2017). However, the current study saw no difference between indoor plants and art pictures in their ability to increase performance.

The pattern of findings for performance in the current study are not in accordance with previous findings (Shibata & Suzuki, 2002; Knight & Haslam, 2010; Pearson-Mims & Lohr, 2000). However, unlike the previous studies, the current study utilised a quasi-experimental approach that manipulated the IV and isolated the plants from the no plants with placebo art pictures

which could have implications when cross-referencing the results of the findings. Niewenhuis, Knight, Postmes and Haslam (2014) found that performance did not increase in a 'lean' environment, however this could have been because the researchers in the Niewenhuis, Knight, Postmes and Haslam (2014) study were unable to control for the relevant variables. In the current research, there was control of the relevant variables through the IV manipulation, and the two comparison groups. However, the researcher was unable to standardise the two comparison groups working environment which may have caused confounding results.

In the current study, the amount of exposure was not necessarily the amount of time that the employees attended to the plants. The participants in the current study worked throughout the exposure period during the work-day and when on lunch, the employees would be in the cafeteria and not on the floor with the plants present. In a home, plants are not passively viewed (Bringslimark et al., 2009). They are nurtured too. However, in the current study, the plants were not attended to by the employees. Rather, the plants were installed and regularly cared for by the horticulturalists from Bidvest Execuflora. Therefore, this could have had an impact on how much time the employees spent paying attention to the presence of the indoor plants, and consequently, the restorative effect (Shibata & Suzuki, 2004). As the current study was not able to utilise repeated measures, as the organisation did not provide the intended 2017 performance data to be matched with the 2018 performance data that was provided, the researcher was unable to analyse whether the results for performance would have differed from the previous year. Additionally, repeated measures would have allowed the researcher to analyse whether the results obtained for the current performance analysis was due to the extraneous variables that have been mentioned above or if it is the trend in performance seen for the organisation.

In two quasi-experimental studies by Raanaas et al. (2011) and Tenessen and Cimprich (1995), the relationship between indoor plants and performance was analysed. However, in these studies sample size was a concern (n=34, n=75, respectively). In the current study there was a large sample size acquired for the performance data with 130 employees overall but only 64 employees for the first floor with the indoor plants. Therefore, the researcher acknowledges that this may have been a factor in the results. In other studies, positive correlations have been found for the relationship between performance, and indoor plants on individuals but demonstrated low statistical power (Bingslimark, Hartig, & Patil, 2007; Evensen, Raanaas, & Patil, 2013). This could be attributed to the fact that correlational designs do not demonstrate

a causal outcome of the relationship (Babbie, 2013). Like these studies, however, the researcher was unable to control for multiple confounding variables such as lighting, leave days, system change, management change, skill level, and volumes of work. Therefore, even though the current study was conducted in a real-working context of a South African organisation which could increase the generalisability of the results; the researcher acknowledges that there are many other factors which can be at play in a real-working context, as opposed to a controlled study. This may have implications for the validity of the study, as every organisation is a unique environment and results of performance can differ when taking into account factors such as the workplace environment, the placement of the indoor plants, the time period, exposure, and the type of work being done by the employees.

4.2.2 The relationship between the presence and absence of indoor plants on perceived performance

Subsequent Hypothesis:

2. *Indoor plants in the employee's workplace will increase the employee's perceived performance.*

Even though perceived performance was a separate construct that was analysed in the current study, the variable still forms the overarching concept of performance. In the current study, the analyses indicated that there was no significant difference between the treatment and contrast group on perceived performance. This result explains that indoor plants did not increase the employee's perceived performance. The results of the current study differ to that of Larsen et al.'s (1998) study in that participants in the plant condition of their research study had increased self-reported perceptions of performance when plants were present in the office space. Therefore, unlike Larsen and colleagues (1998), the indoor plants made no impact on the perceived performance of the employees in the treatment group. As discussed previously, the study was conducted in a real-working context of a South African organisation, and not a controlled environment like that of Adamson's (2017) study. Therefore, the researcher was less able to control extraneous factors so the measured impact that the indoor plants had on the employees perceived performance may have been due to other workplace factors, along with the introduction of the indoor plants.

In the current study, sample size for the survey was small with only 40 participants. Indoor plants might have had even a small effect on their perceived performance, but the detection of the effect requires a large sample size (Bringslimark et al., 2009). Therefore, even though the current study concluded that the differences on perceived performance between the groups were not significant, the difference may have not had sufficient power to detect even a small effect on the variable due to the sample size.

For the individuals in the OPS department, it could be argued that they were in need of restoration due to the type of work that they do, and the number of transactions that they handled throughout the day. However, in the current study, the need or potential for restoration was not analysed by any specific relationship and therefore, it is difficult to identify whether the employees had a definite need for restoration. However, restoration needs are argued by Bringslimark et al. (2009) to differ within individuals over time. Therefore, as Bringslimark et al. (2009) state: "inter-individual variability has implications for the generalisability of the findings" (p. 428). This means that some employees may have been more in need, or have had more potential for restoration, than others. Therefore, this could have impacted the findings on perceived performance.

The setting of the current research could also be identified as problematic. This is because, plants may be perceived differently in different settings (Bringslimark et al., 2009). It is argued that plants in a sterile setting may be have stronger effects than plants in a setting that is filled with other visual stimuli (Bringslimark et al., 2009). In the current study, the setting could be argued to be filled with other visual stimuli, such as the employee's computers that they work on throughout the day. Therefore, unlike the sterile setting of Adamson's (2017) study, the current study could be argued to have other visual stimuli, and this could have resulted in the indoor plants having a weaker effect on the participants. Setting is seen to be a major factor as Bringslimark et al. (2009) argue that what the participants do in the setting is important. For people that are in settings where they are focused on their work tasks that fill a stressful work day, the indoor plants may go unnoticed by the workers (Bringslimark et al., 2009). Therefore, as the employees in the current study were stationed at their work desks all day, focused on the work task of closing transactions, it could be argued that the indoor plants may have gone unnoticed by the employees and this could have had an impact on their potential for restoration which led to the non-significant result.

The results of the current study may be constrained by temporal aspects (Bringslimark et al., 2009). As noted previously, the employees may have adapted or have habituated to the presence of the indoor plants with the beneficial effect lessened during the period of study. In line with this, seasonal variations may have been an area of concern in the current study. It is argued by Bringslimark et al. (2009) that the effect of plants may differ throughout seasons. During the period of study, the plants were installed during winter with one possible reasoning behind the results related to Seasonal Affective Disorder (SAD) which is also referred to as 'winter blues' (Partonen & Lönnqvist, 1998) which could account for feelings of fatigue. SAD could have resulted in some employees feeling fatigued, and depressed, which could have resulted in lowered-self confidence in their abilities to perform their job. This could have impacted the results, as if some employees felt that their abilities were depleted, they could have under-emphasised their perceived performance.

For the current study, the indoor plants were installed into the employees work environment. Shibata and Suzuki (2001) considered different circumstances under which plants would affect task-performance through effects on attention. They hypothesised that plants would be more effective in reducing attentional fatigue during a break from work, than while performing a work task (Shibata & Suzuki, 2001). They argued this was due to a person allowing their attention to go to the plants during the break (Shibata & Suzuki, 2001). Therefore, as discussed previously, the indoor plants were only situated on the first floor with many employees taking a break in the cafeteria to eat and socialise. This could have impacted on the results, as the time in which the employees were exposed to the plants, they were performing work tasks, which could explain that the employees did not allow their attention to go to the plants during their break as they were not around them. Therefore, the time in which the plants were able to restore the employees could have been during their break, but the employees were not in the presence of plants at that time. Shibata and Suzuki (2001) suggest that plants could distract a person when working on a more attentionally demanding task (Shibata & Suzuki, 2001). In line with this, Larsen et al. (1998) found that in the presence of a large amount of plants, performance decreased. Therefore, an argument can be made that the fascinating properties of plants may interfere with some kind of work tasks (Bringslimark et al., 2009). In the current study, this could have been the case as the employees could have been distracted by the presence of the plants as they were focused on their work, which could have resulted in the potential for restoration to decrease. Therefore, the beneficial effect could have been blocked, resulting in the employees perceiving no change in their performance.

The results of the current study are also in opposition to the study by Samaranayake and De Silva (2013) who found in their research study that 86% of the employees perceived that their performance had improved once the green building had been established. This was due to the natural environment and the indoor plants which employees stated had a major impact in reducing their stress levels while at work. In a similar study done by Larsen, Adams, Deal, Kweon and Tyler (1998), participants reported higher levels of positive mood, such as positive feelings of affect; perceived office attractiveness and, in some cases, perceived physical comfort when plants were present as opposed to those in the no plants condition. However, in the current study the employees' perceived performance in the plant group was not significantly different from the employees' perceived performance in the no plant group. Bringslimark et al. (2009) argued that "a positive affective response evoked by plants may also work in non-restorative processes" (p. 429). In accordance with this, Larsen et al. (1998) argued that the plants could have made the participants' mood more positive, which consequently, could have made them less concentrated. The same argument could be made for the current study, as the plants floor was said to be characterised as the 'liveliest' floor within the organisation. This information was gained by the researcher during the meeting with the managers to discuss the findings.

It could also be argued whether the context of indoor plants qualifies as an experience with nature in some way (Bringslimark et al., 2009). This is because nature outdoors is said to differ in many ways from nature that is brought indoors, and these distinctions may impact the realisation of the psychological benefits (Bringslimark et al., 2009). It could be argued that in the current research study, that as the employees were inactively involved with the indoor plants in the indoor setting of the organisation, that the employees were essentially in a synthetic natural environment, but rather were enclosed by built natural structures that "affect the experience of the environment generally and of the plants specifically" (Bringslimark et al., 2009, p. 430). This is because plants that are indoors, are argued to be "separated from their natural habitat and therefore, have an ambiguous character of human intervention in and control over nature" (Bringslimark et al., 2009, p. 430). Much of the literature on the benefit of natural environment experience assumes not only exposure to nature which is outdoors, but also a leisure activity, and in the current study the participants were sitting in the space with the indoor plants and may have noticed the plants only in passing as they proceeded with their work. Therefore, there could be a possibility that context moderates the association between the contact with nature and the psychological benefit.

Therefore, in conclusion, indoor plants did not increase the employee's perceived performance. However, as argued, there are numerous variables which could have accounted for this finding. These include visual salience, the location of the indoor plants in relation to the employee, the activities of the employee during the time of exposure to the plants, and the relationship between the amount of time the employees viewed the plants or otherwise interacted with them which could have played a role in the current study findings on performance, and perceived performance.

4.2.3 The relationship between the presence and absence of indoor plants on work engagement

Subsequent Hypothesis:

3. *Indoor plants in the employee's workplace will increase their work engagement.*

In order to see whether employees felt more engaged at work after the indoor plants had been installed, their perceived work engagement was investigated to explore whether an enriched environment with indoor plans was shown to increase the employees' work engagement. According to the results that were presented in Chapter 3, the relationship between the presence and absence of indoor plants and employee work engagement did not produce statistically significant results. Therefore, there was no statistically significant difference between the treatment and contrast group on work engagement which concludes that the indoor plants did not increase the employee's perceived work engagement. The work engagement items that were measured in this research study included feelings related to strength and vigour, energy, enthusiasm, intensity, pride, and feelings of being immersed or getting carried away while working. These items are contained in three aspects namely vigour, dedication, and absorption (Schaufeli & Bakker, 2006).

