

**A STUDY OF THE IMPACT OF TECHNOLOGICAL INNOVATIONS ON THE
SOCIAL SUSTAINABILITY OF FACILITIES MANAGEMENT EMPLOYEES IN
SOUTH AFRICA**

By

Unekwu Jonathan Adama

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Associate Professor Kathy Michell

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DEDICATION

This thesis is dedicated to the almighty God, the keeper of my life and the maker of heaven and earth.

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LIST OF ABBREVIATIONS

ΣW	Weighted Total
3D	Three Dimension
AI	Artificial Intelligence
AR	Augmented Reality
AV	Augmented Virtuality
BAS	Building Automation System
BIFM	The British Institute of Facilities Management
BIM	Building Information Model
BIMS	Building Information Management Systems
BMS	Building Management System
BEMS	Building Energy Management System
CAD	Computer-Aided Design
CAFM	Computer-Aided Facilities Management
CCTV	Closed-Circuit Television (or Video Surveillance)
CMMS	Computerised Maintenance Management System
COBie	Construction-Operation Building Information Exchange
FM	Facilities Management
FREQ	Frequency
GIS	Geographic Information System
GFMMSS	Global Facilities Management Market Sizing Study
HTML	Hypertext Mark-Up Language
HVAC	Heating, Ventilation and Air Conditioning
IB	Intelligent Buildings
ICT	Information Communication Technology
IFC	Industry Foundation Classes
IT	Information Technology
IFMA	International Facilities Management Association
IoT	Internet of Things
ISM	Interpretive Structural Model

KPIs	Key Performance Indicators
MAR	Mobile Augmented Reality
MS	Mean Score
MVD	Model View Definition
OECD	Organisation for Economic Corporation and Development
OR	Overall Rank
ØRII	Average Relative Importance Index
PC	Personal Computers
PIR	Passive Infrared
R	Rank
REIT	Real Estate Investment Trust
RFID	Radio Frequency Identification
RII	Relative Importance Index
RTLS	Real-Time Location System
SAFMA	South African Facilities Management Association
SD	Standard Deviation
SLA	Service Level Agreements
STS	Socio-Technical System
TAM	Technology Acceptance Model
TI	Technological Innovations
TPS	Total Populations Sampling
UAV	Unmanned Aerial Vehicles
URLs	Uniform Resource Locators
UTAUT	Unified Theory of Acceptance and Use of Technology
VE	Virtual Environment
VR	Virtual Reality
WCED	World Commission on Environment and Development

ABSTRACT

This research investigates the impact of technological innovations (TIs) on the social sustainability of facilities management (FM) employees in South Africa. The rationale for the study is that no empirical evidence shows how the adoption of TIs impacts the social sustainability of FM employees. The study adopts the sequential mixed-methodology approach. The quantitative phase makes use of a questionnaire survey which formed the foundation for the qualitative interview phase. The relative importance index (RII) is used to analyse different questions, such as (1) the factors influencing the adoption of TIs in FM organisations (2) the impact of the TIs on FM practice, (3) the localisation of the employee social sustainability factors and (4) the determination of the impact of TIs on the social sustainability of FM employees. An Interpretive Structural Model (ISM) approach is used to determine which social sustainability factor(s) should be prioritised while promoting the social sustainability of the FM employees.

The findings of this study show that cloud-based TIs, ICT-based TIs and sensor-based TIs are the most popular in FM organisations in South Africa. Furthermore, the impact of TIs on the core business factors in FM organisations have a mean score of between 3.00 to 3.19 depending on the factor of interest. The RII analysis led to the development of the initial FM employee social sustainability framework which identified “job security”, “remuneration” and “professional status” as the three most important FM employee social sustainability factors. However, the ISM analysis which considered hierarchy, driving power and dependence of the factors identified “organisation policy” as main factor in level five that drives other employee social sustainability factors. Furthermore, “overwork”, “autonomy”, “interpersonal relationship”, “work and home-life balance” and “retirement development plan” were the root factors in level four that must be prioritised by facilities managers to promote employee social sustainability.

The study contributes to knowledge by identifying the most popular TIs that are adopted by FM organisations in South Africa, and determining the interrelationship, hierarchical importance and dependences of the various employees’ social sustainability factors in FM organisations. Through the development of the framework for FM employee social sustainability, facilities managers have the knowledge of the factors to prioritise when they need to promote the social sustainability of their employees. The study recommends that FM organisation policies on TI adoption must align with the overall socio-economic wellbeing program to contribute to social sustainability in South Africa.

CHAPTER ONE: GENERAL INTRODUCTION

1.1 Introduction

Contemporary labour practises exist in a world that expects innovation and productivity but also personal wellbeing. The relationship between work and wellbeing is becoming blurred with the adoption of technology. This is particularly so in the FM industry given the nature of FM operations. Hence, this study evaluates the impact of TIs on the social sustainability of FM employees in South Africa. The study is motivated by the fact that impact-assessments of TIs in FM organisations tend to be from a technical perspective. Previous research on TIs has focused on how FM organisations can improve their core-business objectives (productivity, running cost, efficiency, corporate image, flexibility and connectivity) with the use of TIs (Yavari et al., 2014; Morgenthal & Hallermann 2014; Roth, 2017; Gundupalli et al., 2017). Many of these studies have excluded a social perspective (employees) within their assessments despite organisations being socio-technically structured (Kira & van Eijnatten, 2007). Only a few studies have highlighted the social impacts of technological changes in FM organisations (Grimshaw, 2007; Atkin & Bildsten, 2017). For instance, Grimshaw (2007) argued that FM should respond to the changing relationship between work practice and the employees by evolving strategies that support work wherever it takes place. The focus of this study was on how work should be able to take place from any place. Atkin & Bildsten (2017) in a study that evaluated the current debates in FM and the future direction emphasised the current impact of artificial intelligence (AI) on FM practice and also speculated future transformation of FM by AI. Given the focus of these studies, it appears, that the main reason for TI adoption in FM has been to advance core-business objectives with almost no consideration given to other aspects of the organisation such as the employees.

This chapter provides an overview of the study, beginning with the discussion on the background to the research, then the research question is stated, followed by the aim and objectives of the study. It then gives a brief description of the research significance and an overview of the research methodology adopted in the study. The scope and limitations of the study are also stated. Finally, an outline of the thesis structure is presented.

1.2 Background of the Study

FM is a profession that co-ordinates and manages an extensive range of specialist activities including properties and estates, construction and refurbishments, workspace, maintenance and

operations. Other scope of FM includes the management of information technology (IT), support services, and human resources. Linked to this idea of human resources, FM is also responsible for undertaking quality-assessments of labour practises, environments and activities for the wellbeing of its employees (Goyal & Pitt, 2007). In a more concise description, Alexander (1996) and Nutt (2000) suggest that the primary function of FM is resource management at a strategic, tactical and operational level within a clients' organisation. At the strategic level, FM is concerned with long-term strategic planning, while at the tactical level, these strategic plans are made into routine, specific, short-term preventive or managerial operations (Patanapiradej, 2006; Langston & Lauge-Kristensen, 2013). At the operational level, FM activities involve the day-to-day routine support operations to organisations aimed at achieving the tactical and strategic objectives (Langston & Lauge-Kristensen, 2013). Given this background, the focus of FM is the integration of the resource inputs - people, place, process and technology (IFMA, 2017).

According to the Global Facilities Management Market Sizing Study (GFMMSS) 2016, the global FM market was estimated to be worth about \$1.12 Trillion with the North America and the European market being the most developed (Fernandez & Sillivan, 2016). Although the African FM market has remained undeveloped, the GFMMSS 2016 acknowledged that rapid urbanisation and infrastructure development are currently stimulating African FM market growth. For instance, in South Africa, the FM market is growing at 7.2% per annum and the FM sector employs over 2.25% of the about 19.8 Million total workforces in South Africa (Fernandez & Sillivan, 2016). The South Africa FM service is segmented into the outsourced, in-sourced and integrated FM services. The outsourced FM service is the most popular FM service in South Africa. There is however a growing interest for the integrated FM services based on the number of FM organisations promoting their integrated FM offerings. The significant consumers of FM services in South Africa are the public and semi-public organisations. With the global wave of technological advancement, South Africa FM organisations are exploring the available technologies in their FM profession.

Technology is a resource input that continues to experience transformation and innovation. This constant evolution of technology influences FM operations (Grimshaw, 2007; Atkin & Bildsten, 2017). Some of the TIs that are transforming FM operations have been broadly categorised in this study as: information communication technology (ICT), cloud-based technology, drone technology, robots, and sensor devices (see Table 2.2). ICT-based TIs

through the internet of things (IoTs) enables the facilities managers to achieve core-business objectives by supporting building management systems. Some of the capabilities of ICT in FM include video conferencing, multimedia instant messaging, recording and photographing with smartphones. Furthermore, they enable social media technologies, smart appliances, emails, instant messaging, and mobile devices that promote flexible work schedules in FM (Sargent et al., 2012; Abomhara & Køien, 2014; Hoeven et al., 2016; Atkin & Bildsten, 2017). Evaluating the focus of the previous studies on the issue of TIs in FM shows that:

The internet enables the use of cloud-based technologies. The cloud-based technology is a system that enables improved delivery of IT solutions through access to computing services in a more flexible and at a reduced cost (Smith et al., 2009; Jain and Bhardwaj, 2010; Alshamaila, et al., 2013). Instead of hosting IT infrastructure, organisations can subscribe to cloud services and pay by the hour for computing services at lower cost (Lau et al., 2013). The cloud enables facilities managers to store and access any data or software. Studies have shown that the facilities managers can centrally monitor, control and manage all portfolios from a single location at an affordable cost using the cloud (Grimshaw, 2005; Gebauer & Schober, 2006; Sargent et al., 2012; Alshamaila et al., 2013).

Similarly, drone technology helps the facilities managers with maintenance, security, and logistics operations (Wu & Zhou 2006; Rathinam, 2007). In maintenance services, drones are used to access problematic areas, check equipment performance, and obtain valuable details about critical infrastructure at no risk to personnel (Metni & Hamel 2007; Eschmann et al., 2012; Emelianov et al., 2014; Torok, 2014; Morgenthal & Hallermann 2014; Santos et al., 2017). This backdrop of safety is a crucial aspect of FM operations as high industry death rates have been attributed to falls from heights in previous maintenance operations (Nadhim et al., 2016). Furthermore, the use of drones also translates into economic savings on inspections that would have needed the setting up of scaffolds and platforms (Christine, 2018). Therefore, the use of the drone has improved the safety practices of many FM organisations and the efficiency of maintenance operations.

Various robotic technologies assist FM professionals with their operations. The types that are common in FM operations are domestic robots for cleaning and service robots which help gathers data in offices through surveillance and different laser scans. These robots automatically perform complicated and repetitive tasks, such as the maintenance of buildings and machinery, cleaning of floors and building facades, customer care services, and waste

management operations, to mention a few (Chiemchaisri et al., 2007; Saeed et al., 2009; Gundupalli et al., 2017). Additionally, Robots have been seen as a substitute for the human employees thereby reducing the cost of maintaining a large labour force and increasing profitability for the shareholders in FM organisations (Adama and Michell, 2017; Atkin & Bildsten, 2017). In most instances, robots are fitted with sensors to enable it to achieve operational efficiency.

Sensors are categorised into infrastructure sensors and occupant-related sensors. Facilities managers use infrastructure sensors to manage strategic infrastructure, such as bridges, machine tools, and other industrial assets, against any form of trespass, attacks, and activities of vandals. Occupant-related sensors are fixed in building facilities to control lighting, heating, ventilation and air conditioning (HVAC), as well as other presence-related management (Vishal & Bansal, 2000; Chiemchaisri et al., 2007; Saeed et al., 2009). Facilities managers also adopt occupant sensors to create ambient intelligence for energy management. Ambient intelligence is an electronic environment created by sensors, which are sensitive and responsive to the presence of people. Through ambient intelligence, lighting can be automatically turned on and off depending on whether people are present in the building facilities (Husu et al., 2017). Hence, smart sensor devices help to reduce the operating costs, enhance productivity, and improve the occupants' comfort and safety (Husu et al., 2017; Roth, 2017).

From the above review of the various technologies and their relative benefits for core-business operations, it becomes apparent that previous studies in FM have concentrated on evaluating the operational benefits of TI with little attention to their impact on the employees. This is further emphasised by popular areas of interest in previous TI-related research in FM which include: energy efficiency and lighting quality (Maleetipwan-Mattson & Laike, 2015; Pitarma et al., 2016); workplace/worker productivity (Ilona & Nenonen, 2015; Kallio et al., 2015); performance measurement and management (Ling & Wong, 2016; Douglas, 2016); green/sustainable buildings (Kantola & Saari, 2014; Georges et al., 2015); intelligent buildings (e.g. smart sensors and controls) (Irizarry et al., 2014; Arditi et al., 2015); maintainability and durability (Fraser, 2014); sourcing decisions (e.g. outsourcing, insourcing, and transition of services) (Perera et al., 2016); and information and communication technology (e.g. digital tools, including building information modelling [BIM]) (Cardellino & Leiringer, 2014; Gheisari & Irizarry, 2016). Other researchers have focused on the future of FM based on TI

adoption (Atkin & Bildsten, 2017), and lately, the impact of TIs on FM employees (Adama & Michell, 2017).

Previous studies have argued that TI adoption could have unintended consequences which should not be ignored (Sveiby et al., 2009). For instance, Atkin and Bildsten (2017) argue that several managerial and professional cadres are likely to be substantially thinned while many technical level jobs will disappear when smart apps or autonomous devices can perform similar functions. This alludes to the social consequence and employee suffering that arises with the adoption of IT. For instance, Grimshaw (2007) argues that the connectivity and flexibility enabled through the internet have resulted in issues such as social isolation, alienation, the intrusion of work into employee home-life, overwork, and social network problems. While there is no empirical evidence to show how these factors of social sustainability are influenced by TIs, the nature of influence, and the drive for core-business objectives in FM organisations suggest something different. O'Driscoll et al. (2009) and Pfeffer (2009) argue that based on the socio-technical nature of organisations (consisting on both the social and technical components), technology adoption must also consider the impact on the employee along with the value addition for the organisation. The importance of this argument cannot be overstated for FM as a profession that integrates people, place, process, and technology for the functionality of the built environment (IFMA, 2017).

Notwithstanding the many research endeavours above, the understanding of the impact of TI on the social sustainability of the FM employee is not clear. There is a gap in the literature – one that this study seeks to address. In line with Rodman and Fry (2009) and Sveiby et al. (2009), this study acknowledges that new technologies can have positive or unintended effects on the psychological wellbeing of employees, which could affect the productivity and value creation in an organisation. Similarly, Baxter & Sommerville (2011) argue that the simultaneous wellbeing of both the core-business factors of the organisation and its employees, guarantee the sustainability of the organisation. Goldman (2009) affirms that the rapid introduction of TIs in the workplace has brought many changes and widely influenced the work of the organisation, the psychosocial work environment, and work practices. Based on the foregoing narratives, current practices in FM need to emphasise the employees' social sustainability. Hence, this study explores the employee element of the organisation against the backdrop of TI adoption. West (2015) opined that technology in an organisation is, a means to an end and not an end in itself. Thus, the golden rule is to have an organisation that is

economically successful and sustainable in terms of its impact on the employees (Casey & Sieber, 2016). According to Pfeffer (2009), organisations, through their operations, can have a negative impact on employees and their social environment. Given the subtle nature of these effects (often psychological or social) their harm is often understated in comparison to physical security. Yet the sustainability practice in FM continues to focus on the environmental wellbeing that is exclusionary to social wellbeing (Elmualim et al., 2009; Jensen et al., 2013). Organisations are more interested in sustainability that can reduce their costs, with an emphasis on issues such as physical waste and pollution, and little focus on the social externalities that the work practices create. To state the obvious, “organisations are comprised of people, and building a sustainable company should consider the human as well as the physical dimensions of company actions” (Pfeffer, 2009:4). Managers need to be concerned about an organisations’ impact on the employees as much as they are concerned about the natural environment. The concern for employees in an organisation is the foundation for social sustainability and overall business longevity (Almahmoud & Doloi, 2015).

Social sustainability involves assessing the impact of organisations’ activities on the wellbeing of employees in the system. Chiu (2003) suggests that social sustainability is the strategy of supporting and improving the wellbeing of current and future generations. In FM research, previous studies have acknowledged social sustainability as the most undeveloped compared to the economic and environmental sustainability (Senyucel, 2009; Elmualim et al., 2009; Jensen et al., 2013, Sarpin, 2015). The underdevelopment of social sustainability is attributed to the subjective characteristics and inability to empirically measure its defining factors (Boström, 2012; Klintman, 2012). For instance, what is socially suitable for one person may be unsuitable for others, thereby making the measurement very subjective. In spite of the subjective characteristics of social factors, Boström (2012) argues that ignoring the social dimension of sustainability will limit the ability to understand and solve the environmental and economic problems of sustainability. Other studies also infer that FM organisations must begin to appreciate that the promotion of employees’ wellbeing can positively impact its overall success of organisations (Adams & Frost, 2008; Holton et al., 2010; Lindsey, 2011; Elmualim et al., 2012). Previous studies have noted that the assessment of sustainability in FM is mostly driven by the financial incentives that it can bring to the organisation and shareholders (Hodges, 2005; Lai & Yik, 2006; Bebbington & Dillard, 2009; Nielsen et al., 2009; Elmualim et al., 2012; Sarpin, 2015). These studies, therefore, imply that the absence of tangible financial gain could affect the development of a social sustainability pillar in FM.

Grimshaw (2001), however, argues that when organisations help employees to manage the impact of work as a social responsibility, it promotes employees' social sustainability. It therefore suggests that the adoption of TIs in FM organisation should be considered as an issue beyond the economic benefits that can be derived to the impact on the wellbeing of the employees (Pfeffer, 2009). As can be inferred from the earlier submission of Atkin and Bildsten (2017), adopting TIs without holistic assessment of the impact on employees is risky for the social sustainability of the FM employees.

Given the above information, it is clear that there are still gaps in the global knowledge of FM social sustainability in relation to TI adoption. However, these gaps are especially apparent in the academia of developing economies in Africa. Therefore, this study focuses on the case study of South Africa given its position in the continental economy and its use of TI in FM practises. It seeks clarity on these matters by asking poignant questions such as, what are the current TIs that FM service providers adopt in South Africa, what is the level of adoption, and what the is impact of such adoption on FM practice and the social sustainability of the FM professionals, in a bid to understand this complex issue in a regional context.