The results from the analyses for work engagement could be attributed to the change in management which was discussed above. This event could have had an impact on the well-being of the employees which, consequently, could have impacted their engagement while at work as the employees were asked to perceive how engaged they were in relation to how proud, and enthusiastic they were about their job. Therefore, as the employees were aware of the change in management, there could have been a sense of uncertainty of their job tasks and in acquiring a new manager, a new way of doing things. This in turn could have resulted in the

employees not feeling enthusiastic about their job, and therefore, not being able to effectively engage while at work. The system change is another factor with a large impact that could have produced uncertainty and feelings related to being disengaged at work which could have resulted in the findings. The above factors could have negatively impacted the employee's mental resilience, their sense of enthusiasm, as well as their pride in their work. However, as the current study is not a repeated measures design, it is unclear whether this result would have been the same before the implementation of the indoor plants.

A study by Sonnentag (2003) examined performance outcomes through the use of the UWES and found that the level of work engagement is positively related to the degree to which employees recuperated from their previous day of work. The significance that work engagement can have in an organisation is evident through the positive attitude employees display at work towards their work tasks as well as towards the organisation (Schaufeli & Bakker, 2003). High levels of work engagement can be seen to increase employees job satisfaction at work while increasing levels of employee's commitment to the organisation, which in turn lowers the levels of turnover (Schaufeli & Bakker, 2003). The current study findings are in direct opposition to studies such as Knight and Haslam (2010) and Raanaas et al. (2011). The current study is also in direct opposition to the theoretical framework suggested by the *Attention Restoration Theory.* A likely explanation could be that the OPS department is characterised as a sort of call centre environment. These types of environments are referred to by Campbell and Wiesen (2011) as 'toxic,' with Bagnara and Marti (2001) describing them as "modern factories" (p. 223). In line with this, Campbell and Wiesen (2011) described the call centre mentality as a place where employees work to make money for the organisation and where high turnover is evident. From the number of employees that had to be removed from the performance and error rate data due to termination, this may be true in the current study. Within the department, there are many sensory offensives that employees are exposed to throughout the day, such as telephones ringing, people continuously speaking, and computer screens. This is evident by the performance score criteria through the number of calls, and e-mails that are made to clients during the month (Section 2.5). Therefore, it can be argued that the employees were likely to be stressed and therefore not as engaged in their work with reference to pride, and energy levels which could be depleted due to burnout.

Many international studies have produced significant results regarding the positive effect that indoor plants have had on employee engagement. One such study is that of Raanaas and

colleagues (2011) which demonstrated the in the plant condition as opposed to the no plant condition, work engagement improved. Similar results were found in Knight and Haslam's (2010) study. In their study it was found that in the enriched condition, tasks were performed quicker by participants with no reduction in accuracy (Knight & Haslam, 2010). Therefore, Knight and Haslam (2010) argued that in the presence of plants, work performance is increased. Therefore, according to Bringslimark, Patil and Hartig (2006), plants have positive benefits. Adamson (2017) suggested that indoor plants are a "portable, flexible, beautiful, useful and relatively low cost" (p. 431) intervention which can be used in organisations to improve the quality of the environment for employees to increase performance outcomes and other organisational factors through assessing employee's engagement while at work. The current study however, showed non-significant findings for the impact of indoor plants on work engagement. A repeated measures design would have been valuable in understanding the work engagement of the employees prior to the implementation of the indoor plants to assess whether the result would have differed due to the impact of the plants. However, one argument that can be made is that according to the *Attention Restoration Theory,* if a person is focused on a task for a prolonged period, it will result in fatigue. The *Attention Restoration Theory* also suggests that natural elements, such as indoor plants, do not require an extensive period of attention for fatigue for the prolonged attention to be reversed (Raanaas et al., 2011). However, the *Attention Restoration Theory* does require an individual to be focused on the plants. Therefore, as previously mentioned, tasks that require high attentional resources do not permit a person to attend to their environment (Shibata & Suzuki, 2002). This indicates that indoor plants may have less of an effect in highly stressed workplaces (Shibata & Suzuki, 2002). The current workplace can be argued to be a highly stressful working environment as there are tight deadlines, and line-managers that are employed to ensure that employees are meeting their objectives. As discussed previously, this could be linked to the habituation effect in which employees forget to notice the plans as they become incorporated into the workplace.

The current findings are dissimilar to that of Kalantzis (2016) and Bloch (2017). Both researchers utilised the UWES-9 scale, as was done in the current study, and found that work engagement significantly decreased from time 1, to time 2, after the introduction of indoor plants in the workplace. However, the argument made by both researchers for the decrease, was due to problems within the organisation which could have resulted in this outcome. In the current study, the survey was only administered once, so it is not possible to demonstrate whether the employee's engagement would have differed before implementation of the indoor

plants. However, from the performance dataset, as mentioned above, it appears that the organisation has high levels of turnover due to the number of employees that had to be removed from the dataset. Therefore, it can be argued that even though the results demonstrated that the indoor plants did not improve performance, this could be attributed to extraneous factors within the organisation. It is also important to note that the surveys were administered after the system change; therefore, the employees could be said to have been distressed and likely not engaged in their work due to the new system changeover. Therefore, it is necessary to take into account the physical work conditions, as introducing indoor plants into the employee's workplace may not be effective without investigation of the changing psychosocial aspects of the workplace.

There are also many extraneous variables that should be taken into consideration. These could include issues related to financial stress, or home stressors which could affect the performance of an individual. Coka (2016) explains that people on average, spend about 20 hours a month attending to their personal financial pressures while at work, which could have an impact on a person's engagement, and consequently, their performance while at work. This is especially relevant as in South Africa, many working individuals are having to support their entire families as the unemployment rate is at a staggering high and with only 27.9% of South Africans classified as financially stable (Jones & Muller, 2016).

4.2.4 The role of nature identity on the relationship between the indoor plants and performance, perceived performance, and work engagement

Subsequent Hypothesis:

4. Nature identity moderates the relationship between the experimental condition and performance.

5. Nature identity moderates the relationship between the experimental condition and perceived performance.

6. Nature identity moderates the relationship between the experimental condition and work engagement.

In this research study, nature identity was examined using the revised Connectedness to Nature Scale, as well as the Plants in the Workplace items that were added. The final subsequent

hypotheses were interested in analysing whether an individual's concern for the environment (nature identity) moderated the relationship that the impact that the indoor plants had on the employee's performance, perceived performance, and work engagement. The researcher notes that the subsequent fourth hypothesis related to performance was unable to be conducted as the researcher was unable to match the performance data to the survey data.

A one-way ANCOVA was conducted to examine the group (plants and no plants) and nature identity on perceived performance. The predicted main effect of group was not significant, nor was the predicted main effect of nature identity. The interaction between group and nature identity was also not significant. There was shown to be no significant difference between the treatment and contrast group on perceived performance, regardless of their nature identity. Therefore, nature identity was not a moderator of the indoor plants and perceived performance relationship which answers the fifth subsequent hypothesis.

A one-way ANCOVA was used to analyse the group (plants and no plants) and nature identity on work engagement. The results demonstrated no main effects of group, or Nature Identity, and no interaction between group and nature identity. As the interaction between group and nature identity was non-significant, this suggests that nature identity did not moderate the relationship between the indoor plants and the employee's work engagement. Therefore, nature identity did not moderate the relationship between the absence or presence of plants and work engagement which answers the sixth subsequent hypothesis.

According to Restall and Conrad (2014), an individual's relationship with nature is important to determine how it may influence their personal values, attitudes, and ultimately, their behaviours. In literature by Morton, Van der Bles and Haslam (2017), it was found that nature identity has an impact on the benefits that are received from plants. However, in their study, the definition for nature identity was extremely specific and related only to an 'urban identity' compared to a 'rural identity'. Therefore, this may not be considering the same manner in which nature identity was used in the current study. In addition, Mayer and Franz (2004) suggest that individuals with a greater nature identity are shown to respond more positively to nature. In the Knight and Haslam (2010) study, nature identity was regarded as an area for further research. In Adamson's (2017) study nature identity was investigated as a covariate in the relationship between the indoor plants and performance in a similar manner. Like that of the current research study, Adamson (2017) found that nature identity was not a moderator variable

The current study findings, along with Adamson's (2017) study is in contrast to previous studies, including literature by Wilson, Kendal and Moore (2016) in the theory of mutuality and the findings from Knight and Haslam (2010). As discussed in Adamson (2017), nature identity is a multidimensional concept with many aspects, and it can be difficult to measure every facet. Unlike Adamson's (2017) study, nature identity was investigated using the revised Connectedness to Nature Scale, along with the self-developed Plants in the Workplace Scale. The reliability of the combined scale could be said to have played a factor and further research using the combined scale is needed to investigate whether it is a reliable scale in different contexts and with a different sample.

Another explanation for the finding could be attributed to the South African context and the culture of spending time outdoors. It could be argued that the sample already has a generally high nature identity. Prior to running the one-way ANCOVA, the researcher investigated the mean scores of the combined CNS scale. The mean for the combined score demonstrated a mean score of 4.49, approximating 5, therefore, the rating would be "strongly agree." Therefore, it can be argued that in both groups there could have been a high nature identity already present. Adamson (2017) states that this variable is poorly researched and for a better understanding of nature identity to be done for an accurate explanation to be developed. It would also be beneficial to conduct a longitudinal study, with repeated measures to examine the participants' nature identity prior to the implementation, and then again after the implementation to see whether there is a definitive change. Therefore, in conclusion, nature identity was not a moderator in the current study. This is in contradiction with the hypothesised effect that nature identity will moderate the outcome that the plants have.

4.3 Limitations of the Study

This section of Chapter 4 discusses some of the limitations of the current research study that are to be considered in relation to the results.

One of the major limitations within the current study was the quasi-experimental design which made it impossible for the researcher to control for extraneous variables that were apparent in the organisation. Within the current study, psychosocial aspects may have played a role in the results such as one's personality type, financial or personal related problems, or a person's attitude. Performance, perceived performance, and work engagement were the outcomes of focus in the current study, however, indoor plants were the only variable that was looked at in

relation to having an impact. Therefore, other possible phenomenon for the results may have been missed by the researcher.

Another limitation that was found for the current study was in the sample. As mentioned, the sample size for the survey was small due to the low response rate which could have implications for the power of the findings and in the ability of the analyses to produce significant results. Bloch (2017) stated that the small sample of 34 participants accounted for the fact that non-significant results were found. Therefore, the same could be argued for the case of the current research with only 40 participants in the survey. The small sample size has generalisability implications when inferring these results to a larger population. Statistical analyses require a larger sample size in order to certify a representative sample, and distribution of the population to which the results will be generalised. Sample size has implications for normality, but in the case of the current study normality was only a concern in the performance dataset with the larger sample in which a non-parametric test should have ideally been used. However, the homogeneity tests and normality from the histogram argued for the use of the parametric test to be used to analyse the relationship between the indoor plants on the employee's performance. Parametric tests can therefore be argued to be more sensitive to differences which may exist between groups, according to Pallant (2013).

Along these lines, the sample for the study was chosen by the organisation and this could have had validity issues in regard to representativeness of the South African population. The sample from both the survey, and performance data may not have been representative either, as the majority of the participants were female with 63% and 61.5%, respectively indicating an unbalanced sample in regard to gender.

As the current study was conducted in one department, within one organisation. Therefore, it can be argued that organisational culture, intra-personal relationships, and internal politics differ between organisations, and the organisational context of the current study may not be similar to that of another organisation. Therefore, results obtained for the current study may have issues with generalisability when interpreting the results across different organisational contexts.

Apart from the performance data gained from the organisation, all measures that were used to assess performance and nature identity were self-report. This means that the results were dependent solely on the subjective opinions of the employees, in which extraneous factors may

come into play. It is suggested that, depending on a person's personality, or mood at the time of completing a survey, they may over or under exaggerate characteristics that they believe represent them. The participants that completed the surveys, were aware that their employee numbers would remain anonymous to the organisation, and in any other regard than for the purpose of matching the survey data to their performance data. However, this may have resulted in some degree of social desirability bias when answering the survey, whether subconsciously, or consciously to appear more engaged and productive to the organisation. The possibility that the employees knew that the results would be analysed and reported on in this research study, and with a summary of the findings given to the organisation, it is unknown whether the employees that participated in the survey were fully truthful in providing their answers.

The performance data was helpful in providing a slightly more objective measure of the employee's performance. However, there are so many confounding variables at play within the measurement and calculation of the performance and error rate score that it would be unreliable to assume that these results are generalisable to indoor plant outcomes in other South African working populations. The type of work that is done within the current study department, may differ from any other organisation within South Africa, and this may have an impact on the reliability of the results in relation to what is characterised as 'performance' and 'work tasks' within the organisation. Therefore, the definition of work may differ, along with how performance may be measured in another organisation which could have implications on the results. Along with this, the type of work that the consultants on the first floor, compared to the consultants on the second floor differed even though they were characterised as the same department. The number of products, as well as turnaround time differs between floors and this could have had validity issues in relation to the construct of 'performance' that was measured in the current study.

With the survey data, it would have been helpful to look at the perceived performance and work engagement of the employees prior to the implementation of the indoor plants, and once again post implementation to see whether there was a direct effect from the presence of the plants for the employees. Therefore, even though the performance data was a repeated measure, the fact that the performance data was unable to be matched to the survey data did not allow for cross-comparison on both subjective and objective levels which could have aided the results. As discussed previously, performance for each floor within the current study is measured

differently by the organisation which could have implications for what characterises performance as the way it is calculated differs. During the period of study of the current research, the way in which performance was calculated changed one month after installation of the indoor plants. Therefore, this could have implications in the reliability of the pre- and post-performance scores which could mean that they were inappropriate for comparison analyses to be conducted.

Reliability co-efficients were run to analyse the Cronbach Alpha's for the scales used in the current study. The revised *Connectedness to Nature Scale* yielded a Cronbach Alpha which was regarded as poor reliability according to George and Mallery (2003) standards. The Cronbach Alpha for the revised *Connectedness to Nature Scale* increased when item 3 was deleted of "I often feel disconnected from nature." However, when the reliability of the scale was calculated in connection with the added self-developed items from the Plants in the Workplace questionnaire that were developed to be included with the CNS scale, the Cronbach Alpha yielded increased for the combined scale. However, according to George and Mallery (2003) the Cronbach Alpha yielded would still be regarded as a weak reliability co-efficient.

The *Plants in the Workplace Scale* when reviewed in isolation, yielded a Cronbach Alpha that was regarded as acceptable, to good reliability according to George and Mallery (2003). The *Art Pictures in the Workplace Scale* did not yield an acceptable Cronbach Alpha. However, the combined CNS and Plants in the Workplace scale yielded a Cronbach Alpha which according to Gravetter and Forzano (2011) was still above 'unacceptable' standards. However, it is important to note that only the UWES-9, Perceived Productivity Scale, and the combined CNS revised scale with the five self-developed items in the Plants in the Workplace Scale were used to analyse the hypotheses for the current study. The supplementary scales were only used to analyse any additional analyses that were conducted to inform the main, and subsequent hypotheses for the study using the three scales mentioned.

Therefore, even though the Cronbach Alpha for the combined CNS was regarded as questionable to poor according to George and Mallery (2003) standards; the scale was still used in the current study. The reliability co-efficients of the two other scales used to test the hypotheses of the current study were calculated. The UWES-9 yielded a Cronbach Alpha that was acceptable for analysis. The Cronbach Alpha for the *Perceived Performance Questionnaire* by Thatcher and Milner (2012) was unable to be calculated as the scale only contains one item. Future studies should aim to use scales that yield sufficient Cronbach

Alpha's (+.07) to ensure that the instrument used consistently measures the construct. Therefore, it is important to note that the Cronbach Alpha for the combined CNS was low for the current study and the researcher suggests caution with analyses that included the low Cronbach Alpha.

As discussed in the results, the length of time in which the employees were exposed to the plants could have had an impact on the results. Adamson's (2017) study was conducted in a laboratory setting over a short time period. The results of Adamson's (2017) study demonstrated significant results for the impact of indoor plants on the performance outcomes. However, in comparison, the current research study was conducted over a year and as mentioned earlier, the employees may have become habituated to the indoor plants. This may have played a role in the non-significant findings of the current study.

Seasonal changes may have also aided in the non-significant findings that were presented in the current study. As the employee's performance was measured pre and post installation is a strength of the current study, however it is argued that due to the fact that the plants were installed during the beginning of winter, that this may have had an adverse impact on the individuals. Employees may have had what has been characterised as the 'winter blues' which could have made them more fatigued, more prone to burnout, and less likely to feel engaged while at work. In line with seasonal changes, it is apparent that different periods may be more stressful for some individuals. It is argued in the current study that at the end of the tax season, the organisation was more prepared for the amount of client requests, than in December, which is usually the period in which many consultants were stated to take leave. Therefore, for the consultants that were unable to take leave over the December period, it is possible that this may have been a more stressful month as there were less consultants to handle the client requests.

As mentioned in the results section, the amount, and positioning of the indoor plants to the individual may also play a role in the amount of greenery that is actually seen by the individual. This may have implications for the restorative effect of the indoor plants, which in turn could have had an effect on the non-significant results that were presented in the current study. This is argued to be an area of interest within the field that deserves more attention (Knight & Haslam, 2010).

It also came to the researcher's attention that some employees may not be stationed at their work desks throughout the day, due to training, and this may have had an impact on the

performance scores that were obtained and is a factor to consider. Along with this, the performance variable characterised many extraneous factors such as the system change, volume spikes, and management changeover during the period of study which resulted in the performance measurement failing to represent the construct. Therefore, the researcher acknowledges that the performance variable was invalid for analysis in the current study. The researcher also acknowledges that due to this, and due to the performance dataset unable to be matched to the survey data, the subsequent fourth hypothesis was unable to be conducted to test the impact of nature identity on the relationship between indoor plants and the employee's performance. This was because the survey compromised the employee's nature identity through the use of the combined CNS scale that was used in the current study. However, the researcher argues that even if the organisation presented the employee numbers, the matching process would still be inadequate due to matching with the small sample size of 40 participants from the survey.

Nonetheless, the current study was the first of its kind to analyse the effect of indoor plants on a sample of employees within an organisational context with regard to performance outcomes. The researcher acknowledges that there were many limitations with the current study, as with every research study. However, the current research serves as a learning processes and allows for future research to take into account the above aspects that have been mentioned to further the knowledge of the field in South Africa.

4.4 Recommendations for Future Research

As the limitations have been discussed, it is advantageous to consider how the research may be improved for future research that is conducted on the subject. In much of the literature, gender was argued to be a possible moderator variable in the relationship between indoor plants and performance outcomes. Therefore, it may be beneficial to identify whether this may be a covariate factor of interest.

Performance is measured differently for each floor. This may indicate that along with the pre and post-performance scores, between groups analyses may have resulted in inaccurate results for the impact that the indoor plants had on the performance outcome when compared with the no plants group as the scores were dependent upon differing factors. Therefore, it would be useful for future studies to define the performance criteria before analyses to indicate whether between-groups analyses are sufficient in reporting accurate results.

It is recommended that a repeated measures design for the survey data be introduced to strengthen the more objective performance data that is acquired. Along with this, a repeated measures design for the performance data that is gained, possibly from the previous year with the same period of time analysed for the treatment, may be a reliable way to identify the trend in performance and whether the results could be attributed to extraneous variables within the organisation, and not the presence of the plants.

The researcher argues for the use of more than one organisation with similar organisational contexts in order to identify whether context is a moderator variable, or to analyse the results to a broader sample. The researcher believes it would also be beneficial to look outside of a 'call-centre' type environment as the previous studies that have been conducted (Bloch, 2017) argue for context as a possible factor in the non-significant results as call-centre type environments have been argued to be 'toxic' work environments which may have an implication on the results.

In order to strengthen causal claims, the researcher suggests that a plant group, art pictures group, and no plant (control) group be analysed in the same organisation, or over two organisations with similar environments and over the same duration to isolate the conditions. This may provide a more stable form of comparison, as the researcher cannot be sure whether in the contrast group, the art pictures that were added as a placebo accounted for the results found.

The researcher also puts forward the idea for further research studies to consider an open-ended qualitative section at the end of the survey. This will allow for a design that incorporates both a quantitative, and qualitative design, to analyse an individual's subjective experience through viewpoints provided (Brown, 2009). Adamson's (2017) study, which adopted a primarily quantitative nature, included statements provided by the participants within the three conditions as a basis of possible explanations for the results found. This was seen to be useful, and within the current study, the researcher, during casual conversations with the employees, gained interesting information that aided in the understanding of the results. One critique that was brought forward by the organisation in the current study was that there was no place for the employees to include any 'feelings' that they had related to the experience. Therefore, the researcher believes that further studies should aim to adopt a qualitative element to the survey to understand the qualitative aspects of human behaviour during the study to aid the results. According to Brown (2009) these viewpoints are unprovable but have shown to have structure

and form and may provide substantial information that could benefit the researcher throughout the research study in moving the field forward. The support for this is that the literature has yielded confounding results, and with the implementation of an interview, or focus group, the researcher may be able to identify the possible reasoning behind why this may be the case.

From the limitations, it is evident in the current study that external factors such as job satisfaction, skill level, leave, absenteeism, and volumes of work played a role in the calculation of the performance variable. Therefore, it would be advisable for future studies to possibly include a measure which would be able to assess these factors, and the impact that they may have on the results obtained. One recommendation by Bloch (2017) which this researcher wishes to bring forward once again is the to investigate whether time of exposure to the indoor plants has a role in the outcomes that are seen. Therefore, as Bloch (2017) suggests, it would be advantageous to use two organisations and two samples and expose the employees in the first organisation to indoor plants for a short period of time, and exposure the second organisation for a longer period, such as six months to a year. This may provide beneficial information with regards to whether time exposure plays a role. The positioning of plants to individual proximity was also seen to be a variable of interest in the current study which may have played a role in the non-significant results. Therefore, future studies should look at the proximity of the plants to the individual and the impact that proximity may have in the effect of the plants on the individual. Further studies should aim to see whether proximity plays a role and investigate whether the effect of the plant depends on how much of it one could see or whether attending to the plants makes a difference.

As discussed in Chapter 1, South Africa is a multi-faceted context with many different cultures and therefore, it would be beneficial to examine whether culture may play a role in the symbolism which the indoor plants have on the employees, and consequently, their nature identity. Thus, including culture within the CNS scale may have an influence on the results. As sample size was regarded as a limitation in the current study with an unbalanced sample, it would be beneficial for future studies to attempt to gain a more balanced sample between groups for a more normal distribution to be seen, and a better comparisons between-groups to be made.

The last suggestion that the researcher believes would benefit future studies in this new field of study would be to use the combined, revised CNS scale with the self-developed items included. The original Mayer and Franz (2004) Connectedness to Nature Scale, as mentioned

in previous studies such as Kalantzis (2016) may not be appropriate as it is not solely focused on plants with several items related to animals, or other organisms. Therefore, for the current study, the scale was revised for use, and five self-developed items related solely on the focus of plants included. It would be beneficial therefore, for future studies to analyse this combined CNS scale and its reliability across different studies as a possible measure to further the research done in this field.