1.3 Towards the Research Problem

Due to the socio-technical nature of organisations, changes in the organisation affects both the social and the technical parts of the organisation. Hence, the adoption of TIs in FM organisation impacts both the core business and the employees of the organisations. Some of the impact on the core business such as enhanced quality service, operational cost savings, efficiency, and safety have been well documented in previous studies. However, not much is known about the impact on the employees in FM organisation thereby creating an imbalanced assessment of technology adoption in FM organisations. There is empirical evidence from other fields that the adoption of TI could have either positive or unintended consequences for the wellbeing of the employees. The problem is that the imbalanced assessment could deny FM organisations the opportunity of optimising the full potential of technology adoption and further the social sustainability of FM employees. Several studies on TI adoption in FM have been silent on the issues relating to employee wellbeing and social challenges that evolve from TI adoption. Hence, there is no holistic view of the impact of TIs in FM organisations. This study intends to contribute towards having a more holistic view of the impact of TI in FM organisations by examining the effects that the adoption of TIs have on the social wellbeing of the employees in South Africa.

Hence, the problem statement is:

There is no empirical evidence of the impact of the adoption of TIs on the social sustainability of FM employees, thereby resulting in unsustainable FM practices.

1.4 Research Question

The main question to be investigated in this research is:

What is the nature, extent and implications of adopting TIs on the social sustainability of FM employees in South Africa?

The following secondary questions will be used to address the primary question:

- What are the current TIs utilised in FM practice in South Africa?
- What is the level of adoption of TIs in South Africa FM practice?
- What are the factors that influence the adoption of TIs in South Africa?
- How do TIs impact FM practice in South Africa?
- To what extent does the adoption of TIs in FM organisations affect the social sustainability of FM employees in South Africa?
- What framework can be used to manage the influence of TI adoption on the social sustainability of FM employees in South Africa?

1.5 Research Aim

The study aims to examine the nature, extent and implications of TI adoption on the social sustainability of FM employees in South Africa.

1.6 Research Proposition

The proposition of the study is that:

The nature, extent and implications of adopted TIs in FM organisation can impact the social sustainability of FM employees in South Africa.

1.7 Research Objectives

- Identify the current utilisation of TIs in South Africa FM practice.
- Determine the level of TI adoption by FM organisations in South Africa.

- Identify the factors that influence the adoption of TIs by South African FM organisations.
- Determine the impact of adopted TIs on FM practice in South Africa.
- Examine how the adopted TIs affect employee social sustainability in South African FM organisations.
- Develop a framework for the management of the impact of TIs on the social sustainability of FM employees.

1.8 Research Significance

FM is a profession that integrates place, people, process and technology for the functionality of the built environment (IFMA, 2017). Against this background, this study is significant because it spans two crucial aspects of FM: “technology” and “people”. From the technology perspective, the study examines TIs in FM practice, whilst from the perspective of the people it examines social sustainability with emphasis on the wellbeing of FM employees. Previous studies have emphasised the need to assess the impact of technological adoption on the social sustainability of FM employees’ (Love & Bullen, 2009).

Following globalisation trend, technological innovation is transforming professional practice, including FM practice (Grimshaw, 2007). Some of the transformations are radical and destructive, altering the *status quo*, while others are positively propelling the profession into an entirely new direction (Atkin & Bildsten, 2017). Hence, the need to evaluate the nature of effects that the FM profession is undertaken with a view to maximise the benefits and manage the threats. Although technological innovation in FM practice has advanced in the developed economies of America, Europe, and Asia, it is not the same in the developing economies such as South Africa (Zaphiris & Siang, 2009). Hence, the study evaluates the level of technological utilisation by FM organisations operating in South Africa.

From the social sustainability perspective, the study evaluates the impact of TIs on FM employee wellbeing and whether it can affect the ability of the organisation to enhance value creation (Grimshaw, 2003). Hence, a study of this nature serves as a guide for managing the tension between the individual employee social needs and the FM organisation imperatives of technology adoption (Jääskeläinen & Laihonon, 2013).

1.9 Research Methodology Overview

This study is situated within the FM research domain where the positivist quantitative research approach was the most favoured by some researchers (Ratcliffe, 2000; Vischer, 2008; Price et al., 2009). However, other researchers have argued for the qualitative research approach because of the inability of the quantitative approach to account for the intrinsic, attitudinal, behavioural, and sociological aspects (Strauss and Corbin, 1998). Therefore, there is a compelling argument for methodological flexibility and heterogeneity. Dainty (2008) argues that a more liberal outlook towards mixing methodologies and research paradigms could yield deeper insights into, and understanding of, phenomena in the built environment. Therefore, a mixed-method approach was adopted in this study. The mixed method adopted followed a sequential approach, in which the quantitative and qualitative data were collected in sequence (Creswell, 2014). The quantitative data was collected in the first phase as to establish some fundamental parameters, such as obtaining a broad knowledge of the type of TIs that were being used in South African FM organisations, and also to set the basis for the qualitative interviews in the second phase.

Development of the research instrument started with a comprehensive literature review on FM, TI, sustainability, social sustainability concept, and FM practice in South Africa as the focus. Definite issues that were reviewed in the literature involve the TI deployed for FM practice, their influence on the practice, and the implications for social sustainability. The three pillars of sustainability were also reviewed. The literature review guided the development of the conceptual framework based on the relationship between the constructs of the study. It also led to the development of the semi-structured quantitative questionnaire and the qualitative interview guide that were used in this study.

A questionnaire was used to collect data on the types of TIs in FM organisation through a nationwide survey. The questionnaire was also used to determine how the TIs were affecting FM practice, and to estimate the extent of such effects. Furthermore, it validated employee social factors that are affected by the adoption of TIs in FM organisations. The relative importance index (RII) of the factors was determined and subsequently a pair-wise comparison survey was conducted amongst FM professionals to explore their opinions on the relationship between various employee social sustainability factors. Consequently, the ISM technique was used to develop the hierarchical model. ISM was used to analyse the relationships between the social sustainability factors. Furthermore, it was used to understand the dependence and driving

powers of each factor in order to know which factor(s) to give more priority when pursuing social sustainability in FM organisations. Interviews were conducted in FM organisations to understand a practical perspective of social sustainability practice and determine the nature and extent of influence that TI adoption has on the social sustainability of employees. Further details on the methodology are provided in Chapter Four of this thesis.

1.10 Research Scope and Limitations

The study collected data from FM organisations countrywide with the aim of having greater response to enhance the chances of generalising the findings. Despite this the response was lower than expected after nine months of online surveying. Therefore, the extent to which the findings can be generalised is limited, since the respondents may not be representative of all FM organisations that are registered with the South African Facilities Management Association (SAFMA). The reliability of the quantitative phase depends on the accuracy of the responses that were provided by the respondents and may have been limited by the refusal of some people canvassed to participate in the study.

1.11 Thesis outline

Chapter One outlines the research approach and the overall guiding principles of the thesis. The elements of this chapter include introduction to the research, the background to the study, the research problem, the research question, the research aim and objective. It also includes the limitations, justification and scope of the research.

Chapter Two presents both the theoretical and conceptual bases of the study. Comprehensive literature review on trends of FM, the TI in FM, issues on sustainability and sustainable FM, and the social sustainability pillars were reviewed. The challenges that confront the operationalisation of the social sustainability pillar in FM, the various constructs of the study and how they relate with social sustainability and FM practice are also discussed. This chapter further reviews organisations as stakeholders in the society. Furthermore, the chapter reviews the theoretical perspectives that are significant to social sustainability and employee wellbeing in organisations. Through the theoretical review, the factors that support the research intention were outlined and a conceptual model developed.

Chapter Three outlines the research methods adopted for data collection and analysis of the study. This includes the determination of the research philosophy, the paradigm, and the strategy of the study. The population and the sampling selection strategies are described. The

data collection and analysis procedures for the mixed–methods approach is explained in this chapter.

Chapter Four presents the results obtained from the analysis of the quantitative data obtained in the first phase of this study, which constituted a significant component of the second qualitative phase. Furthermore, the relationships that exist among the variables of the research constructs were elaborated upon.

Chapter Five outlines the results of the analysis of the second phase qualitative data. The chapter discusses the outcome of the interviews conducted and the document analysis.

Chapter Six provides a detailed discussion of the findings of the study and presents the framework for the management of the social sustainability of FM employees.

Chapter Seven presents a summary of findings of the study, drawing up appropriate conclusions and establishing the contributions to the FM body of knowledge. It further outlines the practical implications of the research findings and makes recommendations for areas of further studies in the people-centred approach to sustainability.

CHAPTER TWO: THEORETICAL AND CONCEPTUAL FRAMEWORK

2.1 Introduction

This chapter starts with an overview of FM and provides scope on the different levels of FM operations. It also examines the TIs and the various impacts they have on both the core-business factors and the employees of FM organisations. Given that there are numerous factors that impact FM, this chapter specifically focuses on the social sustainability of the employees with the adoption of Tis in FM organisations. The chapter also conceptualises the interrelationships between the various social sustainability factors that were reviewed.

2.2 FM Defined

There are many definitions of FM. Barret and Baldry (2009: xiii) define FM as “an integrated approach to operating, maintaining, improving and adapting the buildings and infrastructure of an organisation to create an environment that strongly supports the primary objectives of that organisation”. The International Facility Management Association (IFMA, 2017:1) define FM as “a profession that encompasses multiple disciplines to ensure functionality of the built environment by integrating people, place, process and technology”. This definition is a holistic illustration of the discipline and the many factors that are interdependent for the realisation of success in an organisation. Similarly, the British Institute of Facilities Management (BIFM, 2017:1) define FM as a discipline that “encompasses multi-disciplinary activities within the built environment and the management of their impact upon people and the workplace”. This definition prioritises human wellbeing in the workplace. These three definitions aptly show that FM activities are not only constrained to the building and its physical characteristics but also involve the wellbeing of the building occupiers (employees and customers, to mention a few).

In this study, FM is defined based on the above definitions as a profession that facilitates the creation of enabling conditions for the execution of the operations in organisations through the coordination and management of extensive range of specialist activities. It is often regarded as the non-core middle management function that ensures day-to-day operations of organisations. FM professionals act as a link and support to both customers and employees alike (Chotipanich & Nutt, 2008). It involves having an integrated view of available service infrastructure and using it to enhance service delivery that satisfies the customers while creating the best value for the shareholders. Traditionally, FM involved cleaning, caretaking, repairs and maintenance.

However, contemporary FM services are viewed more broadly to cover real estate management, change management, financial management, health and safety. Furthermore, these professionals are expected to oversee contract management and human resources management. The scope of this profession goes beyond building and engineering services maintenance to domestic services and utilities supply (Atkin & Brooks, 2009). Given this overview of the profession, one can categorise the activities of FM professionals into three levels, namely: strategic, tactical and operational.

2.2.1 Strategic Level

The strategic level is the platform from which long-term strategic decisions of the organisation are made. FM strategies aim to ensure that an organisation has the necessary framework in place to achieve their particular business goals (McGregor, 2000). Similarly, the facilities manager at the strategic level guides an organisation on the long-term plans in ways that the corporate organisation strategies are integrated with facilities strategies to ensure the creation of added value (Then, 1999; McGregor, 2000). The primary aim of strategic FM is to achieve a calculated fit between core-business objectives and the provision of physical infrastructure. The deliverables expected from the strategic FM levels include the best value, innovation, support for the core-business, and the best use of facilities.

2.2.2 Tactical Level

The tactical level is the middle management level of interaction where the strategic objectives are implemented in the medium term. Facilities managers at the tactical level ensure that the strategic guidelines are adhered to by the operational FM practitioners (Langston and Lauge-Kirstensen, 2013). They also help to break down the policy objectives outlined at the strategic level into smaller, achievable, forms for the operational FM level. The facilities managers, therefore, set timelines and key performance indicators to be followed for the achievement of the strategic goals of the organisations and ensure that the lines of communication are as explicit as possible to remove any ambiguity (Mat and Baharum, 2015).

2.2.3 Operational Level

The operational level is the most visible aspect of FM on a day-to-day basis, where necessary interaction is required to create the environment for end-user satisfaction (Langston and Lauge-Kirstensen, 2013). At this level, the facilities manager superintends service delivery by monitoring and checking the service providers. They ensure that the required services are being

provided and interpret all the service level agreements that are signed by the parties. The facilities manager's role is more of a liaison officer between the organisation and the service providers. Table 2.1 is a summary of the three levels of FM practice.

Table 2. 1: Summary of the Three Levels of FM Practice

Level	Description
Strategic Level	<ul style="list-style-type: none"> • Defining FM strategies and policy-making guidelines • Active correspondence and decision-making at a corporate level • Initiating and monitoring Key Performance Indicators (KPIs) • Analysing FM impacts on the primary activities, internal and external environment, and community
Tactical Level	<ul style="list-style-type: none"> • Implementing and monitoring guidelines to follow strategies • Translating business objectives into the operational level • Defining and interpreting Key Performance Indicators (KPIs) • Communicating with internal and external service providers on a tactical level
Operational Level	<ul style="list-style-type: none"> • Delivering services • Monitoring and checking the service providers and service delivery process • Defining and interpreting Key Performance Indicators (KPIs) • Communicating with internal and external service providers on an operational level

Source: Mat and Baharum (2015:13)

Table 2.1 indicates that FM services are crucial and should optimally be maximised at every level of organisation to achieve integrated value addition. The achievement of the facility managers' responsibilities at the various levels, as described above, requires enormous resources and manpower. This in turn can translate into an expensive venture. However, the advancement in technology can be leveraged upon to achieve cost management and efficient service delivery in this area (Peng et al., 2016; Mohamad et al., 2017). Hence, the following section discusses TI in FM.

2.3 Literature Review: Systematic Categorisation of Key TIs in FM

The range of TIs available to FM professionals is both broad and diverse (Aziz et al., 2016) as shown in Table 2.1. Hence, it is necessary to attempt to categorise or group the TIs into clusters. To this end, a systematic review of the literature was undertaken for articles that were published between 2012-2017. The period covers 5 years and is considered acceptable to the researcher because of the rapid development of TIs (Teicholz, 2001; Ebbesen, 2015; Nysten & Holmstrom, 2015).

Methodical approach

Considering that the subject of TI in FM is relatively a new research area (Volk et al., 2014; Iltter & Ergen 2015), a systematic literature review was undertaken. This review covers an extensive range of journal articles and other related materials to capture the broad themes of TIs in FM (Geddes, 1995). Furthermore, to avoid the limitation that is associated with the use of one search engine (e.g. Scopus), the research used Scopus and Google Scholar as search engines to give a more accurate and wide-ranging perspectives on the phenomena (Meho & Yang, 2007; Yi & Chan, 2014). The review started with a general search of the ‘title’, ‘abstract’ and ‘keyword’ of literature in academic databases and scholarly publication search engines. Scopus, in particular, offers a wide range of academic text that allows for a multidisciplinary investigation and identification of indexed documents and citations in the studied fields (Falagas et al., 2008; Wong et al., 2018). Scopus is widely used for researching literature in the engineering and technology field (e.g. Pérez et al., 2015; Shou et al., 2015; Meerow et al., 2015). Google Scholar, on the other hand, covers conference proceedings which are of significant value to this research (Meho & Yang, 2007).

Journal articles with a focus on TIs and FM were retrieved through keyword searches. Thirty-six journals were retrieved (See Appendix A). The journals were chosen based on their reputation and relevance to the current research topic. The articles were found by conducting a topic search using the keywords “facilities management” AND “facility management” AND “technological innovation” AND “ICT” AND “automation in FM”. The search resulted in a total of 215 articles that contained the keywords. A review of the abstract and the findings of each article was conducted to sort through irrelevant and/or identical papers. Thereafter, there were 97 papers that specifically referred to the role of TIs in FM operations (see Table 2.1).

Categories

From the literature, there are various forms of TIs that have the capacity to displace or reduce the required number of human professionals in FM (see table 2.1). These forms of TIs can be categorised into five thematic groups: 1) ICT-based technologies (IoT), 2) cloud-based technology, 3) drone technology, 4) robots, and 5) sensor devices. The essence of categorising the TIs is to compress the number of comparable TIs into a manageable quantity for the purpose of this research (Pallant, 2010). These five categories are, therefore, the focus of this study.

Table 2. 2 : Research on TI in FM Organisations from 2012 to 2017

Author /Year	Technology categories				Cloud-based/Data repository
	ICT-based	Sensors	Drone	Robots	
Arayici et al. (2012)					BIM
Azhar et al. (2012)					BIM
Barlish and Sullivan (2012)					BIM
Becerik-Gerber et al. (2012)					BIM
British Institute of Facilities Management (BIFM) (2012)					BIM
Lee et al. (2012)					BIM
Manzoor et al. (2012)	BMS BEMS	RFID PIR			
Becerik-gerber et al. (2012)					BIM
				Photogram. Laser scan	
Klein et al. (2012)					BIM
BIM Task Group (2013)					BIM 3D Database
Chen et al. (2013)					
Codinhoto et al. (2013)					BIM
Costin et al. (2013)		RFID sensors	&		BIM
Eadie et al. (2013)					BIM
East et al. (2013)	IFC COBie etc	MVD			BIM
Ghosh & Chasey (2013)					BIM
Golabchi et al. (2013)					BIM
Hichri et al. (2013)					BIM
Irizarry et al. (2013)		AR			BIM
Kasprzak et al. (2013)					BIM
Kelly et al. (2013)					BIM
Kim et al. (2013)	Protocols	AR RFID sensors	&		VR VE
Ko et al. (2013)					Database
Kuiper & Dominik (2013)					BIM
Lin & Su (2013)					BIM
Liu and Issa (2013)					BIM
Mill et al. (2013)					BIM
Motamedi et al. (2013)		RFID RTLS			BIM
Motawa and Almarshad (2013)					BIM
Olbrich et al. (2013)					BIM
Parsanezhad and Tarandi (2013)					BIM
Wang et al. (2013)					BIM
Xiong et al. (2013)					BIM

Abdullah et al. (2014)						BIM
Ammari & Hammad (2014)						BIM
Charlesraj (2014)						BIM
Codinhoto and Kiviniemi (2014)						BIM
Hua et al. (2014)	IB		Sensor			GIS
Hou et al. (2014)			AR AV			Models
Irizarry et al. (2014)			MAR	Drone		BIM
Jung et al. (2014)					Laser scan.	BIM
Karan and Irizarry (2014)						BIM
Kiviniemi and Codinhoto (2014)						BIM
Kriksciuniene et al. (2014)	Protocols, CAFM		CCTV Barcode + RFID			BIM, BAS, BMS
Lin et al. (2014)						BIM
Liu and Issa (2014)						BIM
Morgan (2014)	IoT					
Motamedi et al. (2014)	ICF, CMMS					BIM
Parsanezhad and Dimyadi (2014)						BIM
Rousek et al. (2014)			RFID and sensors			
SmartMarket Report (2014)						BIM
Volk et al. (2014)	IFC COBie					BIM
Wang and Cho (2014)						BIM
Wu et al. (2014)						BIM
Chen et al. (2015)						BIM
Ilter and Ergen (2015)						BIM
Kang and Choi (2015)						BIM
Kang and Hong (2015)						BIM
Kassem et al. (2015)						BIM
Kensek (2015)						BIM
Love et al. (2015)						BIM
Sarkar et al. (2015)						BIM
Terreno et al. (2015)						BIM
Wetzel and Thabet (2015)						BIM
Williams et al. (2015)						BIM
Wong and Zhou (2015)						BIM
Amano & Lou (2016)						
Ashworth et al. (2016)						BIM Point Cloud/laser scanning
Barazzetti (2016)						
Cheng et al. (2016)						BIM
Kang et al. (2016)						BIM
Oti et al. (2016)						BIM
Cheng et al. (2017)						BIM
Katipamula et al. (2017)						BIM

Ko (2017)		RFID	&		
Lu and Lee (2017)		sensors			BIM
Pärn and Edwards (2017)					BIM
Total	10	13	2	1	71

The literature review therefore follows these five categories in its analysis of FM research. Table 2.2 shows that the cloud-base/data repository, with 71 relevant publications, has the highest number of publications. The sensors category has 13 publications, the ICT-based category has 10 publications while the least documented category is the robots with one relevant publication. The result of the analysis shows that FM practices are more focused on data storage technology than any other category of technologies. The details of each of the TI categorisation are discussed in the following sections.

2.3.1 ICT-based Technologies

In the last few decades, the advancement of the internet has transformed the business sector (Cox, 2001; Grimshaw, 2007; Bandyopadhyay & Sen, 2011; Atkin & Bildsten, 2017). Internet technology rapidly grew from a simple tool that aided communication for research collaboration to office desktops and home facilities (Cox, 2001). Moreover, it has radically changed almost every facet of life including the way business is done.

The internet has revolutionised accessibility. It enables the use of email and instant messaging on laptops and mobile phones. These forms of technology have been widely adopted by many organisations to allow for flexible work schedules (Hoeven et al., 2016). From an FM point of view, the internet is an important technical resource because email is an essential tool in a facilities manager’s toolkit (Cox, 2001). Through email, facilities managers can coordinate FM services and personnel from a remote location without necessarily visiting the facilities. Common channels of communication that are enabled by the internet include video conferencing, multimedia instant messaging, recording, photographing with the smartphones, and social media. The internet facilitates the streamlining of organisational processes and enhances the productivity of managers. Employees can communicate with customers more efficiently by obtaining and responding to information promptly via the internet (Grimshaw, 2007; Long, 2016). Internet technology, therefore, promotes different work patterns, such as: flexible work arrangements, open-office environments, telecommuting schedules, compressed work weeks, and teleconferencing (Grimshaw, 2007; Brough & O’Driscoll, 2010; McElroy & Morrow, 2010; Leslie et al., 2012; Golden, 2013; Hing Lo, et al., 2014; Gajendran et al., 2015).

These work patterns positively affect efficiency and profitability of the FM organisation. However, the influence of the internet on FM practice is not without consequences (Rousseau, 2006; Kossek et al., 2009; Pfeffer, 2009). Later sections will discuss some of the consequences of internet use on employees and their wellbeing.

2.3.2 Cloud-based Technologies

Different researchers have described cloud-based technology differently. For instance, Lau et al. (2013) define a cloud as a distributed system that can unify resources in different geographical locations and make one or more available to a user on demand. Similarly, Buyya et al. (2008) describe cloud computing as the provisioning of software, hardware, and data service on demand. According to (Armbrust et al., 2010: 50), “Cloud Computing refers to both the applications delivered as services over the Internet and the hardware and systems software in the data centers that provide those services”.

In the context of FM, cloud computing presents an opportunity for the unification of facilities in geographically dispersed locations for management purposes (Lau et al., 2013). It further provides opportunities whereby Service Level Agreements (SLA) are negotiated between the service provider and the customer in a dynamic manner (Buyya et al. 2008; Leimeister et al., 2010). Therefore, it reduces the prohibitive cost of managing computer infrastructure in each of the locations and provides unlimited access to specialised software and updates. Before the advent of cloud technology, FM organisations incurred high expenses to manage geographically dispersed facilities by having IT infrastructure in each location. However, with the introduction of cloud computing, there is an overall improvement of service delivery in FM organisations because facilities managers can centrally monitor, control, and manage all their portfolios from a single location at an affordable cost. Based on the submissions of Buyya et al. (2008) and Leimeister et al. (2010), the advantages of using cloud-based technology in FM would include: 1) constant facility monitoring, leading to improved facilities performance; 2) proactive maintenance operations through prompt identification and resolution of problems; 3) better occupants’ comfort because of online real-time facility monitoring; and 4) improved response and turnaround time due to real-time alerts about out-of-specification conditions from building elements.

2.3.3 Drone Technology

Drones, also known as unmanned aerial vehicles (UAV), are used for different operations and services. In the FM context, drones are used for maintenance, surveillance, and security operations (Hounsell, 2016; Bobby, 2017). In the case of maintenance operations, drones are used to access problematic areas, monitor equipment performance, and obtain valuable details about critical assets at almost no risk (Bobby, 2017). With the aid of mounted, remote-controlled, cameras, drones can transmit images of building structures and machinery on a rooftop and report on the general condition of roofs. Drones can also provide infrared and X-ray images. These images can be used to identify structural issues or dangerous leaks in an environment that is potentially unsafe for humans to reach (Bobby, 2017). The use of drone technology brings several potential benefits for FM as the technology helps in maximising facilities lifecycle, provides quick access at low cost, and documents the physical condition of a facility in more efficient way (Bobby, 2017).

2.3.4 Robots

Robots adopted in FM can be categorised as domestic and service robots. They are employed to perform a variety of workplace applications such as portering, maintenance, customer care services, and security (Metz, 2014). In maintenance operations, facilities managers have achieved better efficiency through automation of services such as cleaning, floor scrubbing, vacuum operations, and grass cutting robots. The adoption of robots for cleaning and vacuuming enables cleaning to be carried out at night outside normal office hours, thereby reducing the interference with meetings and other daily-activities. Furthermore, manual cleaning activities typically require the engagement of cleaning staff in addition to having the lights and air conditioning or heat turned on for easy drying. However, the use of cleaning robots has reduced energy – costs as the lights, heat and air-conditioning remain off and no cleaning staff are needed (Goossens, 2016). Therefore, with the adoption of robots, cleaning services and energy efficiency are enhanced. Also, robots are more effective, and present less risk, compared to their human counterparts when cleaning windows in high-rise buildings and when there is a challenge of access to small spaces (Goossens, 2016).

Robots are also used for waste management in FM because of the increased tonnage in waste in this generation (Gundupalli et al., 2017). With the robotic waste sorting systems, a large volume of waste can be processed in a 24-hours uninterrupted waste management operation with higher efficiency compared to human operated waste management operations. Robots are

also engaged by facilities managers for security and safety services with higher efficiency and improved operational activities, especially for facilities managers who handle the management of large portfolios. Robots are also deployed to conduct regular safety checks, inspect, report hazard risks, and respond to emergencies (Theodoridis & Hu, 2012).

2.3.5 Sensors

In the built environment, there are two types of sensors, namely: infrastructure sensors, and occupants-related sensors. The infrastructure sensors monitor massive infrastructure while the latter is installed in building facilities to monitor the climate, lighting, safety, and security (Roth, 2017). From an FM point of view, the latter type of sensor is significant for operational FM. Smart sensors in building facilities reduce the operating costs, enhance productivity, and improve the occupants' comfort and safety (Roth, 2017). Smart sensors, such as wireless occupancy sensors, daylight sensors, audio-visual sensors, temperature sensors, carbon dioxide sensors, and door access controls enable adequate space management. Furthermore, they promote effective energy savings, security, and safety management (Millán, 2014). With the widening scope of FM into human resource management, the use of sensors becomes inevitable due to the ability of the smart sensor to collect detailed information about occupants' presence and activities.

The data collected can be used to plan the optimisation of FM services such as hot desking, meeting room bookings, space planning, and energy savings (Yerby, 2013; Roth, 2017). However, Millán (2014) argues that the current use of data generated from sensors is sub-optimal. He further posits that data generated from the use of sensors can be maximised by the facilities managers for some predictive maintenance purposes.

Significant shortcoming of TI in FM research includes the lack of empirical peer-reviewed research on the effects of adopted TIs on the social wellbeing of the FM employees. This shortcoming questions the ability of facilities managers to integrate people, place, process, and technology for the functionality of the built environment (IFMA, 2017). Hence, the following section will be assessing the factors that influence the adoption of TI in FM organisations.

2.4 TI adoption in FM

The adoption of TI is primarily to perform FM functions. TI adoption in FM operations can be attributed to the changing nature of business and service demands (Teicholz, 2001). In the 1960s, as the power of information technology (IT) grew and its ability to lower the cost of

doing business became visible, facilities managers embraced IT automation for efficient service delivery. Hence, the first move towards FM automation occurred between 1960 and 1963. Although the name FM did not exist then, the role of FM was taken up by maintenance managers, facilities planners and service engineers. These professionals assumed FM responsibilities through automation in design and construction, space and asset management, and layout evaluations (Lunn & Stephenson, 2000; Gabriel, 2003).

The second generation of FM automation was 1964-1980 with the emphasis on the development of simplistic assets inventories system (Lunn & Stephenson, 2000). Technology was used to track organisation resource base. The processes generated a database for the organisation up until 1980. According to Lunn & Stephenson (2000: 313), it was during this period that “operational research methods were applied to space planning and management information problems. But the lack of database capability levels of user understanding made the use of automated techniques sporadic and unevenly successful”.

The year 1980 to 1990 marked the third generation of FM automation. This period experienced an increased use of technology by FM professionals due to the development of the personal computers (PC) and many software. This period was characterised by an integration of various FM graphic and nongraphic applications using the PC as the primary hardware platform (Teicholz, 2001). FM professionals explored the flexibility of computer-aided design (CAD) software to develop as-built plans that were necessary for FM automated systems (Lunn and Stephenson, 2000; Teicholz, 2001). The subsequent flexibility and information made it possible for facilities managers to generate real-time space reports with occupancy information and occupancy cost analyses (Teicholz, 2001).

The fourth generation commenced in 1999 with the discovery of the hyperlink and the ability of programmers to link Web addresses (URLs –for uniform resource locators) using a presentation format called hypertext mark-up language (HTML) (Teicholz, 2001). Following the discovery, FM automation was characterised by flexible and multiple integrated applications targeted at workspace management. FM vendors used the internet to post static information by publishing HTML-formatted reports from the client-server applications (Teicholz, 2001).

The emergence of high-speed internet, PCs, networks and the embedded microchip in facilities marked the beginning of the fifth, millennial, generation. With time, communication became

more wireless and the internet supported mobile devices, programming, and interoperability of different communication systems (Lunn & Stephenson, 2000; Teicholz, 2001). The internet and PCs enabled facilities managers to execute simple queries, locate persons and assets through a net, submit the work order or request, investigate health and safety data, and also display floor plans for easy assessment (Lunn & Stephenson, 2000). Following the period between 1999 and the millennium, it becomes difficult to distinctively track the progress of FM related TIs into generations due to the accelerated rate at which a piece of technology became obsolete through the emergence of another (Teicholz, 2001; Nylén & Holmström, 2015). Hence, the following section considered a systematic categorisation of TIs in FM practice.

2.4.1 Factors Influencing the Adoption of TIs in FM Organisations

Various scholars have argued for diverse factors that influence the adoption of TI in FM organisations. For example, Lunn and Stephenson (2000) argue that the adoption of TI in FM is influenced by either a demand impact on the organisation or a system impact. The demand impact refers to the pressure that the business' competition puts on the organisation to adopt TI in their operations. Based on the demand impact, Lunn and Stephenson (2000) and Cesar-Gabriel (2003), in previous studies, highlight ten factors that can influence the adoption of TI as depicted in Figure 2.1. The factors include information technology, global competition, cost of facilities, churn rate (the rate at which customers stop subscribing to a service or employees leave a job), employee expectations, information demands, and cost of mistakes. Others are sophisticated design and the need for inventory, strategic resource management, and the need to manage the effects of changes in the organisations' business.

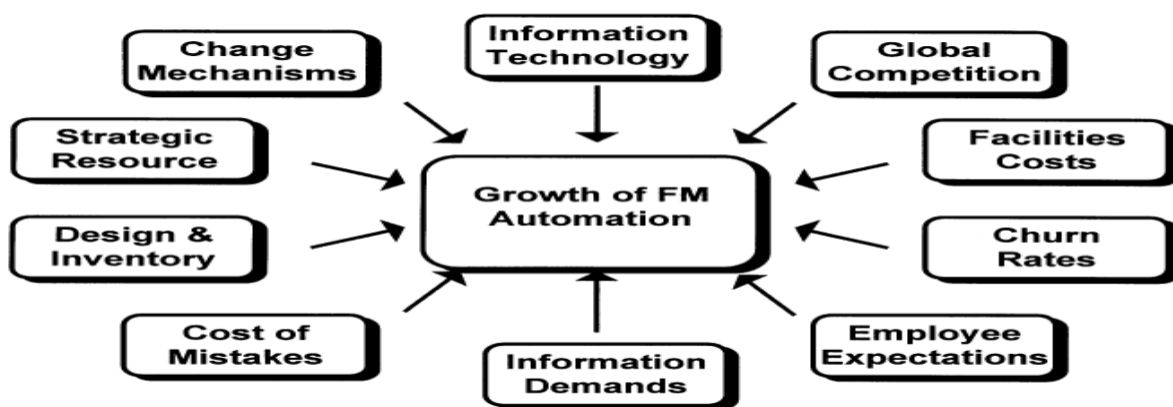


Figure 2. 1: Factors that influence the adoption of TI in FM organisations

Source: Lunn and Stephenson (2000: 315)

Chwelos et al. (2001) ranks the factors that influence the adoption of TI in organisations (FM inclusive) in order of priority as: top management support, perceived benefits, IT sophistication, and external forces. In another study, Liu et al. (2010) argue that management support, perceived benefits, internal readiness, and external forces are the factors that influence the adoption of TIs. Talukder (2012) argues that perceived usefulness and managerial support are more dominant factors compared to others such as peers, social networks, and demographic factors, in adopting TI in any organisation.

Furthermore, the Unified Theory of Acceptance and Use of Technology (UTAUT) model was developed by Venkatesh et al. (2003) to investigate factors that influence technology adoption. The UTAUT classified the factors that influence the adoption of TI in FM organisations into performance expectancy, effort expectancy, social influence, facilitating conditions, top management support, and individual resistance to change. Several studies in the construction management field used the UTUAT model for different purposes (Hjelt & Björk, 2007; Adriaanse et al., 2010; Samuelson, 2011). The seven factors recognised by the UTAUT model that influence the adoption of TI in FM organisation are shown in Figure 2.2.

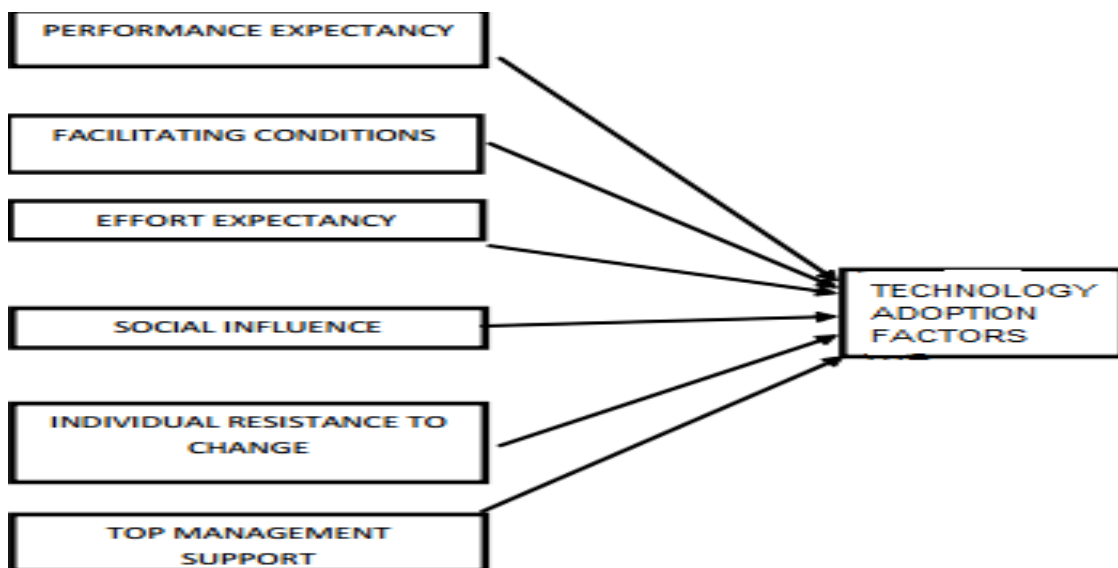


Figure 2. 2: UTAUT model
Source: Sargent et al (2012: 76)

Reflecting on Figure 2.2, Venkatesh et al. (2003) define performance expectancy as the degree to which an organisation trusts a form of technology to accomplish better job performance. Venkatesh et al. (2003) further propose that performance expectancy includes perceived

usefulness, extrinsic motivation, job fit, relative advantage, and outcome expectations. In several previous studies, the performance expectancy construct is consistently the strongest predictor of technology adoption in organisations (Thompson et al. 1991; Davis et al. 1992; Compeau & Higgins 1995; Taylor & Todd 1995; Agarwal & Prasad 1998; Venkatesh & Davis, 2000).