4.5 Theoretical and Practical Implications

As with every research study, there are theoretical and practical implications for the results observed.

Firstly, these results have theoretical implications for those who wish to replicate the current study. It is also important for organisations to better understand their workplace, in order for the horticulturalists to provide the correct type, number and arrangement of the indoor plants to provide the maximum effect possible. Therefore, a more comprehensive understanding of the impact that indoor plants may have on performance must be made.

Secondly, the current research demonstrated no significance of the impact that indoor plants have on performance. Thirdly, nature identity was not identified as a moderator variable, and fourth, the *Attention Restoration Theory* did not provide sufficient evidence for a verified claim to be made in the real-working environment within a South African context. Therefore, context should be explored as to whether this applies to all South African organisations, or only in contexts in which psychological restoration is expected. In all contexts however, it is important to analyse whether the plants were noticed by the participants, as if not, the impact of the *Attention Restoration Theory* is questionable.

Practically, it should be assessed whether it is advantageous to implement indoor plants into the workplace as in the current study it was shown to make no practical difference in benefiting the employee's performance, and work engagement. Future studies will do well to take the recommendations and assess the limitations of the current study to optimise future research conducted in this field.

Through the use of the current study, as well as previous literature that has provided evidence for the effect that indoor plants may have on employees in a work environment, it is beneficial

for organisations to consider alternative resources, or forms of interventions, which could promote a healthy, and productive workplace. This should practically enable organisations to improve their performance and allow for an optimised return on investment. Additionally, the 'green' intervention within the workplace may provide subsequent positive outcomes related to reduced turnover, reduced burnout, and increased work engagement which result in timeously, and more effective work tasks being produced by employees. This in turn will have consequences on the amount of sales, as well as customer satisfaction, and repeat business. The findings from this research study add to the literature in the field and compliment previous literature and theoretical findings.

Chapter Five: Conclusion

The current study was essentially a replication of Adamson's (2017) study in a field context. The current study aimed to investigate the difference between the presence, and absence of indoor plants on employee's performance, perceived performance, and work engagement. From the literature provided as a basis in Chapter 1, it is demonstrated that plants have beneficial outcomes for individuals. The current study however, provided non-significant results on the relationship between indoor plants and performance outcomes. However, these results are only offered as one possible result within the organisational context of South Africa.

A quantitative, quasi-experimental design was utilised with an overall sample from the performance dataset, and survey of 130 and 40 participants, respectively. Multiple analyses were run to answer the proposed hypotheses stated in Chapter 1, Section 1.4. The results of the current study demonstrated that there were no significant differences found for the presence, or absence of plants group on performance, perceived performance, and work engagement as explained in Chapter 3. Nature identity as a moderator variable was investigated with the indoor plants and performance outcome relationship. Nature identity was demonstrated to not function as a moderator variable within the current study. This suggests that regardless of an individual's nature identity, performance, perceived performance, and work engagement were not seen to increase in the presence of plants. The theoretical framework utilised for the current study was the *Attention Restoration Theory* that explains that viewing nature, or spending time in a natural environment, will increase psychological restoration. However, the findings from the current study suggest that extraneous variables may impact the potential for restoration. This may include, and are not limited to, exposure time, toxicity of the work environment, habituation,

and context. Therefore, further investigation should be conducted to attempt to mitigate these concerns.

The current study interpreted the findings through developing on previous literature. Recommendations to assist future research were provided as a reference point when analysing the relationship between indoor plants on performance outcomes. The results of the current study build on previous research and add to the theoretical knowledge that is evident. Those that would benefit from this research study include organisations, researchers within the field, as well as horticulturalists, as a provision for enhancing the research conducted, and impact of indoor plants in the enhancement of employee performance. As this field is relatively new in South Africa, further research which expands on and takes into account previous study limitations will aid in building a battery for use in analysing these relationships.

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Appendices

Appendix A: Participant Information Sheet for the treatment group



Private Bag 3, Wits, 2050 • Tel: 011 717 4524 • Fax: 011 717 4556 • E-mail: umthombo.SHCD@wits.ac.za

Good day,

My name is Bianca May and I am a Master's student at the University of the Witwatersrand. In order to obtain my Masters' degree in Organisational Psychology, I am required to conduct a research project. The aim of my research is to investigate the design of the workplace and the impact that this may have on employees. I would like to invite you to participate in my research project.

In order to participate, you will need to complete this online survey. This should take approximately 10 minutes to complete at a time convenient for you. You are asked to do this within the next two weeks. Once you have answered the survey, your answers will be saved automatically.

Participation is completely voluntary and there is no benefit nor negative consequence to participation in this study. Therefore, if you choose not to participate, it will not disadvantage you in any way. Your answers will remain confidential and anonymous in the final report. The organisation will not have access to your survey responses and only grouped data will be reported on and therefore your responses will remain anonymous. Your employee number will be requested, to link data to the survey but the organisation will not be given any marking code to make meaningful sense of the data and will not be given access to your responses. The employee number will not be traced back to any individual characteristics and once collected, will be removed. The data collected from this research study will be kept on a password protected computer with no identifying characteristics attached and no IP addresses will be recorded.

Feedback will be given to the organisation in the form of a summary report of the findings, however if you wish to have access to the final report, this can be emailed upon request after the study is complete. Individual feedback will not be possible as the data is anonymous. However, with your permission, we would like to store your responses anonymously, in electronic form, to possibly be used for future research studies.

It is worthy to note that the plants that have been placed in your office have been specifically selected to be water-wise and to be watered using only non-potable water. The plants are maintained by Execuflora that uses its own water sources.

This research will help to better understand the impact of indoor plants on performance outcomes and connectedness to nature in the South African workforce, to help companies attract and retain productive employees. To consent to participate in this research study, please click on the 'yes' button placed on the first page of the survey.

If you have any questions or queries, please do not hesitate to contact me or my supervisor for more information as per the details below. Ethical queries can be directed to the course coordinator: Colleen Bernstein.

Kind Regards,

Bianca May
072 836 8902
Beemay8@gmail.com
Researcher Details

Prof. Andrew Thatcher
(011) 717 4533
Andrew.Thatcher@wits.ac.za
Research Supervisor Details

Dr. Colleen Bernstein
(011) 717 4538
Colleen.Bernstein@wits.ac.za
Course Coordinator Details

***Appendix B*: Participant Information Sheet for the contrast group**

THE SCHOOL OF HUMAN AND COMMUNITY DEVELOPMENT
(SHCD)

Private Bag 3, Wits, 2050 • Tel: 011 717 4524 • Fax: 011 717 4556 • E-mail: umthombo.SHCD@wits.ac.za

Good day,

My name is Bianca May and I am a Master's student at the University of the Witwatersrand. In order to obtain my Masters' degree in Organisational Psychology, I am required to conduct a research project. The aim of my research is to investigate the design of the workplace and the impact that this may have on the employees. I would like to invite you to participate in my research project.

In order to participate, you will need to complete this online survey. This should take approximately 10 minutes to complete at a time convenient for you. You are asked to do this within the next two weeks. Once you have answered the survey, your answers will be saved automatically.

Participation is completely voluntary and there is no benefit nor negative consequence to participation in this study. Therefore, if you choose not to participate, it will not disadvantage you in any way. Your answers will remain confidential and anonymous in the final report. The organisation will not have access to your survey responses and only grouped data will be reported on and therefore your responses will remain anonymous. Your employee number will be requested, to link data to the survey but the organisation will not be given any marking code to make meaningful sense of the data and will not be given access to your responses. The employee number will not be traced back to any individual characteristics and once collected, will be removed. The data collected from this research study will be kept on a password protected computer with no identifying characteristics attached and no IP addresses will be recorded.

Feedback will be given to the organisation in the form of a summary report of the findings, however if you wish to have access to the final report, this can be emailed upon request after the study is complete. Individual feedback will not be possible as the data is anonymous. However, with your permission, we would like to store your responses anonymously, in electronic form, to possibly be used for future research studies.

To consent to participate in this research study, please click on the 'yes' button placed on the first page of the survey.

If you have any questions or queries, please do not hesitate to contact me or my supervisor for more information as per the details below. Ethical queries can be directed to the course coordinator: Colleen Bernstein.

Kind Regards,

Bianca May
072 836 8902
Beemay8@gmail.com
Researcher Details

Prof. Andrew Thatcher
(011) 717 4533
Andrew.Thatcher@wits.ac.za
Research Supervisor Details

Dr. Colleen Bernstein
(011) 717 4538
Colleen.Bernstein@wits.ac.za
Course Coordinator Details

Appendix C: **Letter Requesting Access**

THE SCHOOL OF HUMAN AND COMMUNITY DEVELOPMENT
(SHCD)

Private Bag 3, Wits, 2050 • Tel: 011 717 4524 • Fax: 011 717 4556 • E-mail: umthombo.SHCD@wits.ac.za

Dear Michael,

My name is Bianca May and I am a student at the University of the Witwatersrand. I am conducting research as part of the Masters in Organisational Psychology course. I am interested in researching the performance of employees in relation to the implementation of indoor plants. I would like to invite your organisation to take part in my research. It would be greatly appreciated.

Participation in this research involves completing three questionnaires which should take the employees approximately 10 minutes to complete. Participation by your employees to take part in this research is voluntary and employees are able to refuse participation without any negative consequences. There are no direct advantages or disadvantages to employees for choosing to partake or not to partake in this research. There will be no identifying information reported in the final report however, it would be best if the performance data were reported with an employee number so that the performance data can be matched to the survey data. The organisation however, will not have access to the marking key at any point in order to make sensible meaning of the data so that anonymity of your employees can be guaranteed.

Only the normalised performance data will be reported rather than the raw figures to protect the confidentiality and intellectual property of the organisation. All the employee's views will be kept confidential and no data will be reported in terms of individual responses but rather in relation to general trends. Participants have the right to withdraw from the study at any time prior to completion and submission of their completed questionnaires. There is no harm or foreseeable risk to employees in completing the questionnaires.

Participation by the employees will provide information that will be vital in understanding the impact of indoor plants on performance outcomes in a South African workplace. An executive summary of the results will be provided to the organisation upon completion of the research.

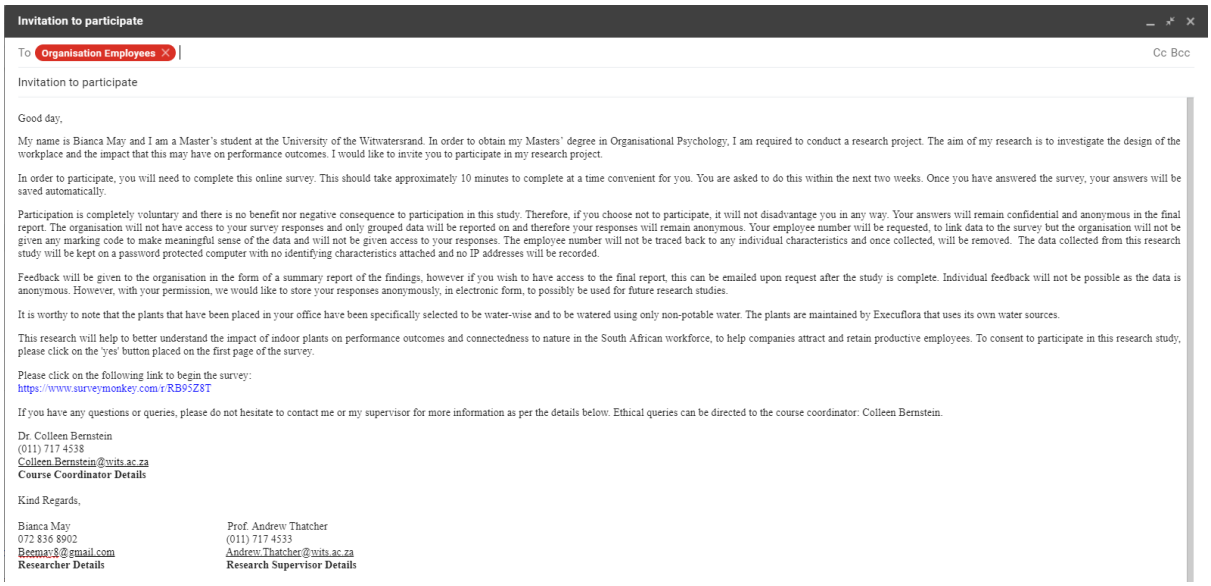
Thank you for considering participation in my study. For any questions related to ethics please contact Colleen Bernstein using the details below.