Effort expectancy is the degree of ease that is experienced with the use of a technology (Venkatesh et al., 2003: 450). Three constructs make up the effort expectancy factor, namely: ease of use; complexity; and perceived ease of use (Sargent et al., 2012). Ease of use is the degree to which an individual believes that using technology would free them from physical and mental efforts (Davis et al., 1989; Moore & Benbasat, 1991). Complexity refers to the degree to which technology is perceived as difficult to understand and use (Thompson & Higgins, 1991). In terms of the UTUAT depicted in Figure 2.2, social influence is the degree to which an individual perceives that other people or competitors believe he or she should have adopted a new system (Venkatesh et al., 2003). Three constructs define the social influence, namely: subjective norms; social factors; and image (Sargent et al., 2012). Facilitating conditions are the degree to which infrastructure is available in the organisation and from a technical perspective it refers to the support structures for the use of an adopted technology (Venkatesh et al., 2003). Three constructs are used to measure the facilitating conditions, namely: perceived behavioural control; facilitating conditions; and compatibility.

Successful technology adoption needs implementation support and encouragement from senior managers (Peansupap & Walker, 2005). Support and encouragement involve the managers devoting time to develop the use of the technology within the organisation through reviewing plans, monitoring results and facilitating the integration of the technology within the process of the business (Young & Jordan, 2008). Top management support inspires technology usage. Similarly, better user performance influences positive user perceptions and improves the overall technology uptake (Dong et al., 2009). Previous studies argue that the ultimate success or failure of adopted technology depends on the support from top management (Neufeld et al., 2007; Ifinedo, 2008; Noor & Pitt, 2009).

The individual resistance to change reflects the “individual's dispositional inclination to resist change and predict reactions to specify change” (Oreg, 2003:680). Bovey and Hede (2001) acknowledge that employees are naturally resistant to organisation change because change involves going from the known to the unknown. The level to which employees in an

organisation resist or embrace change becomes a factor to consider in the adoption of TI. Technology failure in organisations often occurs as a response and in resistance to unmanaged change (Venkatesh et al., 2003; Sargent et al., 2012). Furthermore, changes in work process as a result of technology adoption can lead to stress on the employees. Hence, managers must consider the employees' disposition to change in the organisation (Sargent et al., 2012).

It is evident from the above review that the UTAUT model covers a broader perspective than any other single study on this subject matter. For instance, the ten factors that Lunn and Stephenson (2000) mention with regard to the adoption of TI in FM fits into the sub-constructs of performance expectancy. Furthermore, the factors named by Chwelos et al. (2001) and Liu et al. (2010) can also be categorised under job expectancy, social influence, top management support and facilitating conditions in the UTAUT model. The following section will be considering the impact of TI adoption on FM practice.

2.5 Impact of TI on FM Practice

Technology is crucial to the FM profession as its advancement in technology led to the development of the FM profession (Alexander, 1994; Price, 2003a; Price 2003b; Moore & Finch, 2004). The adoption of TI in FM organisations provides opportunities to optimise employee capabilities, respond to customer needs, gain valuable feedback, and useful information for the enhancement of FM operations more efficiently (Lindkvist & Elmualim, 2009; Martin & Omrani, 2015; Kandampully et al., 2016). Previous studies have argued that the adoption of TI holds enormous potential for the achievement of core FM business goals. These include: productivity, running cost, efficiency, corporate image, flexibility, and connectivity (Grimshaw, 2007; Barret and Baldry, 2009). The following section briefly discusses each of the core business factors influenced by the adoption of TI in FM organisations.

2.5.1 Productivity

The adoption of TI in FM organisations improves the productivity of the employees (Grimshaw, 2007; Shabha, 2006). The productivity gains manifest as innovative service delivery mechanisms that evolve from the interconnectivity of the internet (Grimshaw, 2007). Internet connectivity is therefore a key innovation driver and productivity measure. The European Commission (2006) reported that internet and communication-based TIs drive more than half of the European Union's productivity. In a similar submission, Shabha (2006) argues

that the use of sensors for FM services has resulted in efficient space utilisation which influences employees' productivity.

2.5.2 Running Cost

The use of cloud-based technology reduces the need for FM organisations to install technology infrastructure in all portfolios. This minimised infrastructure model further decreases the associated employee and maintenance cost (Grimshaw, 2005; Gebauer & Schober, 2006; Sargent et al., 2012; Alshamaila et al., 2013). According to Ratten (2012), FM organisations adopt cloud-based services to enhance their flexibility, cost-effectiveness, and better scalability of information services. Rathinam et al. (2007) also argue that the cost of maintenance, security surveillance, and other logistics operations in FM have been substantially reduced by the use of drone technology. Furthermore, Qureshi and Syed (2014) affirm that the adoption of robots in FM services have led to about a 65% reduction in labour costs in some instances. Therefore, the adoption of TI in FM organisations has substantially led to the reduced running cost of business in FM organisations.

2.5.3 Corporate Image

Technology is one of the factors that can change the corporate image of an organisation (Melewar, 2003). A positive corporate image is critical to competitive advantage and organisation success (Pfeffer, 2009; Morgan-Thomas & Veloutsou, 2013). A good corporate image leads to successful brand relationships with customers who have positive experiences with an organisation (O'Laughlin et al., 2004; Morgan-Thomas & Veloutsou, 2013). A brand relationship is the long-lasting loyalty bond between the organisation and the consumer that give a competitive advantage to the organisation (Thomson, MacInnis & Park, 2005; Morgan-Thomas & Veloutsou, 2013). The internet and other related technologies enhance the efficiency of facilities manager to respond to queries from his clients, thereby increasing personal and corporate image. Creation of a good corporate image between the organisations and their customers guarantee continuous patronage (Pfeffer, 2009).

2.5.4 Efficiency

Organisational efficiency is shown by the degree that an organisation fulfils its objectives with the smallest costs or resources. Organisations experience improved efficiency through the innovative services of employees in combination with internet-enabled devices (Grimshaw, 2007; Barret & Baldry 2009). According to Qureshi & Syed (2014), efficiency is the most

obvious gain of TI adoption. For instance, robots can do better, cheaper, and faster jobs than any human employee in areas of operational FM (Chiemchaisri et al., 2007; Saeed et al., 2009; Qureshi & Syed, 2014; Gundupalli et al., 2017). Also, the use of technology ensures consistency and improvement of service delivery since machines are known to reduce variation in task delivery (Gibbs, 2017; Ijasan et al., 2017).

2.5.5 Flexibility

Flexibility is the ability of a process to easily accommodate a certain level of variation with regards to the requirements of the supported business process (Applegate et al., 1999; Gebauer, & Schober, 2006). Insufficient flexibility in the operations of an organisation can limit the degree of success and accomplishment of organisation objectives (Gebauer, & Schober, 2006). Excessive flexibility can also be detrimental by complicating organisation process (Silver, 1991; Gebauer, & Schober, 2006). In FM organisations, employees that are connected through the internet and technology can do their work anywhere and anytime regardless of location given flexible work practices (Grant et al., 2013; Morgan, 2004; Nilles, 2007). Previous studies have argued that interconnectivity through mobile devices gives employees more flexibility to meet both work and family needs (Hill et al., 2001; Hill et al., 2003; Valcour & Hunter 2005; Nam, 2014).

2.5.6. Connectivity

TI in FM practice leads to enhanced connectivity, innovative work practices, the possibility of a “Virtual Office”, increased commitment of employees, and more significant task involvement and reduced operational cost (Nutt, 2000; Grimshaw, 2005; Prandelli et al., 2008; White & Bryson, 2013; Scupola, 2014; Martin & Omrani, 2015). The adoption of these technologies has substantially aided the professional capacities of facilities managers through enhanced connectivity (Taival, 2017). Taival (2017), further observes that through the connectivity that TI supports, FM services are moving from being reactive to proactive. With increased sophistication, FM services are becoming predictive.

It is obvious from the preceding literature that the impact of TI on FM has brought positive transformation to FM practices. As previously stated, FM organisations are constituted of core-business objectives which are supported by the TI as well as the employees who drive the technology for business success. It is this socio-technical characteristic of FM organisation that

underscores the need to consider the adoption of TI within the context of sustainability. Hence, the following section will focus on sustainability.

2.6 Sustainability and Operationalisation

Sustainability is “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland Report, 1987:43). The World Commission on Environment and Development (WCED) affirmed that sustainability is “a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations” (WCED, 1987:46 quoted in Hediger, 2000:481–482). This second definition inclusive, covering the different forms of development and emphasising the need for harmonious co-existence among sustainability pillars to meet human needs (Chiu, 2003).

Sustainability consists of three pillars, namely: economic, social, and environmental (Lehtonen, 2004). Theoretically, the pillars should holistically cover the notion of sustainability through balanced interaction (Högberg, 2014). However, the operationalisation of the sustainable pillars has not been holistic due to the different approaches that have been adopted by organisations in combining them. Kopfmüller (2001), as interpreted by Littig and Grießler (2005), categorises the operationalisation of sustainability pillars into two models, namely: the one pillar-model and the multi-pillar model.

The one-pillar model of sustainable development prioritises the environmental pillar above the other pillars (Littig and Grießler, 2005). The proponents of the one-pillar model argue that the desire for economic freedom is responsible for environmental issue. Therefore, regulating environmental practices of organisations will reduce harmful environmental conditions. However, the three-pillar model, which is more internationally recognised, is in favour of equal treatment of the environmental, economic, and social pillars of sustainability. The model argues that human needs extend beyond the provision of a stable and healthy environment to include social and cultural dimensions (Littig & Grießler, 2005). Therefore, holistic sustainable development entails living within environmental, economic and social boundaries that prevent an environmental and social crisis (Högberg, 2014). Mirroring this position to the employees in FM organisations means that the wellbeing of employees should be managed in such ways that they do not experience social crises.

Therefore, a sustainable practice should be deliberate in promoting human wellbeing that stimulates the attainment of a good life full of potential beyond environmental management. Furthermore, environmental, economic, and social pillars are separate features existing in a social system which must remain stable for the harmony of the system. This assertion is depicted in Figure 2.3. The figure shows that the natural resource of the planet sets the environmental boundary within which human activities can take place (Raworth, 2012; Högberg, 2014). The following sections further elaborates on the three pillars of sustainability in greater details.

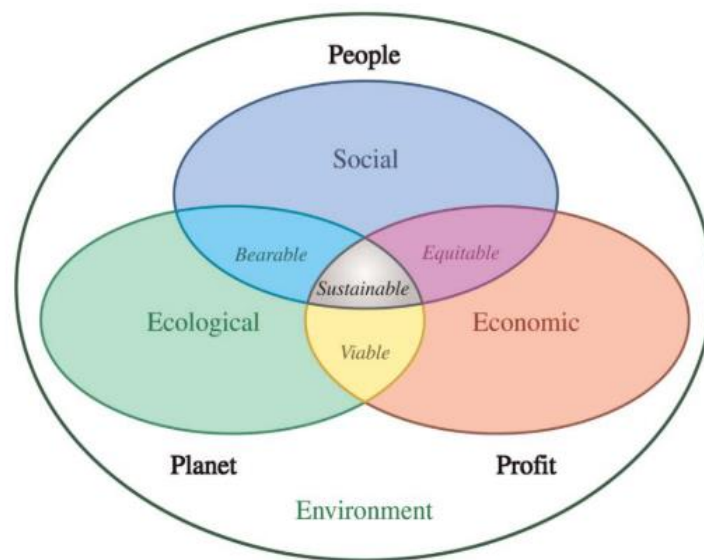


Figure 2. 3: The Dimensions of Sustainability

Source: Thomsen and van der Flier (2009: 650)

2.6.1 Economic Pillar of Sustainability

Economic sustainability is the practice that ensures that present consumption levels do not compromise future needs. It is the process of developing prosperity without compromising the chances of future generation (Silvius & Schipper, 2014). Economic sustainability is secured through the effective management of capital in ways that guarantee the continuous generation of income, be it at the government, private, or household sectors (Goodland & Daly, 1996; Stern, 1997; Högberg, 2014). From the FM perspective, economic sustainability involves ensuring minimal life-cycle costs and non-declining capital (real estate) values (Goodland & Daly, 1996; Stern, 1997; Stavins et al., 2003). Economic sustainability seeks to put in place strategies that guarantee the success of an organisation’s business future.

2.6.2 Environmental Pillar of Sustainability

Environmental sustainability involves making decisions and actions that do not endanger natural resources, species, and ecosystems with the aim of preserving the capacity of the environment to support human life (Anan & Sen, 2000). It involves making responsible business decisions that reduce the negative impact of business on the environment. Within FM, environmental sustainability involves controlling the amount of waste generated and promoting a management practice that focuses on efficient use of water resources, energy consumption, and minimum CO₂ gas emission into the atmosphere (Elmualim, 2009; Nielsen et al., 2016). In the context of SFM, environmental sustainability is the most developed and practised pillar of sustainability. Facilities managers have made significant contributions to the overall sustainability agenda through their activities at the building level. They positively influence the climatic condition, carbon footprint, energy efficiency, sustainable development, and the green agenda through the management of the building facilities in the various organisations (Nielsen et al., 2016). The operational actions of facilities managers are acknowledged as a contributor to the global sustainability agenda given that 80 percent of climate change inducing activities by buildings happen at the operating phase (Junnila, 2007; Nielsen et al., 2016).

2.6.3 Social Pillar of Sustainability

Social sustainability is also known as the human dimension of the sustainability (Vallance et al., 2011). Vallance et al. further affirms that the success of social sustainability depends on the understanding of the complexities of the social dimensions. Social sustainability focuses on the personal assets like education, skills, experience, consumption, income and employment (Omann & Spangenberg, 2002: p. 2). Despite this, social sustainability is the most neglected sustainability pillar in FM (Hill & Bowen, 1997; Littig & Grießler, 2005; Edum-Fotwe & Price, 2009; Åhman, 2013; Elmualim et al., 2013). The neglect is attributed to various factors including the lack of unified measurement strategy (Bebbington & Dillard, 2009; Boström, 2012; Boyer et al, 2016) and the subjective nature of social issues. However, Högberg (2014) argues that social sustainability can be assessed from two perspectives: enhancing people's capabilities to generate economic wealth and through social capital development. Various studies have highlighted the factors of social capital that can be developed towards improving social sustainability of society to include: norms, trust and reciprocity, economic equity, liveability, health, equity, community development, social support, human rights, labour rights, social responsibility, social justice, cultural competence, community resilience, and human

adaptation (Lehtonen, 2004; Adams, 2006; Högberg, 2014). Since the focus of this research is on the social sustainability pillar, this will be discussed in greater depth in the following section.

2.7 Social Sustainability Concept

All organisations have the moral responsibility to protect natural resources and promote social equality because of increased economic growth and progress (Alexander & Brown, 2006). However, SFM has not been able to account for the social sustainability pillar as compared to the economic and environmental pillars (Lützkendorf & Lorenz, 2006; Zhenhong et al., 2006; Edum-Fotwe & Price, 2009). Jensen et al. (2013:11) asserts that the “wider aspects of sustainability in relation to social aspects need to be developed much further”.

The concept of social sustainability in organisations indicates the promotion of social welfare factors (Brandl & Hildebrandt, 2002) that are not limited to secured employees’ income but to encourage integration and social cohesion among employees (Senghass-Knoblauch, 1998). Employment is an essential part of employee social sustainability because of the economic livelihood that it provides (Omann & Spangenberg, 2002; Littig & Grießler, 2005). However, beyond the provision of livelihood, employment is also a means through which society is stratified and structured (Senghass-Knoblauch, 1998). Consequently, Littig and Grießler (2005) describe employment as a factor of social sustainability that defines the structure of society through which an extended set of human needs are met, and society’s reproductive capacity is upheld. Littig and Grießler (2005) further argue that individual human wellbeing is essential for the wellbeing of a society. Similarly, Hodge and Hardi (1997) emphasise that realising progress toward social sustainability will involve sustaining and improving, both human and environmental wellbeing due to their interdependent nature. Hence, social sustainability, as concept, is centres around the promotion of human wellbeing which also resonates to societal wellbeing. Therefore, the following section is on the impact of technology adoption on the wellbeing of FM employees.

2.8 Impact of TI on the Wellbeing of FM Employees

Previous studies have argued that the adoption of TI in organisations affect employee social relationship (Black et al., 2012; Stone et al., 2013). In FM organisations Grimshaw (2007) and Barret & Baldry (2009) highlighted the employees social relationship factors that are impacted by TI adoption to include alienation, social networks, work and home-life balance, overwork, and social isolation. Furthermore, in a study by Attar and Sweis (2010), on the adoption of TI

in a building service organisation, the study argues that the adoption of TI impacts employee job satisfaction. However, job satisfaction is a multipart concept with several factors influencing it. According to Stamps and Piedmonte (1986) and Oduro-Owusu (2010), job satisfaction factors include remuneration, autonomy, task requirements, organisational policies, interpersonal relationships, job security, and professional status. Furthermore, some studies argue that the adoption of TIs influences knowledge development (Bhatt 2001; Dempsey et al., 2011). Employee knowledge development is achieved through strategies such as workshops and seminars (Bhatt, 2001; Bebbington & Dillard, 2009; Dempsey et al., 2011), professional development programmes (Ware & Grantham, 2003); retirement development plans (Wiewiora et al., 2013) and on-the-job training (Bhatt, 2001; Ware & Grantham, 2003, 2003; Wiewiora et al., 2013; Dempsey et al., 2011). Therefore, the social factors of employees that are affected by adoption of TIs were categorised into three constructs namely: social relationship, job satisfaction, and knowledge development. The factors are discussed in greater detail in the following sections.

2.8.1 Social Relationship

Social relationship describes the social connectedness that people experience (Smith & Christakis, 2008; Umberson & Montez, 2010). It is also the minimal state of interdependence that exists among employees (Clark, 2001). Various types of social connectedness factors such as alienation, social isolation, and social network influence social relationship (Umberson & Montez, 2010). Other factors that influence social relationship are overwork and the intrusion of work into employee home life. Previous studies allude to the fact that technological advancement have both negative and positive impacts on the different social factors that influence social relationship (Grimshaw, 2007; Barret & Baldry, 2009; Amichai-Hamburger, 2009). Each of these factors of social relationship influences the social sustainability of the employees (Berkman et al., 2014). For instance, people with a weak social relationship are more predisposed to the risk of premature death (Holt-Lunsad et al., 2015; Valtorta, 2016a). Hence, the quality and quantity of social relations are crucial for the health (Umberson & Montez, 2010) and the productivity of employees in an organisation (Amjad et al., 2015).