Kind Regards,

Bianca May
072 836 8902
Beemay8@gmail.com
Researcher Details

Prof. Andrew Thatcher
(011) 717 4533
Andrew.Thatcher@wits.ac.za
Research Supervisor Details

Appendix D: Draft e-mail to Employees



Invitation to participate

To **Organisation Employees** | Cc Bcc

Invitation to participate

Good day,

My name is Bianca May and I am a Master's student at the University of the Witwatersrand. In order to obtain my Masters' degree in Organisational Psychology, I am required to conduct a research project. The aim of my research is to investigate the design of the workplace and the impact that this may have on performance outcomes. I would like to invite you to participate in my research project.

In order to participate, you will need to complete this online survey. This should take approximately 10 minutes to complete at a time convenient for you. You are asked to do this within the next two weeks. Once you have answered the survey, your answers will be saved automatically.

Participation is completely voluntary and there is no benefit nor negative consequence to participation in this study. Therefore, if you choose not to participate, it will not disadvantage you in any way. Your answers will remain confidential and anonymous in the final report. The organisation will not have access to your survey responses and only grouped data will be reported on and therefore your responses will remain anonymous. Your employee number will be requested, to link data to the survey but the organisation will not be given any marking code to make meaningful sense of the data and will not be given access to your responses. The employee number will not be traced back to any individual characteristics and once collected, will be removed. The data collected from this research study will be kept on a password protected computer with no identifying characteristics attached and no IP addresses will be recorded.

Feedback will be given to the organisation in the form of a summary report of the findings, however if you wish to have access to the final report, this can be emailed upon request after the study is complete. Individual feedback will not be possible as the data is anonymous. However, with your permission, we would like to store your responses anonymously, in electronic form, to possibly be used for future research studies.

It is worthy to note that the plants that have been placed in your office have been specifically selected to be water-wise and to be watered using only non-potable water. The plants are maintained by Execuflora that uses its own water sources.

This research will help to better understand the impact of indoor plants on performance outcomes and connectedness to nature in the South African workforce, to help companies attract and retain productive employees. To consent to participate in this research study, please click on the 'yes' button placed on the first page of the survey.

Please click on the following link to begin the survey:
https://www.surveymonkey.com/r/RB95Z8T

If you have any questions or queries, please do not hesitate to contact me or my supervisor for more information as per the details below. Ethical queries can be directed to the course coordinator: Colleen Bernstein.

Dr. Colleen Bernstein
(011) 717 4538
Colleen.Bernstein@wits.ac.za
Course Coordinator Details

Kind Regards,

Bianca May
072 836 8902
Beemay8@gmail.com
Researcher Details

Prof. Andrew Thatcher
(011) 717 4533
Andrew.Thatcher@wits.ac.za
Research Supervisor Details

Appendix E: **Biographical Details Questions**

1. **What is your age in years?**

2. **What is your gender?**

   - **Male**
   - **Female**
   - **Other**

3. **What is your ethnicity? (Please note: This was only used for descriptive purposes to determine the number of people from different ethnic groups within the sample)**

   - **Black**
   - **White**
   - **Coloured**
   - **Indian**
   - **Asian**
   - **Other**

4. **Employment type:**

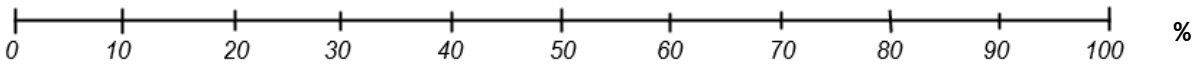
   - **Full-time**
   - **Fixed-term**
   - **Part-time**
   - **Sessional**
   - **Contracted**

5. **How many years have you been working for the current organisation (in years)? *This had a pull-down bar to access the answer**

   - **6 months – 1 year**
   - **1 year – 5 years**
   - **5 years – 10 years**
   - **10+ years**

Appendix F: **Perceived Performance Scale**

On a scale of **0-100** percent (where 100% is full capacity), rate how well you have been working over the last **month** in relation to your full capacity.



Appendix G: **Utrecht Work Engagement Scale**

While **at work,** to what extent have you experienced the following conditions during the **last month:**

	Never	Almost Never	Rarely	Sometimes	Often	Very Often	Always
At my work, I feel like I am bursting with energy							
At my job, I feel strong and vigorous							
I am enthusiastic about my job							
My job inspires me							
When I get up in the morning, I feel like going to work							
I feel happy when I am working intensely							
I am proud of the work that I do							
I am immersed in my job							
I get carried away when I am working							

Appendix H: **Connectedness to Nature Scale**

CONCERN FOR THE ENVIRONMENT QUESTIONNAIRE

Please rate the extent to which you agree with each statement, using the scale from 1 to 5 as shown below. Please respond as you really feel, rather than how you think "most people" feel.

	1 Strongly Disagree	2 Disagree A Little	3 Neutral	4 Agree A Little	5 Strongly Agree
1) I often feel a sense of oneness with the natural world around me					
2) I think of the natural world as a community to which I belong					
3) I often feel disconnected from nature					
4) I have a deep understanding of how my actions affect the natural world					

Appendix I: **Plants in the Workplace Scale (First floor with plants implemented)**

As a manipulation check the following items were developed:

Please rate the extent to which you agree with each statement, using the scale from 1 to 5 as shown below.

	1 Strongly Disagree	2 Disagree A Little	3 Neutral	4 Agree A Little	5 Strongly Agree
1) Plants in the workplace are dirty because they collect dust on their leaves					
2) I like plants in the workplace because they bring the natural world inside					
3) I dislike plants in the workplace because they are a distraction					
4) I dislike plants in the workplace because they bring in insects					
5) I notice the plants in my workplace					

Appendix J: **Art Pictures in the Workplace Scale (Second floor with art pictures added)**

Please rate the extent to which you agree with each statement, using the scale from 1 to 5 as shown below.

	1 Strongly Disagree	2 Disagree A Little	3 Neutral	4 Agree A Little	5 Strongly Agree
1) Art pictures in the workplace are dirty because they collect dust					
2) I like art pictures in the workplace because it brings the outside world, inside					
3) I dislike art pictures in the workplace because it is a distraction					
4) I dislike art pictures in the workplace because it makes the space feel cluttered					
5) I notice the art pictures in my workplace					

Appendix K: Permission from Organisation

ALLANGRAY

25 June 2018

University of Witwatersrand
1 Jan Smuts Venue
Braamfontein
Johannesburg
2000

To Whom It May Concern

Permission to Conduct a Study

Allan Gray Proprietary Limited hereby give permission to Bianca May to conduct the following study at our Head Office, namely, 1 Silo, V&A Waterfront, Cape Town.

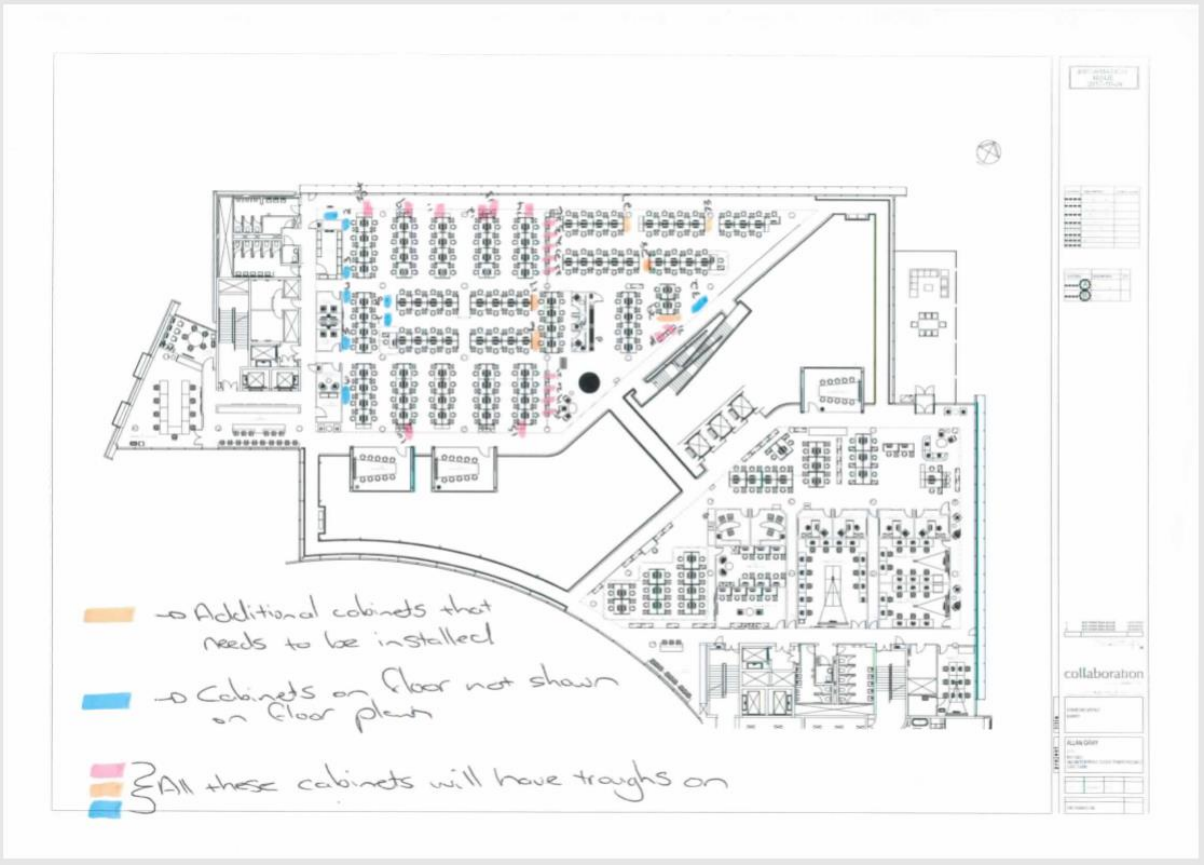
The study is the restorative effects of a plant enriched environment on employee performance in the workplace.

Yours sincerely

Michael Smith
Head of Department: Facilities Management

Directors: M Cooper BBusSc FIA FASSA, R W Dower BSc (Eng) MBA, W B Gray BCom MBA CFA (Irish)*, A R Lopping BSc (Eng) BCom CFA, I S Liddle BBusSc (Hons) CFA**, T J Mahoma BA (Hons) MPhil*, T Mhlambiso AB MBA ID, K C Mandla BSc (Eng) MEng*, N M Nene BCom (Hons)*, * Non-Executive Chairman **Company Secretary:** C E Solomon BBusSc (Hons) CA (SA) **Allan Gray Proprietary Limited:** Registration Number 2005/002576/07
1 Silo Square V&A Waterfront Cape Town 8001, P O Box 51318 V&A Waterfront Cape Town 8002 South Africa Tel +27 (0)21 415 2300, Fax +27 (0)21 415 2400 Email info@allangray.co.za www.allangray.co.za
Allan Gray Proprietary Limited is an authorised financial services provider.