According to Amjad et al. (2015), the level of informal social relationship among the employees affects their job performance. In similar submission, Kohll (2018) argues that good social relationship in the workplace provides the essential cohesion needed for employee creativity, teamwork and collaboration. Furthermore, Diener & Biswas (2008) in the study

found that the level of social relationship and the nature of employment influences employee wellbeing. Saligman (2011) also affirmed that the condition of social relationship influences employee happiness. Face to face interpersonal relationship is a crucial factor of social relationship that is affected by the adoption of TIs that support alternative means of interconnectedness (Grimshaw, 2007). For instance, in FM practice, the adoption of internet-enabled TIs substantially reduces the level of face to face contact among employees and clients, hence, reducing the level of social relationship. The following sections elaborate on the factors of the social relationship earlier mentioned.

i. Alienation

Alienation is the estrangement from the social world which can stem from a variety of factors including occupation and changing work patterns due to TI (Grimshaw, 2007; Shantz et al., 2015). It is the subjective gap that exist between desired and actual level of social contact (Perlman & Peplau, 1981; Valtorta, et al., 2016b). Osin (2009) argues that alienation results in people becoming dissatisfied with themselves, less happy, less able to cope with stress, and exhibiting worthlessness. Work alienation is also related to professional stress (Längle, 2003). Studies indicate that there is a significant relationship between alienation, psychological wellbeing and a fulfilled existence with the use of internet (Kraut et al., 1998; Osin, 2009; Burger et al., 2013). According to Kraut et al. (1998:1029), “the internet is a social technology used for communication with individuals and groups, but it is associated with declines in social involvement and the psychological wellbeing that goes with social involvement”. From the analysis of Marx’s early writings, work pattern can trigger alienation as employees lose control over their labour or process of work, especially those tasks that are routine and do not require education to perform (Shantz et al., 2015). With the increasing automation of operational FM, the evolving work pattern encourages work alienation because technology in most cases takes control of the work process (Bailey & Kurland, 2002; Kurland & Cooper, 2002; Grimshaw, 2007; Osin, 2009; Barret & Baldry, 2009). For instance, in FM practice, the internet promotes virtual connectivity more than physical connectivity, which in turn affects the social networks and psychologically alienates employees (Grimshaw, 2007; Barret & Baldry, 2009; Amichai-Hamburger, 2009). The implications of employee alienation, in the long run, are decreased productivity and efficiency, thereby making the technological adoption in FM organisations not to be fully optimised (Shantz et al., 2015).

ii. Social Network

Social networks are characterised by the joint activities and constant exchanges between members of an organisation or a social system that reflects the state of a recurrent relationship (Zavaleta, 2014; Valtorta et al., 2016a). Studies argue that the opportunities created by the organisations in the form of employment draw employees out of their private lives and connects them to the social world beyond the satisfaction of their economic needs (Fukuyama, 1996; Barret & Baldry, 2009). Layard (2005) suggests that employment does not only provide income for employees but also enhances overall life-satisfaction. The new work pattern created by TI adoption in FM influences the nature of work, employees' morale, employee relations and ultimately employee wellbeing (Barret & Baldry, 2009). This work pattern can also impact the strength of other social networks such as friends, family, and community. These connections influence an individuals' social investment, kinship and their public position (Barret & Baldry, 2009; Samuel et al., 2014).

There are intrinsic benefits to social networks and their ability to elicit communal emotional attachment in the workplace (Samuel et al., 2014). This is especially true in the context of FM, where personable relationships are crucial for creating added value. Similarly, studies suggest that social networks, across industries, have a positive impact on health, wellbeing, job opportunities, financial security, and the physical safety of people (Cattell, 2001; Kahneman & Krueger, 2006; Putnam, 2000). Additionally, Nardi et al. (2002) and Golden et al. (2008) argued that professional social networks among employees also plays a significant role in workplace cohesion and overall business success.

Therefore, the power of social networks is expressed in the joy that people derive from being in the company of other people (Narayan & Petesch, 2002). A social network in an organisation is not just a means to an end, a pay-check, but an essential part of human interactions as social beings in larger communities (Fukuyama, 1996).

iii. Work and Home-life Balance

Many studies agree that TI is a crucial factor that influences work and home-life balance (Wallace 2004; Wajcman et al., 2008; Nicholas & Guzman 2009). The central TIs influencing work-life balance are internet-enabled devices which promote the use of mobile and virtual technology devices between work and home spaces (Nam, 2014). Contemporary work and home-life are fundamentally intertwined rather separate given the interconnected technological age. Other studies also affirm that the adoption of mobile and virtual devices in FM have

blurred the boundaries between work-life and home-life (Grimshaw, 2007; Nicholas & Guzman, 2009; Beutell, 2010; Mokyr et al., 2015; Nørgaard et al., 2015; Valtorta et al., 2016a; Zhang, 2016).

However, there are different views on work and home-life balance. For example, some studies argue that the distorted boundaries between work and home-life, a product of changing work patterns, leads to more work and expenses for FM employees (Pocock & Clarke 2005; Brett & Stroh, 2003; Warhurst & Haunschild 2007; Eikhof et al., 2007). Other studies highlight a decrease in employee psychological wellbeing (Evans & Steptoe 2002), mental and physical stress (Westman, 2001), conflicts between multiple roles (Byron 2005; Bulger et al., 2007), and negative influences on teamwork (Hill et al., 1998). Furthermore, studies also show that work-life balance affects job satisfaction (Allen et al., 2000; Frone, 2003), life fulfilment (Adams et al., 1996; Kossek & Ozeki 1998), and task requirements (Witt & Carlson 2006; Hammer et al., 2003).

On the contrary, other studies argue that work can be enjoyable and appealing when it can be executed from anywhere including the home (Sullivan & Lewis, 2001). More studies suggest that the blurring of work boundaries, through telework and other virtual work models, result in higher productivity, higher morale, increased flexibility, and more critical job satisfaction (Hill et al., 1998; Tremblay, 2002; Nam, 2014). In another study, Steward (2000) argues that the balancing of work and multiple non-work activities makes the boundary-crossing mobile workers mentally and physically healthier than their boundary-keeping colleagues. Hence, the debate about work and home-life balance holds both positive and negative outcomes, and there is no one position.

iv. Overwork

Previous studies identify overwork as a factor that is responsible for workplace stress (Eikhof et al., 2007; Grimshaw, 2007). Overwork is considered a job-stressor and reflects the excessive demand that is placed on an employee to deliver on tasks (Ilies et al., 2007). Studies have found that the adoption of TI in organisations can lead to overwork situations where employees do not have work boundaries (Rousseau, 2006; O'Driscoll et al., 2009; Kossek et al., 2009; Pfeffer, 2009). The resultant stress created by overwork negatively affects employees' physical health, emotional wellbeing, and social relationships, which further impacts productivity and profits of the organisation (Sparks et al., 1997; Krantz et al., 2005; Bickford, 2005). In a similar submission, White (2008) notes that the health of workers, and by extension that of

organisations, faces a threat from job stress due to overwork. The number of lost workdays and diminished employee productivity due to poor health is considered a greater cost than paying workers health benefits. It follows, therefore, that inefficient management of overwork-induced stress can result in sick and socially unsustainable employees, who spend their resources on health care.

In the context of FM, overwork situations can arise from the virtual work pattern. For instance, Grimshaw (2007) argues that the employees who are working from home are logged on to the internet for excessive periods to prove that they are working as hard as office-based staff, therefore leading to overwork situations. Furthermore, Altnam (2013) affirms that the adoption of cloud-based technology has been associated with promoting employee overwork conditions due to the real-time nature of information availability, especially where the internet is accessible.

v. Social Isolation

Social isolation involves the separation of employees from social inclusiveness in the organisation, which can cause a social sustainability problem for the employees and the community (Semenza, 2009). According to Benach et al. (2014), social isolation is an important employee social wellbeing factor because employment stimulate social inequalities which further leads to health inequalities. People with stronger social networks are more likely to be healthier than people that are socially isolated. Previous studies have reported that social isolation is one of the major experience of employees working in virtual offices (Marshall et al., 2007). In FM profession, the practice of “virtual office” limits the rate of physical contacts that the employees could have with their colleague and customers. Hence there is low positive community life within the organisation and consequently the wider society (Kasim and Hudson, 2006). People with stronger social networks are more likely to be healthier than people that are socially isolated. Furthermore, the connectivity of the internet leads to situation where the facilities manager is continually monitoring building elements thereby connected to work and isolated from other social activities. Early management of social isolation among employees will reduce absenteeism among employees due to the health challenges and enhance commitment of employees to the organisation goals. An organisation can promote social inclusiveness by creating both the formal and informal social events for the employees (Nørgaard et al., 2015; Valtorta et al., 2016a).

2.8.2 Job satisfaction

Job satisfaction has been a subject of research for a long time; therefore, there are many definitions (Liu, 2016). For instance, Mueller and McCloskey (1990) defined job satisfaction as the level of positive affective orientation that employees have toward their job. Also, Liu et al. (2016) defined job satisfaction as the matching of human needs to the perceived potential driveable from performing a task. However, two popular definitions describe the concept of job satisfaction as: “the pleasurable emotional state resulting from the appraisal of one’s job as achieving or facilitating the achievement of one’s job values (Locke, 1976: 1342)”; and “the extent to which people like (satisfaction) or dislike (dissatisfaction) their jobs (Spector 1985: 2)”. The concept of job satisfaction is influenced by several factors that include: remuneration, autonomy, task requirements, organisational policies, interpersonal relationship, and professional status (Stamps and Piedmonte, 1986; Danziger & Dunkle, 2005). Each of these factors which can be influenced by technology adoption in an organisation. Studies also affirmed that negative impact of technology on the job satisfaction factors adversely affects the productivity of employees (Danziger & Dunkle, 2005; Tumen & Zeydanli, 2016; Shobe, 2018). The following sections discusses how employee job satisfaction and by implication, employee social sustainability is influenced by each of the factors.

i. Remuneration

Remuneration is the incentive that employees get paid for offering services. Remuneration is used as a means to evaluate employee performance and also stimulate them to achieve higher level of performance (Bol et al., 2015). Many studies have found relationship between the adoption of technology and the remunerations of employees (Autor et al., 1998; Goss and Phillips, 2002). The adoption of TIs has both positive and negative influences on remuneration (Marzuki et al., 2012). According to Goss and Phillips (2002), organisations that adopt relatively low level of technology pay higher wages than those characterised by intensive use of technology. Employers can negotiate lower remuneration because of the high automation of routine services. Unskilled employees in most cases lose their jobs leading to loss of remuneration. In some instances, the adoption of TI leads to outsourcing and renegotiation (mostly downward review) of employee remuneration. The employees that can develop new skills have their competences rewarded with higher remuneration. Both scenarios have implications for job satisfaction and also the social wellbeing of employees. Previous study found that when employee remuneration is low, it affects the wellbeing of the employee (Parcel & Menaghan, 1997).

The adoption of TIs also leads to different outsourcing practices where employees either lose their job or have the remuneration renegotiated. The employees that lose their jobs or have their remunerations reviewed downwards have reduced access to social services such as healthcare, education, and necessities of life, thereby affecting the level of their job satisfaction and social sustainability (Burgard et al., 2007). In the context of FM, the adoption of TI leads to displacement of unskilled employees and different form of outsourcing arrangements leading to both loss of remuneration or reduced remuneration.

ii. Job Autonomy

Autonomy is the level of job-related independence and freedom either permitted or required in daily activities of the employees (Flanagan & Flanagan, 2002). Job autonomy is a crucial factor in employee job satisfaction and social sustainability (Meyer, & Maltin, 2010). Job autonomy has been identified to influence the level of employee stress (Arnetz 1997; Korunka and Zauchner 1997; Liu, 2016). Pfeffer (2009) and Meyer & Maltin (2010) argue that limited job autonomy will be detrimental to employees' physical and psychological wellbeing. The Organisation for Economic Corporation and Development's (OECD) (2013:13) report argues that "people's engagement and high sense of wellbeing at work depends more on whether they have autonomy in their job, are given learning opportunities and well-defined work objectives". The adoption of TI in FM organisations has led to the automation of almost all the operational job processes thereby reducing the level of autonomy that is available to the FM employees. the reduced level of autonomy invariably affects the level of job satisfaction that the employees derive.

iii. Job Security

Job security is defined as the assurance or probability that employees have that they will continue to stay in a job for a longer period (Adebayo and Lucky, 2012;). Previous studies identified job security as a key factor of job satisfaction (Wilson & Musick, 1997; Rotolo & Wilson 2003; Gallie et al., 2017). The concept of job security is mostly described from its inverse - a job insecurity perspective. Job insecurity has been defined as the subjective perception of employees of the possibility of losing the present job in the future, as well as the associated fear or anxieties of the possibility of job loss (de Witte, 2005; Vander Elst et al., 2014). Since job insecurity is characterised by job loss (von Wachter, 2010), the news of job loss because of TIs, generates anxiety among professionals in workplaces (Kivimaki et al., 2000). In the context of FM professionals, job loss arising from the adoption of TI can expose

the FM professional to lack of job satisfaction and a myriad of social problems. Reports from earlier studies have shown that job loss can increase the rate of depression in displaced employees by over 200 percent (Dooley et al., 2000). Furthermore, the loss of a job can also lead to psychological disorders and increase the chances of someone engaging in violent behaviour by a factor of 6 (Catalano et al., 2002). Job displacement increases the death rate of those laid off by about 17% in 20 years following the layoff. This means that someone who is laid off at age 40 would live approximately 1.5 fewer years than someone not laid off (Sullivan & von Wachter, 2007; Pfeffer, 2009).

Technology advancement and adoption in organisations are major causes of job loss (Autor, 2015; Goos & Manning, 2007; West, 2015; Gallie et al., 2017). The level of job losses in an organisation can influence employee job satisfaction. The effect of job loss on both the employees and the society is significant because employment plays an integrative role of stimulating employees' social life (Durkheim, 2018). Previous studies have argued that stable employment influences higher levels of social integration (Wilson & Musick, 1997) and employees' psychological wellbeing (De Cuyper et al., 2008; Silla et al., 2009; Stander & Rothmann, 2010; Fatimah et al., 2012; Brand, 2015). Furthermore, job loss can also trigger acute stress and lead to prolonged economic, social, and psychological strain through the abrupt interruption of an employee's social role (Pearlin et al., 1981; Burgard et al., 2007). Triggered health conditions include higher levels of depressive symptoms, somatization, anxiety, and the loss of psychosocial assets including self-acceptance, self-confidence, self-esteem, morale, life satisfaction, goals, social support, and a sense of control (Brand et al., 2008; Burgard et al., 2007; Catalano et al., 2011; Brand, 2015). All these factors can contribute to defining an employee's social wellbeing.

At the level of society, Brand and Burgard (2008) argue that workers who lost their jobs have significantly lower probabilities of socially participating with other people in the society. They further argue that the strain arising from the job loss diminishes employees' social trust and erodes their confidence and commitment to social reciprocity. The diminished confidence, which stimulates social withdrawal, affects the collective welfare and the distribution of welfare in society (Brand, 2015). The social consequences of employees' job loss to society becomes a critical factor that organisations, as stakeholders in society, must help to reduce in the drive towards socially sustainable society. As stated earlier, the adoption of TIs in FM

organisations often leads to loss of job for the unskilled and semiskilled employees thereby affecting their level of job satisfaction.

iv. Interpersonal Relationship

Interpersonal relationship is the opportunities presented by employment for both formal and informal social and professional contact during working hours of the employees (Flanagan & Flanagan, 2002). Employees enhance interpersonal relationship by augmenting their face-to-face interactions with colleagues and people within their social networks with several ICT devices, such as mobile phones and internet-enabled PCs and laptops (Boase et al., 2006; Chan, 2014). These ICT devices create supportive rapport with colleagues in organisations and also increases the employee level of job satisfaction. Previous studies have argued that interpersonal relationship can help employees to manage work pressure and emotional demands of work thereby guaranteeing healthier and more productive employees (OECD, 2013). However, there are divergent opinions about the impact of TIs, (especially the mobile devices that have internet connectivity) on the interpersonal relationships of the employee. For example, Rainie and Wellman (2012) and Chan (2014) argue that internet connectivity through the various communication devices has created opportunities for individuals to develop and maintain a meaningful interpersonal relationship. However, Turkle (2011) argues that increased connectivity can develop paradoxically into more loneliness as employees must exercise mental and emotional effort to distinguish between the blurred boundary of their private and public time and space. Most FM services require that the employees be constantly available on their communication devices. The need for constant availability creates extra stress and diminished job satisfaction for the employees (Quan-Haase & Collins, 2008). Furthermore, consistent connectivity to work leaves the employees with a feeling of not being in control of their own lives (Mieczakowski et al., 2011; Chan, 2014).

v. Professional Status

Professional status encompasses both the employee's and the community's perception on the importance of a job (Flanagan & Flanagan, 2002). Professional status is the accomplishment of professional recognition in an employee's career path. In the contemporary business environment, there is increased desire among employees to increase their professional status and attractiveness to employers. According to Maslow's Hierarchy of Human Needs, when humans' psychological and social needs are met, they begin to seek self-esteem needs, desiring recognition for themselves (Thielke et al., 2012). The adoption of TI in FM organisations puts

pressure on professional development which could be discouraging for older employees and the consequences may lead to induced retirement. The eminent knowledge of induced retirement can affect the employee level of job satisfaction.

vi. Task Requirement

The task requirements and organisational policy define the way that work is designed and organised. The adoption of TIs substitutes or complements different types of tasks, and also changes the relative demand for the skills set needed to perform those tasks (Atkin & Bildsten, 2017; Gibbs, 2017). The skills that machines can perform tend to have lower demand (Adama & Michell, 2017; Atkin & Bildsten, 2017; Gibbs, 2017). Docherty et al. (2009) argues that the way in which tasks are designed by organisations can affect the level of employee job satisfaction. Therefore, task design in organisations should not only be tailored towards profit maximisation for the shareholders' needs but also in ways that satisfy the social needs of the employees. In FM organisation, task requirements are designed to reflect short-term, static, efficiencies that are mainly centred around productivity and profitability. In order to encourage better job satisfaction, FM task requirements should be long-term, dynamic, and efficient (Docherty et al., 2009).

vii. Organisation Policy

Policies are sets of rules and guidelines that organisations formulate to guide their operations and practices towards achieving their long-term goals. A policy is also seen as the tool of governance which guides organisation decisions towards achieving a rational outcome (Howlett 2009; Husin, & Hanisch, 2011). Previous studies have shown that well formulated organisation policies have positive influence on the level of employee job satisfaction which ultimately improves organisational performance (Applebaum et al., 2000; Pule et al., 2014). However, the changing business dynamics through the introduction of TIs in organisations can substantially influence the policy of an organisation (Husin, & Hanisch, 2011; Howcroft & Taylor, 2014; Morgan, 2014). For instance, Husin, & Hanisch (2011) argues that there is need to improve organisation policies to protect both organisations and employees based on the advancement in TIs and its use adoption in organisations. TI adoption in FM organisations introduces new work patterns that are a departure from the initial visions of organisations. Therefore, organisation policies have become more dynamic with the advancement in TI. Many FM organisations are going "Virtual", with greater investment in communication network technology than physical building assets and employees (Lim et al., 2002; Grimshaw, 2007).

This changing work pattern also influences the level of employee job satisfaction. However, Lim et al. (2002) argues that organisations that have realised the greatest competitive advantage from TI adoptions concentrate more on employee resource management practices to achieve high-performance work systems. Gibbs (2017) affirms that organisations should encourage TIs that complement employees' tasks, while investing in the training of employees to fit into the new change.

2.8.3 knowledge Development

According to Pathirage et al. (2008), knowledge is a social construct that is developed and transmitted to maintain a social situation. Hence, the success of an organisation depends on the interaction between employees and types of knowledge – tacit and explicit. Tacit knowledge is when the focus is on people to deliver solutions while the explicit knowledge is when the focus is placed on technological tools to deliver solutions. The adoption of TI in organisation attract the enhancement of knowledge through different training opportunities. When the employees acquire knowledge through trainings, the organisation gain competitive advantage in TI adoption (O'Brien, & Tornack, 2008). Kandampully (2002) affirmed that technology advancement has increased the need for knowledge development of the employees. Employees are expected to respond to the 21st century technology advancement through constant trainings and workshops. The various avenues of knowledge development include workshops and seminars, and other on-the-job trainings while the object of the trainings include to evolve a professional development plan, retirement development plan. The following section will elaborate on these factors.

i. Workshops and Seminars

A workshop and seminars are types of interactive training that follow the adoption of TI in many organisations. According to Bhatt (2001) and Gibbs (2017), the adoption of TIs has caused the need for prolific training, both at an individual and organisational level. It is through the training of the employees that the organisations are able to derive the full benefit of the TIs. Organisations need to train the unskilled and semiskilled employees to become skilful with the use of the adopted TIs. As earlier stated, the adoption of TIs also means that only a few people will be needed for a job the hitherto engaged many employees. Hence, in the process of the training, the employees that are unable to cope are prematurely retrenched under the unskilled labour category. In the context of FM where many people are involved in manual operations, the adoption of TI leads to premature retrenchment of many employees. Therefore, the

workshops and seminars that follow the adoption of TI in FM organisations help to develop employee knowledge. Some of the trainings are also designed to equip the employees that are prematurely retrenched with the requisite skills to help them in retirement. This aspect of training resonates with the concept of training as a social benefit.

ii. Professional Development Plan

Professional development is an unavoidable component of TI adoption in FM organisations (Bhatt, 2009; Lim et al., 2002). TI has changed all aspects of employee professional development from how they are selected and hired (via Web site applications), how they are trained (by means of online learning), to evaluation (using computerised performance appraisals) the type of work they do and where the work is done (e.g., telework, virtual teams). Therefore, the adoption of TI has augmented the requirement for professional development which can only be attained through professional development training (Kandampully, 2002). Hence, employees are under pressure to acquire new knowledge for survival because their experience is of limited value because of rapidly evolving TIs that require new knowledge to operate. Knowledge becomes increasingly obsolete and new knowledge is required to operate or perform with new TIs (Kandampully, 2002; Pathirage et al., 2008). The consequence of the knowledge requirement is that, while lower skilled jobs are being lost to technology, skilled jobs are being created for higher level employees (Kandampully, 2002). When we consider that one major characteristic of low-skilled employees is poverty and that money is required to acquire requisite skills to match new TIs, then it becomes apparent that the low-skilled employee is faced with a socio-economic challenge which affects his social sustainability. Kandampully (2002) argues that the true economic value of an employee is fundamentally attributed to his or her knowledge.

iii. Retirement Development Plan

According to classic human capital models (MacDonald & Weisbach, 2004), human capital may become obsolete with technological change. When the employees are not able to develop the required knowledge that is suitable for technological development, they are retrenched (Meyer, 2007). The early retirement leads to disruption of the retirement plan and all the associated consequences job loss. Therefore, employees need to be assisted by having a retirement development plan so that the social impacts that derive from this loss are not as detrimental. In the context of FM, given the high level of unskilled employees, the adoption of TI in FM organisations will lead to the premature retirement of employees that are not able to

cope with the wave of technological advancement. The employees that are prematurely retired are faced with loss of income and wellbeing related challenges.

iv. On-the-job Training

TI adoption in the workplace is significantly associated with providing on-the-job training (Zeytinoglu & Cooke, 2009). On-the-job training is recognised as a strategy for staying professionally relevant (Jacobs, 2003). It entails being up-to-date with the development in a chosen field of endeavour, which is achieved through workshops, seminars and attachment trainings (Bhatt, 2001). It is, therefore, understandable that workshops and seminars be grouped together with on-the-job training.

On-the-job training enhances the competitive advantage of an organisation. Work, training, programmes and reward systems often need to be reconfigured to support employees' use of modern technology (Noe et al., 2006). As a result, there is an ongoing need for skills development given fast-paced technology adoption (Deutsch, 1987). Therefore, employees should be supported to develop their skills; a social good that will help the society as well as the employees in FM organisations.

In summary, the different TIs that were studied in this research individually and collectively influence FM employees' social sustainability factors in some way. Some of them have the capability to reduce the number of employees that are needed for FM operations. While others have the capability of enhancing the capacity of the employee through trainings. The capabilities of these TIs in FM operations further raise questions as to how socially sustainable the employees of FM organisations are with their implementations. Hence, the need to evaluate the promotion of social sustainability in FM organisations.

2.9 Promoting Social Sustainability in FM

Previous studies have suggested different strategies to promote social sustainability in FM. Grimshaw (2003) suggests that social sustainability in FM can be promoted when organisations become socially responsible for employees in the workplace over and above the contractual boundaries of engagement. It involves organisations looking out beyond their legal welfare obligations to ensure that the wellbeing of employees is enhanced. Alexander and Brown (2006) argue that for corporate social responsibility (CSR) as the strategy that organisations can adopt to meet their social sustainability obligations. However, Jensen et al. (2014) argues that CSR strategy is philanthropic, hence, it lacks tangible impact. Almahmoud and Doloi

(2015) recommended the quantifying of social benefits that are flowing to the stakeholders as well as to the community at large. In another submission, Nielsen et al. (2016) proposes that FM organisations can promote social sustainability by adequately managing materials that can have an adverse effect on the health and wellbeing of building users. From the above submissions, there is no coherent strategy for promoting social sustainability in FM practice. Since social sustainability is about promoting the wellbeing of people, the proposal by Nielsen et al. (2016) is more in line with the position of this study. This study seeks to identify and profile FM employees' social sustainability factors that are affected by the adoption of TIs and finding effective ways of managing them. Hence, the following section will be conceptualising the social sustainability framework in FM organisation.

2.10 Conceptualising a Social Sustainability Framework in FM

When the concept of social sustainability is applied in an organisation, it does not only preserve the employees as a human resource but also supports the growth and development of the organisation (Kira & van Eijnatten, 2009). As mentioned earlier, the adoption of TI in FM organisations affects employees' social relationships, job satisfaction, and knowledge development. Based on this understanding, a conceptual framework for this study was needed. Hence, it was necessary to search for and review literature pertaining to social factors and the implications for individual employees. As a result, the researcher undertook a perusal of the sociological literature for potential theories that could provide a conceptual framework for this study. A conceptual framework is essential in supporting research for several reasons (Miles & Huberman, 1994; Ticehurst & Veal, 2000; Yin, 2009). First, the conceptual framework serves as a lens through which the research can be understood, and it makes the identification of the critical variables of the research study explicit (Kumar, 2005). A conceptual framework also helps in the identification of the suitable method of data collection and analysis of the relationships among the key variables of the study (Yin, 2009). According to Miles & Huberman (1994), the development of the conceptual framework can be based on existing theories, new insights, the experience of the researcher, informal observations, and the general objectives of the study. Therefore, some of the theories found that could support this study were:

2.10.1 Functionalist Theory

According to functionalism, society is an interconnected system that work together in harmony to maintain a state of balance and social equilibrium for the whole (Huaco, 1966; Smith, 2010).

The theory focuses on structures that create society and how they make society stable. It acknowledges that society is made up of distinct parts which are necessary for its stability. Hence, it proposes the need to maintain social balance that is fundamental to sustainability and emphasises the maintenance of mutual interdependence for the survival of the system. However, the emphasis of this theory is more on institutional balance than individual balance. Although the role of the individual is acknowledged but the theory believes that the impact of individuals cannot affect the structure of the society. Therefore, functionalism cannot accommodate the problem of social changes because it is a doctrine of normative consensus (Smith, 2010). Moreover, the theory focuses on the macro-level of social structure, rather than the micro-level of everyday life of the organisations. Hence, as this study is focused at the individual employee wellbeing, this theory is considered inappropriate.

2.10.2 Systems Theory

The systemic perspective argues that we are not able to fully comprehend a phenomenon simply by breaking it up into elementary parts and then reforming it; instead one needs to apply a global vision to understand its functioning (von Bertalanffy, 1968; Bogdanov, 1980; Checkland, 1997; Jackson, 200; Meadows, 2008; Mele et al., 2010). The theory is concerned with how organisations work and how to maximise various goals of the organisation. It recognises that the changes to one part of the organisation will influence the entire system because organisations consist of subsystems which cannot run in isolation (Meadows, 2008; Mele et al., 2010). Therefore, the theory emphasises the importance of communication and that organisations cannot be separated from the environment. However, the theory is not able to address issues of social inequalities and their consequences because it does not recognise that social systems are not naturally occurring like organisms. This theory is, therefore, too abstract to apply to practical problems. It understates various characteristics that are vital for social organisations. Therefore, the theory is considered inappropriate for a study of this nature that examines practical social wellbeing issues of employees in an organisation.

2.10.3 Stakeholder Theory

Stakeholder theory states that managers should make decisions that account for the interests of all stakeholders while pursuing the organisation's core-business objectives (Freeman, 1984; Freeman, 1990; Roberts, 1992; Donaldson and Polonsky, 1995; Freeman et al., 2004). The theory focuses on managers who make strategic decisions on behalf of their organisations. It acknowledges that the organisation has a relationship with many stakeholders that are crucial

to the sustainability of the organisation. Therefore, it seeks to balance the relationship that exist among all the stakeholders in an organisation. Stakeholder theory recognises that no one stakeholder should dominate another because the interest of every stakeholder has intrinsic value (Donaldson and Polonsky, 1995). The theory argues that the organisations that consider the interest of all stakeholders will be more productive, profitable and sustainable. The actions of managers affect a broad base of other stakeholders; therefore, it gives a more holistic view of the players in an organisation. Hence the stakeholder theory is more concerned with value-creation for all the stakeholders of an organisation rather than just ensuring that the organisation is up and running. Due to this aspect, stakeholder theory it more suitable for this study.

2.10.4 Socio-technical theory

Socio-technical theory is one that views the organisation as an entity consisting of both technical and social parts. It premises that both must be considered as complementary aspects of an organisation (Emery, 1959; Cherns, 1987; Kira & Eijnatten, 2009; Baxter & Sommerville, 2011). The theory recognises that organisations succeed in productivity and wellbeing when social and technical aspects are treated as symbiotic parts of a complex system. With respect to employees, they theory suggests that there should be joint optimisation with emphasis on both excellent technical performance and quality of employees' lives. Socio-technical boundaries include the customers, suppliers, formal or informal rules and regulations that govern the organisations. This theory is considered suitable for this study because it recognises the breakdown of the complementary parts of an organisation.

Based on the evaluation of the characteristics and the above theories, the stakeholders and the socio-technical theory have been adopted as the overarching theories for this research. The stakeholder theory is about the creation of value for the various stakeholders in the business organisation as against the mere survival of the organisation. This quality of the stakeholder theory resonates with the fundamental principle of value creation in FM practice (Jensen et al., 2013). The socio-technical theory, on the other hand, is most suitable for explaining the interrelationship that exist in oragnisations between the employees, the technical processes and tools that are used for value creation. The conceptual framework of this study based on these two theories. A detailed discussion of both the stakeholders and the socio-technical theory are made in the following sections.

2.11 Stakeholder Theory

Stakeholder theory has its roots in sociology, organisational behaviour and politics (Jensen, 2002). The theory is popular among managers and enjoys the endorsement of professional organisations because they cannot succeed in their business objectives if they ignore their stakeholders (Jensen, 2002). Stakeholder theory states that managers should make decisions that account for the interests of all stakeholders while pursuing the organisation's core business objectives (Freeman, 1984; Roberts, 1992). The stakeholder groups, which are classified as internal and external, are groups or individuals that can be substantially affected by or affect the welfare of the organisation as shown in Figure 2.4 (Freeman, 1984; Polonsky, 1995). Hence, organisations must acknowledge the responsibilities they have towards both the internal and external stakeholders while developing their strategies.

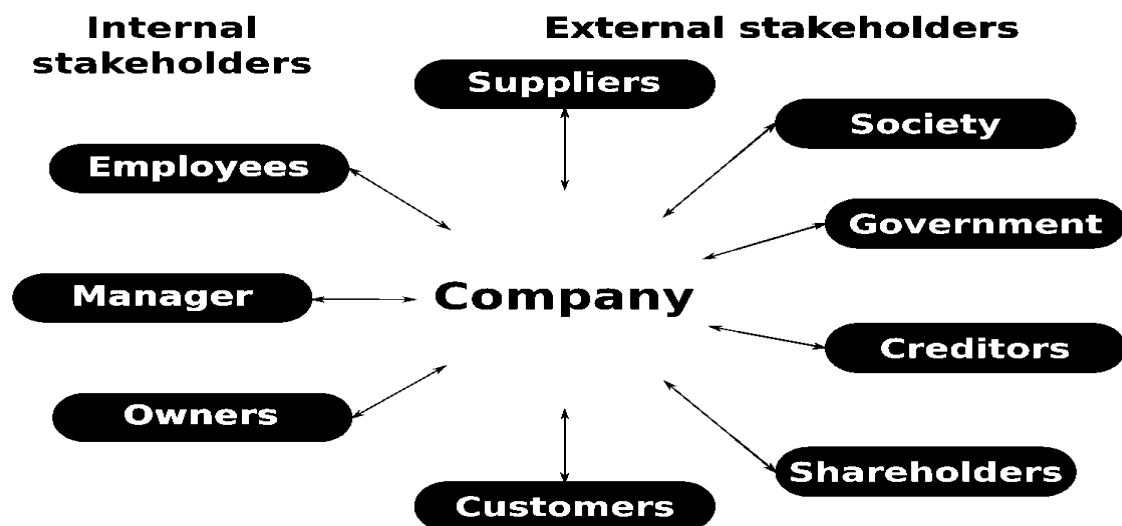


Figure 2. 4: The Classifications and Members of the Stakeholder Groups
Source: Freeman (1984)

Previous studies have used the stakeholder theory in assessing the social sustainability performance in facilities provision. Dolo (2012) uses the stakeholder theory as a measure of the number of social benefits that flows to a community where construction development was being executed. Furthermore, the stakeholder principle was used in understanding the sub-systems of the social sustainability performance. Other studies have analysed social benefits through the stakeholder approach.

According to Donaldson and Preston (1995), the central thesis of the stakeholder theory is descriptive/empirical, instrumental, normative, and managerial. It is descriptive by presenting a model to describe what the organisation is. Donaldson and Preston further argue that stakeholder theory describes the organisation as a constellation of co-operative and competitive interests that has intrinsic value. Stakeholder theory is instrumental because it leads to the development of a framework that examines the connections that may exist between elements in the stakeholder categories and organisations. The focal point of the instrumental character of the stakeholder theory is to show managers the path to successful implementation of organisation goals. The stakeholder theory is normative because its constituent parts are elements and persons or groups with intrinsic value and substantive interest because they deserve consideration on their merit.

Stakeholder theory is also managerial and does not only describe the existing situation but also predicts the cause and effect of relationships and further recommends structures and practices that must be implemented for organisational success (Donaldson and Preston, 1995; Freeman et al., 2004). The managerial attribute of stakeholder theory demands that attention be given to the legitimate interests of everyone in the organisation while decisions and policies are being made. Freeman et al. (2004) affirm that the stakeholder principles value healthy relationships amongst stakeholders as part of an ongoing successful business. Therefore, the ideology of facilities managers that practice the stakeholder principle is hinged on creating value and promoting human relationship. The stakeholder manager does not play by the separation thesis which propounds that ethics and economics can be sharply separated (Freeman et al., 2004). The central motive of the stakeholder theory supports the aspirations of this research that seeks to examine the wellbeing of the employees in FM organisations that have been neglected and seen as inevitable liability in the running of FM organisations.

Evaluating the central point of the stakeholder theory shows that organisations consist of different stakeholders that influence each other to ensure the realisation of an organisation's objectives. The stakeholder theory therefore, emphasises the need for managers to be holistic by considering all stakeholders in building a successful organisation.

2.11.1 Strategies for Management of Stakeholder's Relationships

Stakeholder management allows the organisation to evaluate strategic issues towards meeting the core-business objectives of the organisation. Freeman (1984) designs a four-step stakeholder management strategy that can be used in organisations. The steps include: (1)

identify the stakeholder groups for the problem to be addressed; (2) determine the importance and stake of each of the stakeholder groups; (3) determine how the expectations of each stakeholder group are being met at present; and (4) modify corporate policies and priorities in ways that they capture every stakeholder group interest. The following sections will elaborate on each of the points above.

2.11.2 Identify the Stakeholders Group for the Problem to be Addressed

Due to the multiple stakeholder groups and interests that may be impacted by an organisation's activities, it is important to identify the stakeholder groups that are most relevant in any particular study (Freeman et al., 2004). On a general note, the stakeholder groups for business organisations include but are not limited to: employees, investors, suppliers, legislators, governmental agencies, environmentalists, retailers, the media, children, management, shareholders, scientific community, unions, competitors, the courts, special interest groups (of all kinds), local state and federal government, and the general public (Coddington, 1993; Ottman, 1992; Polonsky, 1995). However, the scope of this study is limited to the employees as a stakeholder in FM organisations. A stakeholder may either have a legal claim on the financial resources of the organisation or be interested in how the operations of the organisation affect the society. The organisations have a responsibility to manage their operations in ways that account for the interest of the stakeholders.