Appendix L: Floor Plan of the First Floor with Plants added



Appendix M: Floor Plan of the Second Floor with Art Pictures added



Appendix N: **Pilot study for Plants in the Workplace Scale**



Good day,

My name is Bianca May and I am a master's student at the University of the Witwatersrand. In order to obtain my Masters' degree in Organisational Psychology, I am required to conduct a research project. The aim of my research is to investigate the design of the workplace and the impact that this may have on performance outcomes. In order to examine the feasibility of the surveys used, a pilot study is required in order to test the questionnaire: 'Plants in the Workplace,' using a smaller sample. Therefore, I would like to kindly invite you to participate in the pilot study for my research project.

In order to participate, you will need to complete this hard copy survey. This should take approximately 5 minutes to complete. Your answers will remain confidential and anonymous. There is no benefit nor negative consequences to participation in this pilot study and participation is strictly voluntary. Therefore, if you choose not to participate, it will not disadvantage you in any way.

The data collected from this pilot study will be kept in a safe, password protected computer with no identifying characteristics attached. Once the data from the pilot study surveys have been captured, all hard copies will be destroyed.

Your consent to participate in this pilot study will be deemed to have been given upon completion and return of this survey.

If you have any further queries, please do not hesitate to contact me or my course coordinator.

Kind Regards,

Bianca May
072 836 8902
Beemay8@gmail.com

Prof. Andrew Thatcher
(011) 717 4533
Andrew.Thatcher@wits.ac.za

Evaluation Sheet for 'Plants in the Workplace' Scale

In order to design an effective working environment which enables employees to perform at optimum levels, it is important to examine the employee's work environment and how their surroundings may impact the employees and their performance levels. The following survey was designed in order to evaluate how employees feel about plants in the workplace.

Instructions:

- Please read through the list of items below and tick how well you believe the item relates to the construct that is being measured (based on the description above).
- Please change the wording of any items you feel need modification in order to be more representative of the construct.

Please **rate** how representative of the construct (plants in the workplace) you feel the item is:

Representative of construct:	Very	Somewhat	Not
1) Plants in the workplace are dirty because they collect dust on their leaves			
2) I like plants in the workplace because they bring the natural world, inside			
3) I dislike plants in the workplace because they are a distraction			
4) I dislike plants in the workplace because they bring in insects			
5) I notice the plants in my workplace			

Please **rate** and **comment** based on the overall survey:

	Rating (No → Yes)	**Comment**
Face Validity: When looking at the overall survey, does it measure what it says it is meant to measure?	**1 2 3 4 5**	

Content Validity: Does it reflect the behaviour for which it is intended?	**1 2 3 4 5**	
Lack of Ambiguity: Were there any questions that were vague or that you were unclear about?	**1 2 3 4 5**	
No Double-Barrelled Statements: i.e. I like to read AND watch series	**1 2 3 4 5**	
Reverse Meaning: Were there any items that have apposite views to what is being measured?	**1 2 3 4 5**	
Social Desirability: If you were an employee at an organisation, would you be okay with competing this scale? How was the length? Do you feel it would be harmful in any way?	**1 2 3 4 5**	
Offensiveness: Was the overall scale offensive in any way?	**1 2 3 4 5**	
Repetition: Were any items too similar that you feel should be removed? (Please indicate the item numbers)	**1 2 3 4 5**	

Appendix O: **Pilot Study for the Art Pictures in the Workplace Scale**



Good day,

My name is Bianca May and I am a master's student at the University of the Witwatersrand. In order to obtain my Masters' degree in Organisational Psychology, I am required to conduct a research project. The aim of my research is to investigate the design of the workplace and the impact that this may have on performance outcomes. In order to examine the feasibility of the surveys used, a pilot study is required in order to test the questionnaire: 'Art Pictures in the Workplace,' using a smaller sample. Therefore, I would like to kindly invite you to participate in the pilot study for my research project.

In order to participate, you will need to complete this hard copy survey. This should take approximately 5 minutes to complete. Your answers will remain confidential and anonymous. There is no benefit nor negative consequences to participation in this pilot study and participation is strictly voluntary. Therefore, if you choose not to participate, it will not disadvantage you in any way.

The data collected from this pilot study will be kept in a safe, password protected computer with no identifying characteristics attached. Once the data from the pilot study surveys have been captured, all hard copies will be destroyed.

Your consent to participate in this pilot study will be deemed to have been given upon completion and return of this survey.

If you have any further queries, please do not hesitate to contact me or my course coordinator.

Kind Regards,

Bianca May
072 836 8902
Beemay8@gmail.com

Prof. Andrew Thatcher
(011) 717 4533
Andrew.Thatcher@wits.ac.za

Evaluation Sheet for 'Art Pictures in the Workplace' Scale

In order to design an effective working environment which enables employees to perform at optimum levels, it is important to examine the employee's work environment and how their surroundings may impact the employees and their performance levels. The following survey was designed in order to evaluate how employees feel about art pictures in the workplace.

Instructions:

- Please read through the list of items below and tick how well you believe the item relates to the construct that is being measured (based on the description above).
- Please change the wording of any items you feel need modification in order to be more representative of the construct.

Please **rate** how representative of the construct (art pictures in the workplace) you feel the item is:

Representative of construct:	Very	Somewhat	Not
1) Art pictures in the workplace are dirty because they collect dust			
2) I like art pictures in the workplace because they bring the outside world, inside			
3) I dislike art pictures in the workplace because they are a distraction			
4) I dislike art pictures in the workplace because they make the space feel cluttered			
5) I notice the art pictures in my workplace			

Please **rate** and **comment** based on the overall survey:

	Rating (No → Yes)	**Comment**

Face Validity: When looking at the overall survey, does it measure what it says it is meant to measure?	**1 2 3 4 5**	
Content Validity: Does it reflect the behaviour for which it is intended?	**1 2 3 4 5**	
Lack of Ambiguity: Were there any questions that were vague or that you were unclear about?	**1 2 3 4 5**	
No Double-Barrelled Statements: i.e. I like to read AND watch series	**1 2 3 4 5**	
Reverse Meaning: Were there any items that have apposite views to what is being measured?	**1 2 3 4 5**	
Social Desirability: If you were an employee at an organisation, would you be okay with competing this scale? How was the length? Do you feel it would be harmful in any way?	**1 2 3 4 5**	
Offensiveness: Was the overall scale offensive in any way?	**1 2 3 4 5**	
Repetition: Were any items too similar that you feel should be removed? (Please indicate the item numbers)	**1 2 3 4 5**	

Appendix P: Ethical Clearance

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

HUMAN RESEARCH ETHICS COMMITTEE (SCHOOL OF HUMAN & COMMUNITY DEVELOPMENT

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: MORG/18/004 IH**
PROJECT TITLE:	The restorative effects of a plant enriched environment on employee performance in the workplace
INVESTIGATORS	May Bianca
DEPARTMENT	Psychology
DATE CONSIDERED	28/06/18
DECISION OF COMMITTEE*	Approved

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

DATE: 28 June 2018

CHAIRPERSON
(Dr Colleen Bernstein)

cc Supervisor:

Prof. Andrew Thatcher
Psychology

DECLARATION OF INVESTIGATOR (S)

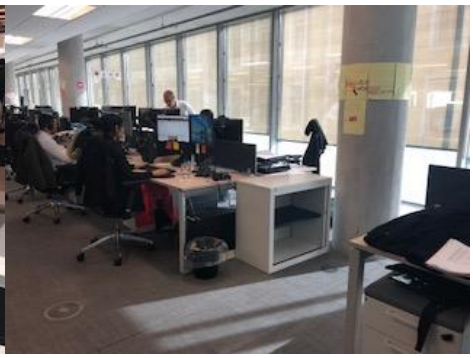
To be completed in duplicate and **one copy** returned to the Secretary, Room 100015, 10th floor, Senate House, University.

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

This ethical clearance will expire on 31 December 2020

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

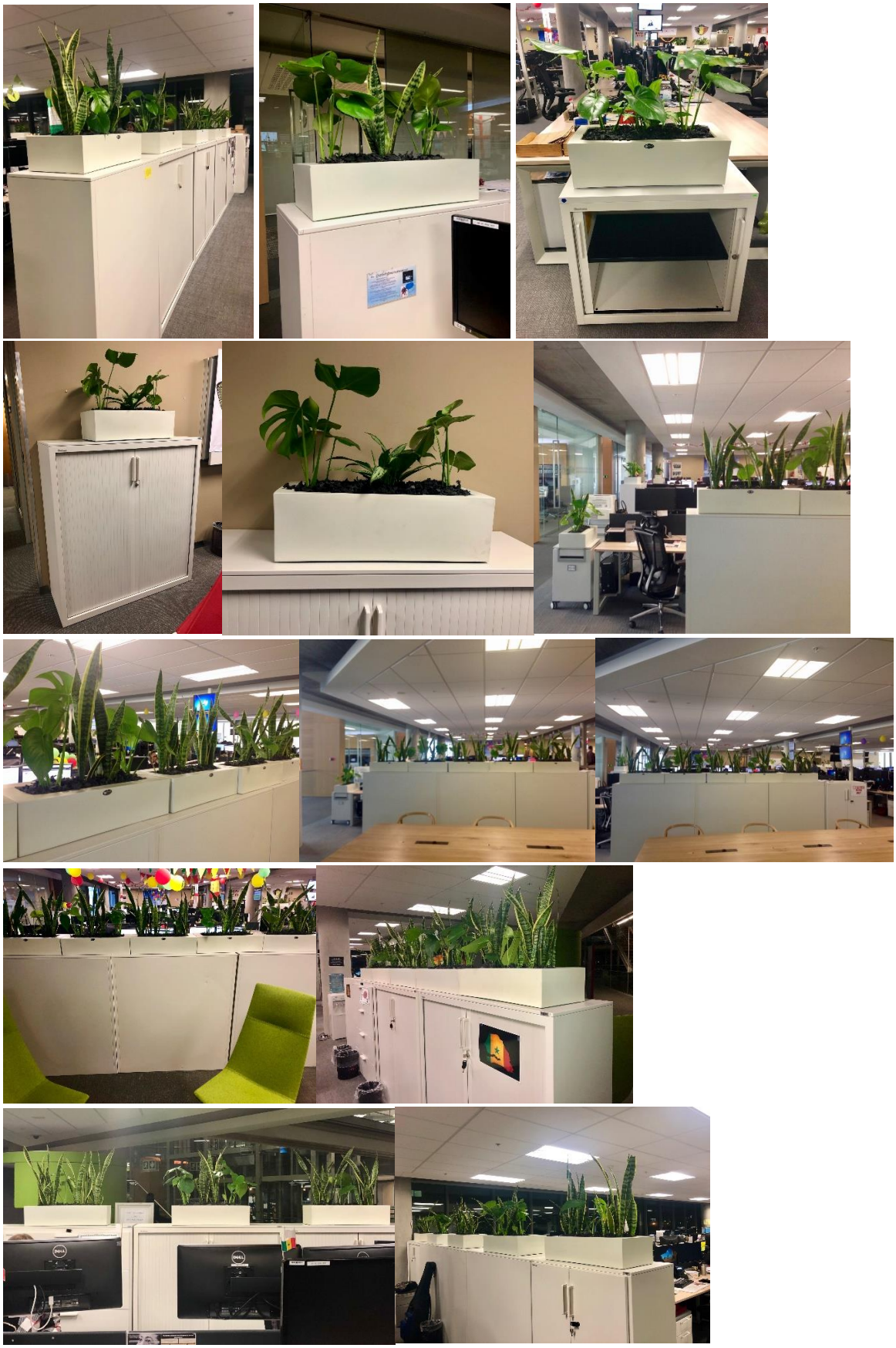
Appendix Q: **Images of the first floor prior to implementation of the indoor plants**

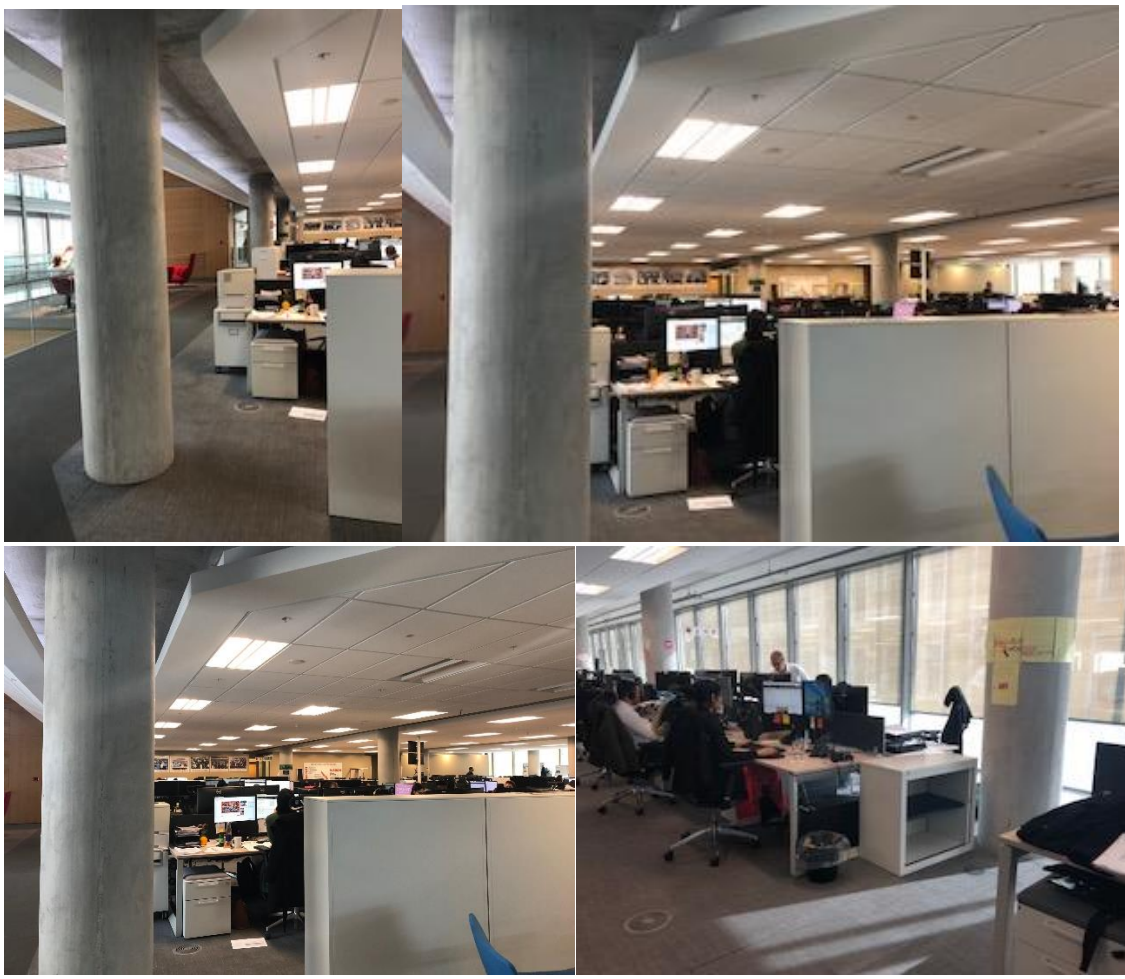




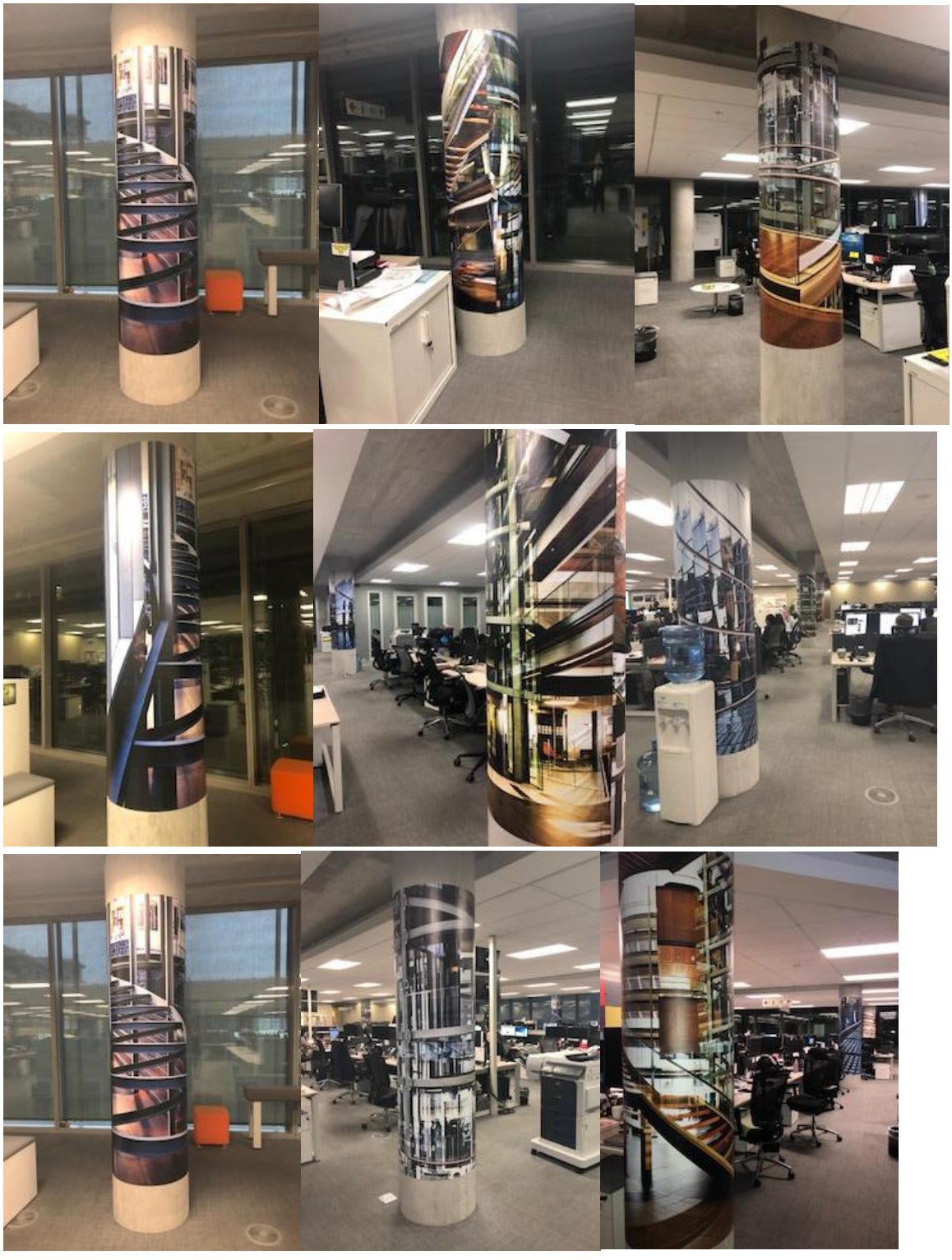

Appendix R: Images of the first-floor post installation of the indoor plants



Appendix S: **Images of the second floor prior to implementation of the art pictures**