Looking at the elements that constitute the stakeholders, it is evident that organisations are an integral part of society that influences the creation of wealth, production process, and the socialisation of employees (Stone et al., 2013). Therefore, there is a symbiotic relationship between organisations and society as they are implicated in the others' actions (Katz & Kahn, 1978). For instance, when organisations cut jobs, it negatively affects the welfare of society, and when there is a change in the demography of society, it influences the strategies by which organisations attract and retain employees (Stone et al., 2003).

2.11.3 The Determination of Stakes

This step involves the identification of stakeholders that can be affected or affect the organisation in one way or the other. The determination of the right stakeholders is crucial to the attainment of organisation goals and objectives. Almahmoud and Doloï (2015) argues that the degree to which the needs of various stakeholders are satisfied is highly significant in achieving social sustainability performance of projects. Almahmoud and Doloï further posit

that considering the satisfaction of the stakeholders is a fundamental step towards social sustainability outcomes in construction. From the different stakeholder groups that were mentioned in section 2.9.2, the focus of this study is on the employees in FM organisations. According to Rao (2014), employees of FM organisations are the drivers of the business goals. Hence, the experience of the employees from work impact can affect or influence the quality of the core business goals that an organisation can achieve.

2.11.4 Determination of How the Expectations of Each Stakeholder Group are Being Met

After the determination of the stake of each stakeholder, the expectations of the stakeholders (in this case, employees) should also be determined. It is not enough for employers to assume the expectations of their employees because often, the assumptions do not match the reality (Dobre, 2013). The mismatch in expectations and realities is expressed through employee boycotts or refusing to meet organisations objectives (Dobre, 2013). Organisations can assess stakeholders' expectations through social audits that are aimed at capturing the correct picture of employees' expectations. A social audit is a measurement of an organisation's social performance against the backdrop of different stakeholders (Rahim & Vicario, 2015). Feedback can be collected from the employees to evaluate the social impact of organisations' actions on the employees. In this way, an organisation and the employees can foster a harmonious relationship towards the attainment of the organisation's core business objectives.

2.11.5 Adjusting Strategies to Capture Each Stakeholders Group's Interests

After assessing how the current needs of the employees are being met, better strategies can be put in place to improve employee experiences. This will involve resolving the current problems and the setting in place of contingency plans for future challenges. The primary objective of this step is to close any existing gaps between the employees' expectations and organisation's operations. In the context of FM, the adoption of TIs impacts both the core business and the employees of the organisation, who are described as part of the internal stakeholders (Carayon et al., 2015). Most often, organisations are interested in analysing the impact on the core-business because of their profit-driven motivation (Sena & Shani, 2009). Moreover, this practice is not reflective of the stakeholder ideologies and the socio-technical theory which recognise that organisations comprise various stakeholders and are made up of both technical and social parts.

2.12 Socio-Technical Theory

The essence of technology is primarily to enable the work process (Kane et al., 2015; Avgerou & Walsham, 2017). Emery and Trist (1965) use the term “socio-technical system” to portray a system of organisation that involves an intricate interaction between humans, machines, and the environmental aspects of an organisation. The socio-technical theory emphasises the dual components of any typical organisation and the need for balancing the interrelationship between the components. Socio-technical theory is a logical framework that considers every organisation to be composed of a social sub-system (the people) using a technical subsystem (tools, techniques, processes and knowledge) to produce goods and services (Trist 1982; Taylor & Felton 1993; Pasmore 1994; Kolodny & Halpern 2008; Sena & Shani, 2009). According to Baxter and Sommerville (2011), the socio-technical system describes the interaction between the elements that make up an organisation. Other social commentators have argued that the concept of the socio-technical system is still relevant even in the 21st century (Mumford, 2006; Baxter & Sommerville, 2011). The socio-technical theory intends to ensure that both the technical and social aspects are considered in any proposed action by the organisation (Baxter & Sommerville, 2011; Carayon et al., 2015).

Baxter and Sommerville (2011) argue that the adoption of a socio-technical approach in organisations leads to systems that are more acceptable to end users and deliver better value to stakeholders. They further attributed the failure of organisations to achieve the core business objectives to the fact that managers do not recognise the full importance of the social and technical systems that make up the organisations. In a similar submission, other studies have acknowledged that the degree to which the technical and social sub-systems are integrated, influences the success and competitiveness of the organisation (Adler & Docherty 1998; Eijnatten et al., 2008; Sena & Shani, 2009). It implies that the traditional approach to cost-cutting in FM, which involves the adoption of TIs with little consideration for the employees, is reaching its limit of utility with the growing need to consider the fundamental social aspect of FM.

The application of the socio-technical approach will lead to a better understanding of how to maximise the employees’ social wellbeing and technology adoption to achieve the core-business objectives in FM organisations. When applying the socio-technical theory, the various approaches that can be used include problem definition, defining the role of the employees, and identifying theoretical precepts, scientific paradigms, and methodologies (Carayon, 2015).

A comprehensive evaluation of these approaches will generate valuable insight that can lead to the innovative promotion of social sustainability for FM employees while still adopting TIs. To this extent, the socio-technical view is considered suitable in this study because it will be more holistic in the assessment of TI impact in FM organisations (Šajeva, 2010). The adoption of the socio-technical theory is premised on the assertion that technology is not an end, but a means to an end (Kane et al., 2015; Hultquist, 2016). This position underscores the suitability of the socio-technical theory in this research. Figure 2.5 shows the two components of an FM organisation based on the socio-technical theory.

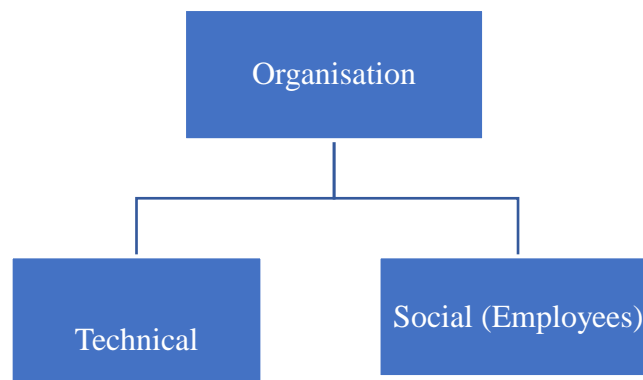


Figure 2. 5: Socio-technical relationship in an organisation

2.13 Development of a Socio-Sustainability Framework in FM organisation

Considering the fundamentals of both stakeholder theory and socio-technical theory, it becomes apparent that ignoring the employees of an organisation will undermine the value that the organisation gets from the employees (Jensen, 2001; Reitz, 2012). Following the earlier argument by Emery and Tries (1965), that organisations are socio-technical systems, a holistic management of the impact of TI adoption in the organisation will guarantee the social sustainability of the employees. Based on the discussions on the conceptualisation of social sustainability framework in FM in section 2.10, the stakeholder theory, and the socio-technical theory, a conceptual framework of the study was developed as shown in Figure 2.6.

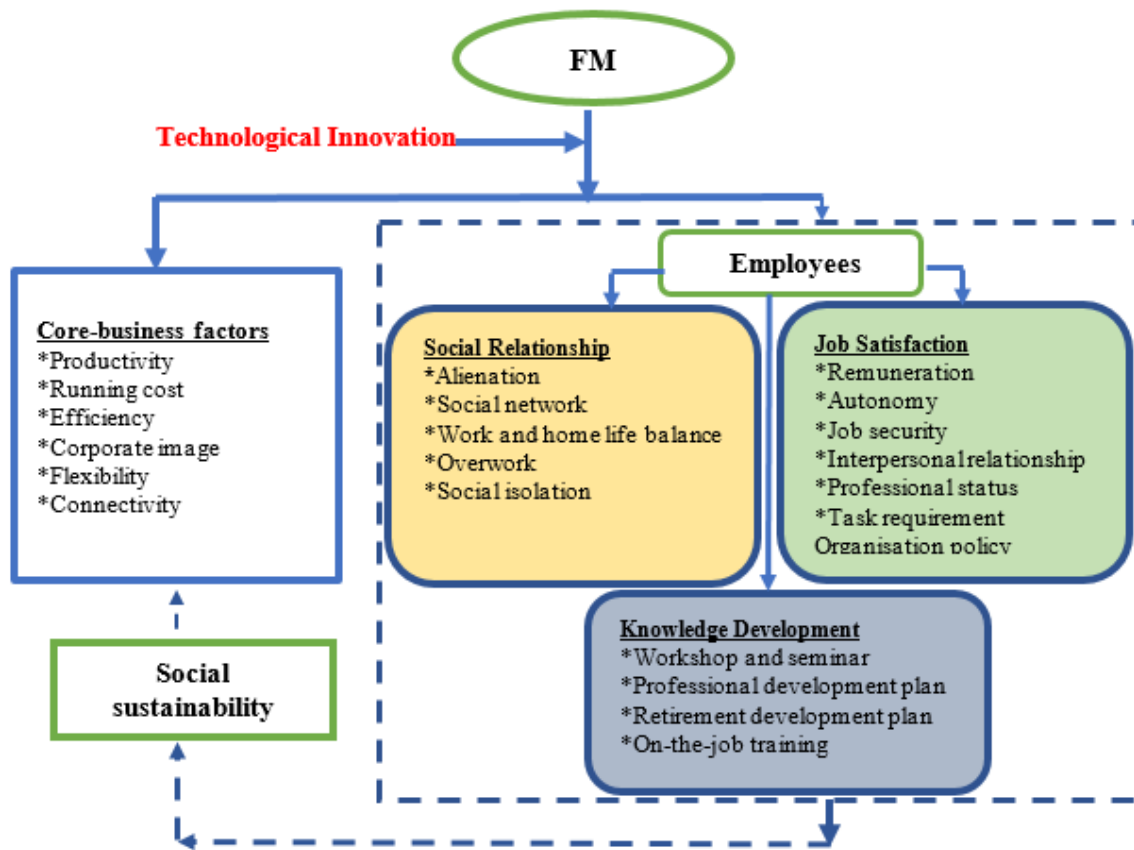


Figure 2. 6: Conceptual Framework

Figure 2.6 shows the position of the researcher regarding the research problem that is being investigated. It illustrates that the adoption of TI in FM organisations impacts both the employees and core-business factors of the organisation. It implies that the enhancement of employee social sustainability factors will positively influence the accomplishment of core-business factors. This is not a popular argument in the FM literature where more focus is given to the impact of TI on the attainment of core business factors. On the side of the employees are three constructs, social relationship, job satisfaction, and knowledge development (with their associated sub-factors), which constitute the employees' social sustainability factors in FM organisations. The framework indicates that these constructs and their associated factors have direct influence on employees' social sustainability and the attainment of the core-business factors. Hence, it can be inferred that there is a relationship between the adoption of TI in FM organisations, the employees' social sustainability, and the attainment of the core-business factors.

It means that the social sustainability of the employees influences the accomplishment of the core-business objectives of the organisations. According to Whitener (2001) and Docherty et

al. (2009), commitment to employee social sustainability increases employee trust in management and rededicated commitment to achieving organisational core-business objectives. Therefore, the promotion of social sustainability in FM organisations is a long overdue necessity for overall optimum performance.

2.14 Summary

This chapter examined the influence of TI in FM practices by chronicling the emergence of the profession. The common forms of TIs in FM practice were identified and classified to form the TI categories that were studied in this research. It also examined the factors that influence the adoption of the TIs in FM organisations. The chapter further discussed how the adopted TIs affect both the technical and human aspects of the organisation based on the socio-technical nature of organisations. The review identified employee-related factors that are impacted by the adoption of TIs in organisations. It was evident that, although TI affect the employees of FM organisations, there are no studies that address such aspects. Additionally, both stakeholder theory and socio-technical theories were used as lenses to examine the social sustainability factors of the employees. The consideration of the two theories led to the development of the conceptual framework that shows the interdependent relationship between the adoption of TI in FM organisations, the employees' social sustainability, and the attainment of the core business factors.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

The influence of TI on FM practices and social sustainability is a complex study that needs a detailed methodological approach to unravel the intricate inter-relationship among the factors of the study. This chapter presents the philosophy that underpins the research and examines the research paradigms, approach and strategy. The section thereafter discusses the processes of data collection, determination of the unit of analysis, sampling procedure, sample selection and the methods of data analysis employed.

3.2 Research Philosophy

A research philosophy is the logical assumptions and undertakings which guide an inquiry in a study or research (Ponterotto, 2005). Research philosophy is influenced by the researcher's understanding of the problems at hand and the systematic process that will seemingly solve the problem (Greener, 2011). Thus, a philosophy helps to determine the researcher's choice of research method(s) for the study (Easterby-Smith et al., 2002; Greener, 2011). The systematic process usually includes formulating necessary fundamental assumptions and beliefs in terms of research objectives, research questions, theoretical concepts and designs upon which the study will be based (Guba & Lincoln, 2005; Flower, 2008; Creswell & Plano Clark, 2011). These underlying assumptions are centre around ontology, epistemology and human nature (Morgan & Smircich, 1980; Creswell, 2014). The terms, such as 'paradigms' (Fellows & Liu, 2008; Lincoln et al., 2011), and 'worldview' (Creswell, 2014) are usually used to describe these underlying assumptions in social research. This study adopted a research paradigm to describe the underlying research assumptions and beliefs.

3.3 Research Paradigms

The research paradigm forms the basis on which a researcher's study can be conceptualised (Ponterotto, 2005). In a similar submission, Creswell (2014) explains that the purpose of a research paradigm is to aid the researcher in understanding where his/her discipline is situated within the available worldviews. The research paradigm also helps formulate the philosophical and conceptual framework as well as the methodological path that provide answers to the research questions and problems (Denzin & Lincoln, 2000; Ponterotto, 2005; Greener, 2011; Creswell & Plano Clark, 2011). The significant paradigms that offer theoretical direction are ontology, epistemology, axiology and pragmatism (Phillips & Burbles, 2000; Johnson &

Onwuegbuzie, 2004; Creswell & Plano Clark, 2011; Creswell, 2014). The following section discusses each of the paradigms in more detail.

3.3.1 Ontology

Ontology is the nature of reality and people within a social world (Trigg, 2001; Denzin & Lincoln, 2005; Saunders et al., 2009). It is the ontological assumption that underpins the collection and understanding of data (Ikediashi, 2014). Ontological assumptions can be classified into two positions, namely, objectivism (realism) and constructivism (nominalism). Objectivists assume that social phenomena are independent of the individuals that are involved and that the individuals have no influence over the social phenomena (Saunders et al., 2009). The constructivist argues that realities within the social world are influenced by human minds and a projection of consciousness and cognition of individuals within the social world (Robson, 2002; Easterby-Smith et al., 2008; Ikediashi, 2014).

3.3.2 Epistemology

Epistemology is concerned with the adequate knowledge within a discipline or field of study (Bryman & Bell, 2007; Saunders et al., 2009). The fundamental epistemology issue revolves around whether the same approaches that are applied within the natural sciences are equally suitable for investigating the social sciences. There are two epistemological assumptions, namely, positivism and interpretivism. Positivism is linked with natural science and aims to observe the world by merely collecting data to explain regularities and causal relationships between the elements of the phenomena under investigation (Robson, 2002; Easterby-Smith et al., 2008; Creswell, 2014). The positivist also believes that the social world is external to the individuals that live within it and that the reality of the social world is both hard and tangible (Bryman, 1984). Positivist assumptions are challenged by the inability of the positivist to generate causal explanations for phenomena in social systems (Ventuvuori, 2007). For example, the sole utilisation of the positivist approach is unrealistic for a FM study because FM organisations need to respond to dynamic market trends and the changing work pattern introduced by the adoption of TI.

Interpretivist epistemological assumptions are founded on the principles of the social world. Therefore, understanding the people and things within it can only be from the perspective of the individuals who are involved in the activities or problem context to be investigated. According to Easterby-Smith et al. (2008), people make sense of the world by sharing their experiences with others via the medium of language. It means that people within an

organisation can play an active part in shaping the social characteristics of their organisations (Ikediashi, 2014). Ikediashi further argues that there is a link between ontological and epistemological assumptions. Hence, an expansive interpretation should be made on the assumptions underlying any research. In this regard, both positivism and interpretivism ideologies can be adopted in any study depending on its aim.

However, there is a general lack of unanimity in the literature on the appropriate methodology for use in construction management research because of the struggle for methodological pre-eminence among the paradigms (Seymour et al., 1998; Wing et al., 1998; Dainty, 2008). For instance, Falqi (2011) argues that positivism, interpretivism, and a pragmatic approach are the fundamental methodological paradigm. Ratcliffe, (2000), Dainty (2008), Price et al. (2009), and Michell (2010) observe that the dominant paradigm within FM research is rooted in a positivistic philosophy. Other authors argue that the interpretivist and the positivist approaches are the two dominant paradigms (Love et al., 2002; Holt & Goulding, 2014). However, Love et al. (2002) further argues that no single research paradigm can exclusively solve problems in built environment research; instead, finding a point of convergence between the positivist and the interpretivist paradigms is more suitable.

3.3.3 Axiology

Axiology is concerned with assumptions that are on the value system of the individual (Pathirage et al., 2008). Research can either be value-free or value-laden. Denzin and Lincoln (2005) affirm that research that is seen to be value-free and decided by entirely objective criteria is termed value-neutral research. At the other end of the continuum, where the individual's beliefs and experience influence the research decisions, it is termed value-laden (Pathirage et al., 2008). Hence, a value-laden research is a subjective research.

3.3.4 Pragmatism

The propounding scholars of the pragmatic concept in its early history are Charles Sanders Peirce (1839 - 1914), William James (1842 - 1910), and John Dewey (1859 - 1952). Contemporary scholars include, Murphy (1990), Patton (1990), Rorty (1990), Cherryholmes (1992), Creswell and Plano Clark (2011) and Creswell (2014). These authors continue to promote the pragmatic paradigm. The strength of the pragmatic paradigm is that it focusses on the real problem and also the appropriate method for problem solving (Patton, 1990; Morgan, 2007; Tashakkori & Teddlie, 2010; Creswell & Plano Clark, 2011; Creswell, 2014). According to Fendt et al. (2008), the paradigm creates a link between truth and action; and the interface

between knowledge and action helps to solve immediate problems by creating an understanding that can be practically applied in problem-solving.

There is a relationship between the pragmatic paradigm and a mixed-methods approach to research (Tashakkori & Teddlie 2003; Creswell, 2014). Mixed-methods research combines the strength of both the quantitative and qualitative components in data collection, which are separately founded on the positivism and interpretivism paradigms in original research (Johnson & Onwuegbuzie, 2004). In a similar view, Creswell and Plano Clark (2011) affirm that the mixed-method approach combines both the positivist and interpretivist (quantitative and qualitative) views in solving a research problem.