Appendix T: **Images of the second-floor post installation of the art pictures**



Appendix U: Histograms

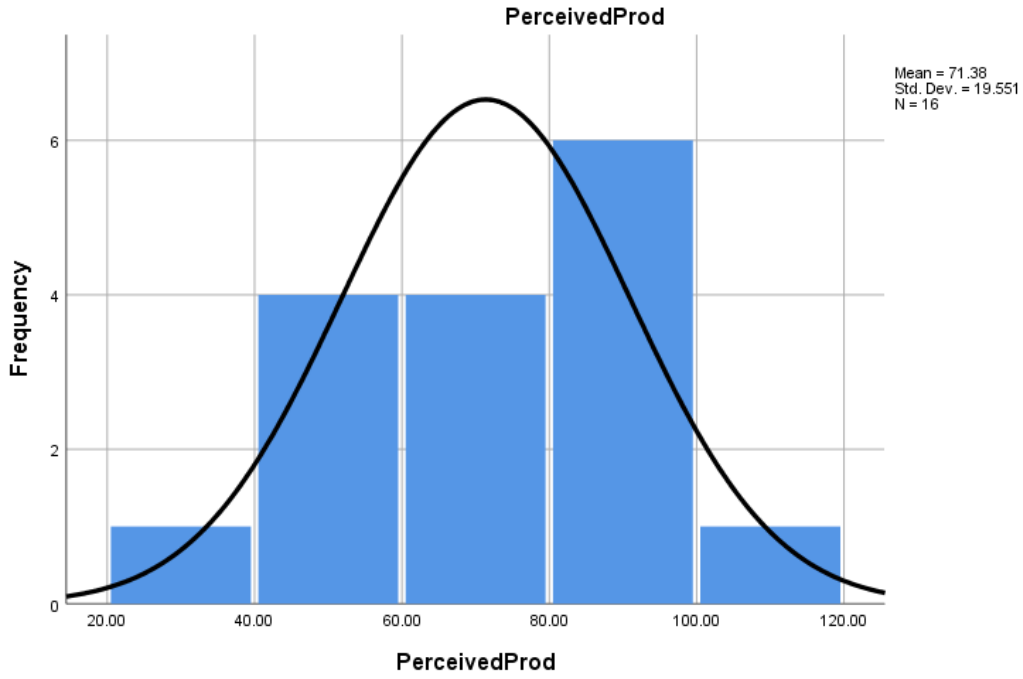


Figure 1: Histogram for Perceived Productivity variable

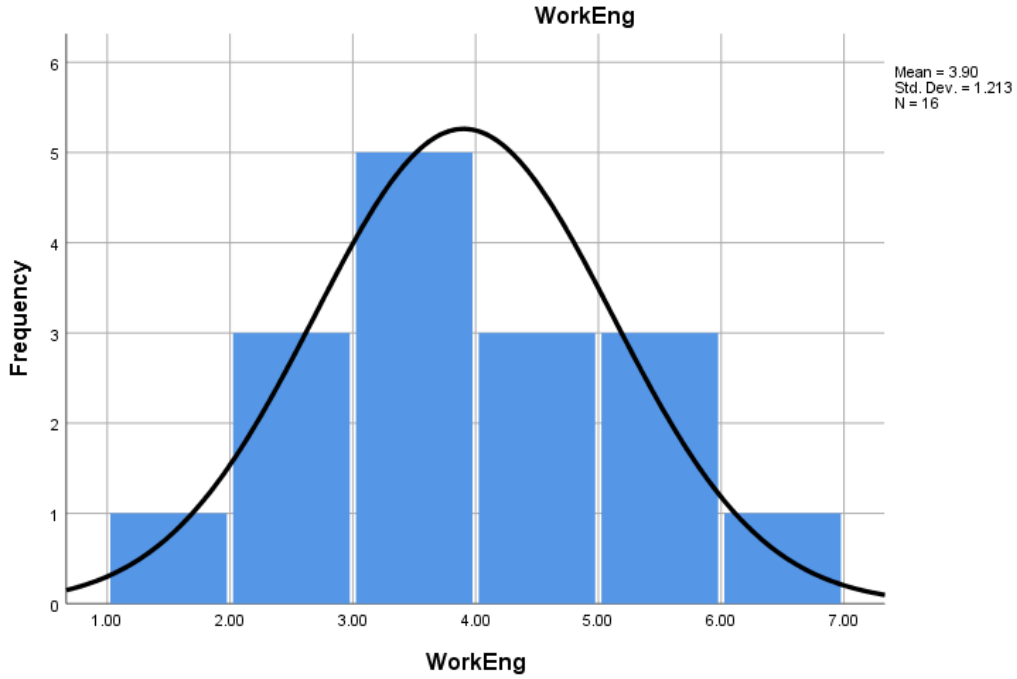


Figure 2: Histogram for Work Engagement variable

Appendix V: Histograms for Normality

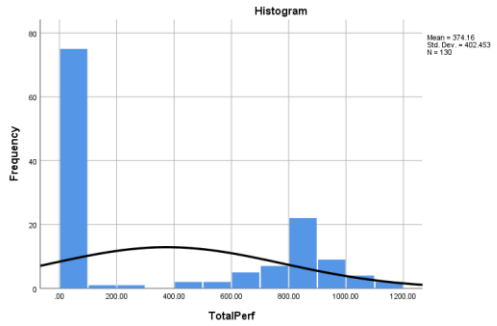


Figure 3: Histogram of total performance

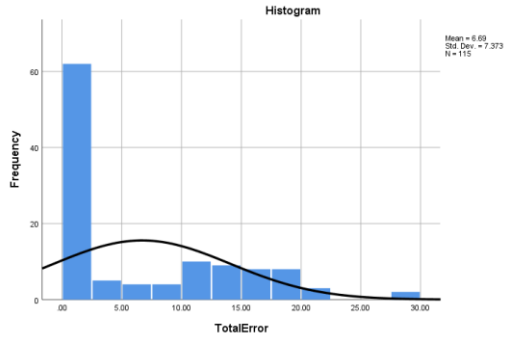


Figure 4: Histogram of total error rates

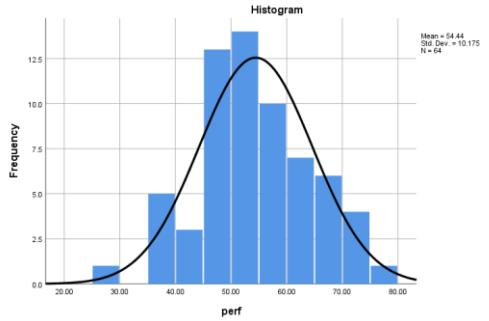


Figure 5: Histogram for performance (plants)

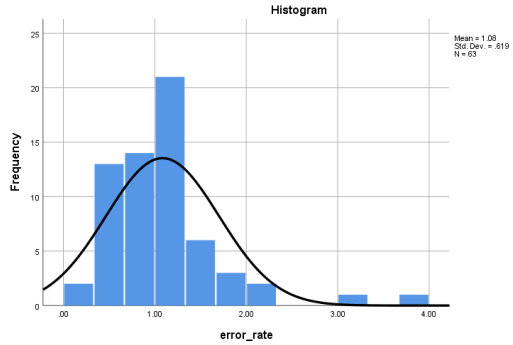


Figure 6: Histogram for error rate (plants)

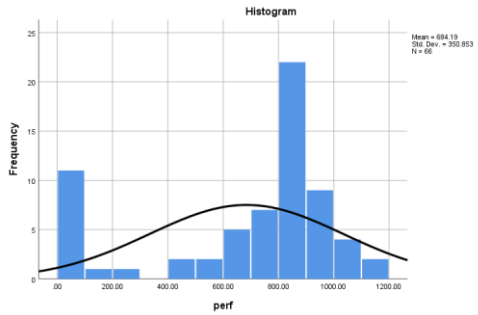


Figure 7: Histogram for performance (no plants)

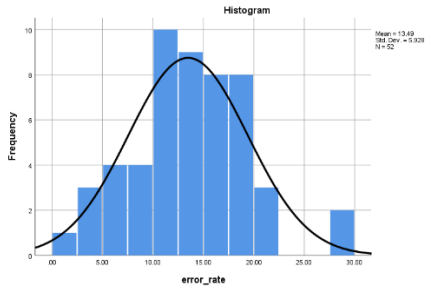


Figure 8: Histogram for error rate (no plants)

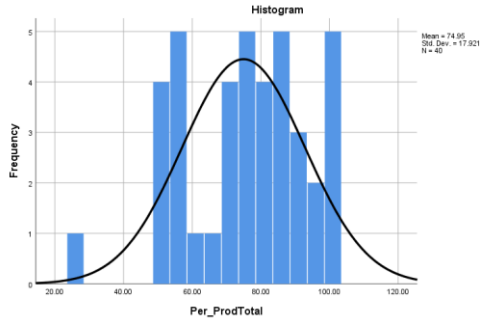


Figure 9: Histogram for total perceived productivity

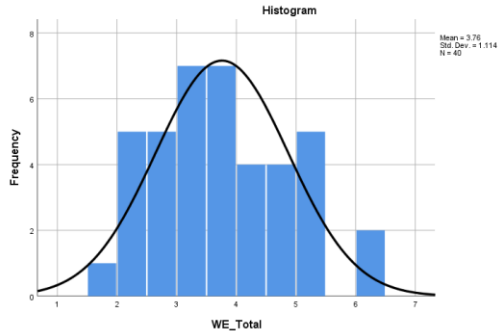


Figure 10: Histogram of total work engagement

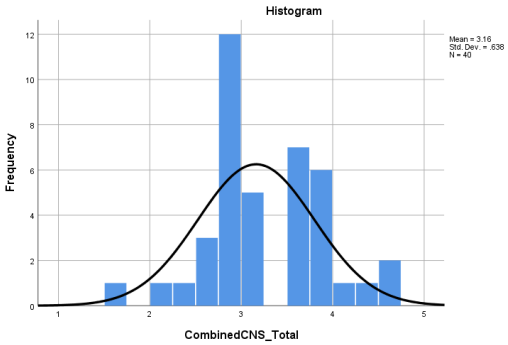


Figure 11: Histogram of total combined scale CNS

Appendix W: Histograms paired samples t-test

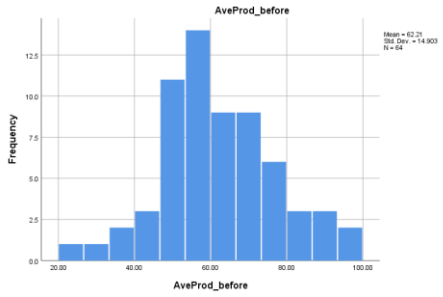


Figure 12: Pre-implementation performance

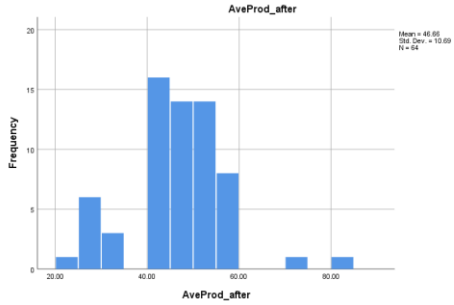


Figure 13: Post-implementation performance

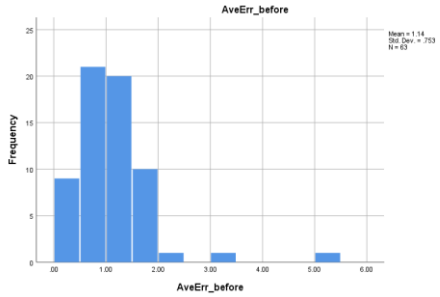


Figure 14: Pre-implementation error rate

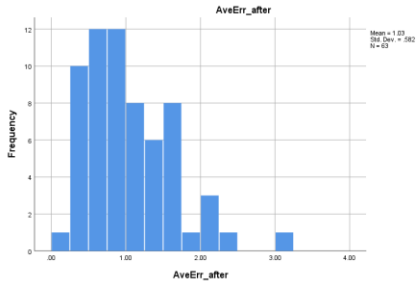
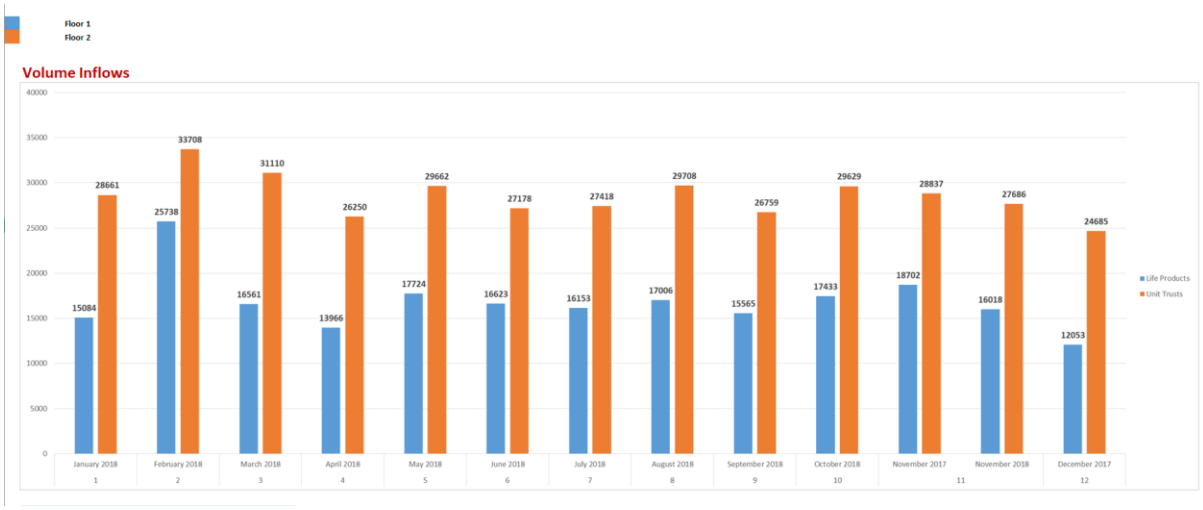


Figure 15: Post-implementation error rate

Appendix X: **Means of Performance Scores (First-Floor)**

Month	**Mean**
Jan.	57.90
Feb.	78.89
March	65.02
April	53.88
May	66.66
June	56.54
July	59.00
Aug.	51.23
Sept.	48.63
Oct.	43.54
Nov.	42.30
Dec.	34.74

Appendix Y: Volume Inflows 2018



Appendix Z: Employee Proximity to the Indoor Plants

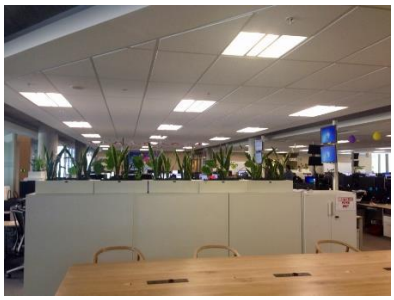


Figure 25: Long range



Figure 26: Close range

Appendix AA: **Total Error Rate Numbers for First-Floor Employees**

Month	**Number of errors**
Jan.	548
Feb.	977
March	791
April	610
May	684
June	536
July	630
Aug.	552
Sept.	581
Oct.	732
Nov.	754
Dec.	618