The positivism paradigm takes the form of deductive research based on the realist ontology and objectivist epistemology, making use of quantitative techniques to test existing theories that will help the analytical understanding of the phenomena. The interpretivism paradigm adopts the form of inductive research based on ontological nominalism and epistemological subjectivism, making use of qualitative techniques to understand phenomena through the interpretation of people's experiences (Bryman & Bell, 2007, Ikediashe, 2014). The pragmatic research ideology involves incorporating both positivist and interpretivist ideologies into a single piece of research.

According to Creswell (2014), pragmatism provides the opportunity to acquire knowledge that has the following characteristics:

- Pragmatism is not based on any one system of philosophy and reality.
- The researcher is at liberty to choose the methods, techniques, and procedures of research that is most suitable for the purpose and need of the research at hand.
- Pragmatists do not view the world as unified. In the same manner, mixed-methods researchers explore many approaches to collecting and analysing data rather than being fixated on a singular method (e.g. quantitative or qualitative).
- The pragmatist always seeks the truth of what works per time: therefore, it is not based on a strict dualism between the mind and reality, nor is it completely independent of the mind. The mixed-methods researcher uses both quantitative and qualitative data because they work to give the best understanding of a research problem.
- Pragmatist researchers look to the “what” and “how” of research, based on the intended consequences (i.e. where they want to go with it). Therefore, the mixed-methods researchers must show the rationale for mixing both quantitative and qualitative data.

- Pragmatists agree that research can take place in different spheres, such as, social, historical, political, and other contexts. Hence, mixed-methods studies may include a postmodern turn, a theoretical lens that is reflective of social justice and political aims.

Based on the assessment of the various paradigms discussed above, this study adopted the pragmatic paradigm because it enables a holistic view of the phenomenon under investigation more than any of the other paradigms. More discussion on the choice of the pragmatic paradigm is given in later sections.

3.4 Research Approach

FM is a complex discipline that encompasses different professions to ensure the functionality of the built environment by integrating people, place, process, and technology. Hence, the knowledge base in FM is multidisciplinary. Its scope encompassed the built environment, social sciences and management elements, such as, financial, legal, political, human resource, engineering, and natural science (Dainty, 2008; Fellows & Liu, 2008). There are three research methods (quantitative, qualitative and mixed-method) available to researchers in the social sciences, but the choice method is dependent on the phenomena under investigation, the experience of the researcher, the unit of analysis, the type of data, and the desired conclusion (Morgan & Smircich, 1980; Creswell, 2014). Therefore, no research method is perfect because each can offer only a partial solution to a problem (Morgan & Smircich, 1980; Amaratunga et al., 2002). The following section explains in more detail the three research approaches.

3.4.1 Quantitative Research Approach

This approach projects the post-positivist worldview where assumptions are made that human behaviour can be explained by social facts (Amaratunga et al., 2002; Creswell, 2014). The quantitative research approach involves empirical testing of assumptions, theories and hypotheses using statistical procedures (Ponterotto, 2005; Creswell, 2008; Creswell, 2009). A quantitative approach can take the form of either experimental quantitative research (quasi-experimental, or applied behavioural, or single subject experimental) or non-experimental quantitative research (typically a survey) (Cooper et al., 2008; Creswell, 2014; Campbell & Stanley, 2015). In the case of non-experimental research, the researcher can compare to establish a correlating relationship between two or more groups based on the cause (independent variable) and the recipient (dependent variable) (Creswell, 2014). The advantage of using the quantitative method is that the researcher can use survey forms with closed-ended questions that have pre-determined scales from which statistical inferences can be made. The

researcher can also have some open-ended questions within the survey form to obtain further information about an earlier closed-ended question. Furthermore, the data collected is usually precise and consistent, and the findings obtained can be easily generalised to the entire population when sampling has been accurate (Neuman, 1997; Amaratunga & Baldry, 2002; Stiles, 2003; Creswell, 2003; Awodele, 2012).

3.4.2 Qualitative Research Approach

The qualitative researcher approaches the external world indirectly through the views and personal understanding of the people therein (Stiles, 2003; Ardley, 2008; Greener, 2011). The qualitative research approach is an investigative process in which the researcher gradually makes sense of a social phenomenon by contrasting, comparing, replicating, cataloguing, and classifying the object of study (Miles & Huberman, 1994). Marshall and Rossman (2011) suggest that the qualitative researcher becomes involved in the everyday life of the setting chosen for the study; eliciting information from the respondents' perspectives. This type of research approach requires an in-depth understanding of available information to arrive at comprehensive knowledge about the specific problem (Creswell, 2014). The emphasis of the qualitative approach is on comprehensive investigation of textual data, which could be pictures, written information, or conversations (Neuman, 1997; Oyewobi, 2014). According to Amaratunga (2002) the process of data collection in a qualitative research approach is flexible and guarantees a more exhaustive, richer and meaningful outcome.

The different ways to conduct qualitative research include narrative analysis – the study of an individual's life (Clandinin & Connelly, 2000; Riessman, 2008); a phenomenology method – eliciting the experience of individuals (Moustakas, 1994; Giorgi, 2009; Marshall & Rossman, 2011); grounded theory – a multi-stage data collection, refining, categorising and classifications, until it eventually results in theory generation (Miles & Huberman, 1994; Charmaz, 2006; Corbin & Strauss, 2007); ethnography, – the researcher studies common patterns, behaviours, or actions of people through participation over an extended period of time (Punch, 2005; Wolcott, 2008; Fetterman, 2010); and case studies – eliciting in-depth, multi-faceted information from the exploration of complex issues in their real-life settings (Punch, 2005; Yin, 2012).

3.4.3 Mixed-Methods Approach

The mixed-method research approach combines both the quantitative and qualitative views in a single research endeavour (Greene, 2007; Johnson, Onwuegbuzie & Turner, 2007; Creswell

& Plano Clark, 2007; Creswell, 2014). According to Johnson et al. (2007: p.123), mixed-methods research is “the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the broad purposes of breadth and depth of understanding and corroboration”.

Christ (2009) argues that mixed-method is much more than an ordinary research method because it combines the totality of all the phases of research, such as the paradigms and the philosophical assumptions, theoretical perspectives with the research questions of the quantitative and the qualitative research. Furthermore, the strength of the combined approach is counterbalanced by the weakness of each of the methods because the quantitative and qualitative research approaches are complementary to one another (Boyd et al., 2005). This research adopted the mixed-methods approach to maximise the inherent advantages of both quantitative and qualitative methods and to enhance the quality, credibility, and the validity of the research results (Love et al., 2002; Boyd et al., 2005; Christ, 2009; Creswell & Plano Clark, 2011; Easterby-Smith et al., 2012).

The rationale for combining both quantitative and qualitative processes derives from several factors. For instance, Punch (2005) stresses that there are fundamental issues that researchers must consider when combining approaches. Firstly, it is essential to state what the word "combine" connotes and what are the diverse ways that the combination of approaches can be achieved. Punch further lists the ways as “adding one approach to the other, interweaving the two approaches, integrating the two approaches and linking the two approaches” (Punch, 2005:241). Secondly, the researcher must distinguish between combining findings, combining data, and combining methods. Combining findings means the quantitative and qualitative data and methods are not combined, but only the results from the two processes are combined (Punch, 2005). In the case of combining data, Punch (2005) stated that only the data from the two approaches are combined during the analysis to contribute to the findings. However, where the combination involves the methods, findings, and the data, it is known as the full multi-method or mixed-method approach (Brewer & Hunter, 1989; Punch, 2005).

Various studies argue that the combination of the two research approaches can assume different forms, based on whether the two approaches will be given equal weight, be integrative or separated, and sequenced (Mathison, 1988; Brewer & Hunter, 1989; Morse, 1991; Bryman,

1992; Miles & Huberman, 1994, Punch, 2005; Creswell, 2014). Hence, Table 3.1 summarises the eleven forms of combining in mixed-method research.

Table 3. 1: Forms of Combining Quantitative and Qualitative Research Approaches

No	Form of Combination	Description
1	Logic of triangulation	The findings from one type of study (quantitative) can be checked against the findings from another type (qualitative). The aim is to enhance the validity of findings.
2	Qualitative research enabling quantitative research	Qualitative research helps to create background information on context and subject; acts as a source of hypothesis; and aids scale construction.
3	Quantitative research enabling qualitative research	Quantitative research, in this case, helps with the choice of subject for qualitative study.
4	Quantitative and qualitative research are combined to give a general picture of phenomena.	Here the quantitative research may be used to plug gaps that may arise in qualitative research in cases that either quantitative or qualitative research may capture not all issues on their own.
5	Structure and process	The strength of the two processes can be maximised for structure and process. While quantitative research is more efficient for studying the structural features of social life, qualitative research is more efficient for the processual aspect.
6	Researchers' and subjects' perspectives	Researchers' concerns usually drive quantitative research while qualitative research takes the subject's perspective as the point of departure. These perspectives can be brought together in a single study.
7	Problem generality	Combining quantitative research may help in generalising the findings of qualitative research.
8	Qualitative research may ease the interpretation of relationships between variables.	Quantitative research usually allows the researcher to establish relationships among variables, but it is often weak when it comes to exploring the reasons for the relationships. A qualitative study may be used to explain the factors underlying the deep relationships that are established.

9	The relationship between macro- and micro-levels	Quantitative research can often tap large-scale, structural features of social life, while qualitative research tends to discuss small-scale, behavioural aspects. Research that seeks to explore both levels will need to combine both quantitative and qualitative studies.
10	Stages of the research process	Quantitative and qualitative research may be adopted for various stages of a longitudinal study.
11	Hybrids	When it is crucial to conduct qualitative research within a quasi-experimental (quantitative) research design.

Source: Punch (2005:241)

In this research, the motive of combining both the qualitative and quantitative approach was to use the quantitative research to plug observable gaps that existed in each of the approaches because either quantitative or qualitative approach is not enough to capture all the issues to be addressed by the research.

However, the mixed-method approach is not without criticism. The replicability has been questioned, and the relevance of the research design to questions to be addressed has been considered a disadvantage. In this study, such issues were carefully managed by ensuring both internal and external validity of the research study are credible. Further discussion is given in section 7.3.

3.5 Research Approach and Strategy adopted for the study

To understand the relationship between the social sustainability constructs of this study (social relationship, job satisfaction, and knowledge development) and how TI in an FM organisation impact them, this study requires a suitable research approach. In making a choice, the researcher considered some key factors, such as the central research question, the data to be collected, the type of analysis, and conclusions to be made. It was apparent that the approach to be adopted must be such that will allow for the “what” and “why” question of the research problem to be answered. Therefore, the pragmatic approach was considered as most suitable for this study because it supports the combining of both quantitative and qualitative approaches in single research (Bryman, 2006; Creswell, 2014).

Reflecting on the overarching aim of this study, which is to examine the nature and extent of the relationship between TI adoption in FM organisations and the social sustainability of employees, this overarching aim was sub-divided into two research phases. The first,

quantitative phase, identified the current TIs used South African FM organisations, the rate of the adoption of such TI, the factors that influence their adoption, and how the adoption of the TI has influenced the practice of the organisations. Furthermore, the first phase provided the researcher with the opportunity to validate the social sustainability factors that were identified from the literature review and also enabled the testing of the social sustainability factors that were being affected by the adoption of TI in FM organisations. The first phase also afforded the researcher with the opportunity to conduct an industry peer-review of the FM organisations that adopted the most TI in their operations in South Africa. Finally, this phase was used to elicit the willingness of organisations to take part in the second, qualitative, phase. This information was necessary to kick-start the process that led to the discovery of which organisations were willing to be interviewed.

The positivist approach was adopted to achieve this phase through the survey questionnaire. Previous studies affirmed that this approach is efficient in explaining the behavioural aspects, as well as measuring the descriptive aspects, of built environment research (Amaratunga et al., 2002; Punch, 2005; Oyewobi, 2014). Given these aspects within the FM research field, the quantitative approach has been described as the “choice approach” by some FM researchers (Ratcliffe, 2000; Vischer, 2008; Price et al., 2009). However, Michell (2010) argues that the “approach has failed to take into account the intrinsic attitudinal, behavioural and sociological aspects of FM” (Michell, 2010:72).

The second phase, relating to the overarching research question, dealt with the impact of adopted TI on the social sustainability of the employees in FM organisations. The qualitative research approach was used in the second phase. It allowed the employees to offer an in-depth account of their experiences regarding the social sustainability issues that technology adoption has created. Strauss and Corbin (1998) argue that qualitative research can uncover what lies behind any phenomenon while also providing intricate detail. In a similar argument, Michell (2010) affirms that the qualitative approach can be used to account for the fundamental attitudinal, behavioural and sociological aspects of employees in FM. Previous literature affirmed that both qualitative and quantitative approaches are relevant built environment research (Amaratunga et al., 2002; Dainty, 2008; Love et al., 2002). Furthermore, most of the past studies in Sustainable FM, which is the domain of this research, used either quantitative (Elmualim, et al., 2008; Gimenez et al., 2012, Elmualim, 2013) or qualitative (Edum-Fotwe & Price, 2009; Greene et al., 2014; Coutinho, et al., 2017) or mixed-methods (Sarpin, 2015) approaches. Other researchers suggested that exploring the complexities of construction

management studies will require the adoption of multi-methodology to draw from the strength of the two approaches (Love et al., 2002; Dainty, 2008).

3.5.1 Research Plan

Based on the discussions in chapter two, a research plan for the study was developed as shown in Figure 3.1 below. The research plan is separated into five stages. It begins with a literature review, followed by the questionnaire survey, then quantitative data analysis, qualitative interview survey, and lastly, the discussion, conclusion, and recommendations.

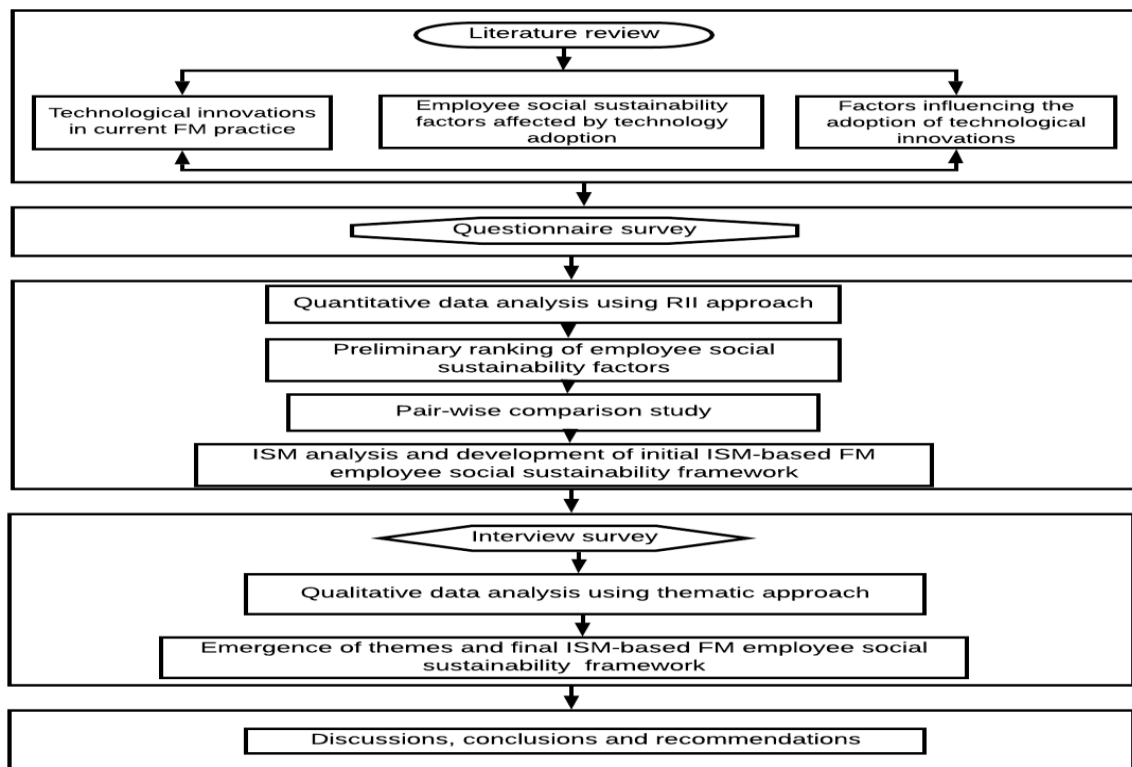


Figure 3. 1: Overall Framework of the Mixed-Methods Approach used in the Study

3.6 Data Collection Procedures

The central question of this research is: What is the nature, extent and implications of adopting TIs on the social sustainability of FM employees in South Africa? As earlier said, the research adopted both the quantitative and qualitative research approaches in a sequential manner to achieve the required depth and breadth in answering the question. The first in the sequence was the quantitative survey, then the qualitative interviews. Each of the approaches constituted an independent phase of the research. According to Creswell and Plano Clark (2011:417), a phase within a research design is “a component of a mixed-methods study that encompasses the basic

process of conducting quantitative or qualitative research: posing questions, collecting data, analysing data, and interpreting results based on that data". Therefore, each of the phases followed the full process of question formulation through to the interpretation of analysed data.

3.7 Quantitative Phase

The goal of the quantitative phase as earlier stated in section 3.5 was to find the current TIs that FM organisations were utilising in South Africa, the rate of the adoption of such TIs, the factors that influenced the adoption and how the adoption of the TIs influenced the practice of FM organisations. The phase also aided the validation of the social sustainability factors and enabled the testing of how the social sustainability factors were being affected by using TI. The participants of the second qualitative phase were also sought after in the first phase. The quantitative data was collected through a self-developed and pilot-tested questionnaire instrument (see appendix C). The questionnaire included both open and closed-ended questions. The open-ended questions created the opportunity for respondents to elaborate on any question in their own words. Furthermore, the respondents were also given an opportunity to make a list of TIs that they were using in their organisations, which were not included in one of the unstructured questions through the open-ended questions. The closed-ended questions needed the respondent to rate their responses on a Likert scale. The use of the questionnaires enabled the researcher to investigate and describe the nature of relationships between variables (Saunders et al., 2009; Oyewobi, 2014).

There are different strategies for administering the questionnaire which can affect the outcome or response rate that is achieved (Blaxter et al., 2006; Saunders et al., 2009). For instance, while face-to-face self-administered questionnaires may get a better response rate, it is time consuming. Postal and internet-aided surveys are likely to have lower response rates because the researcher is not available to respond to participants' queries, but the methods allow for a larger population to be considered (Blaxter et al., 2006; Oyewobi, 2014).

The primary criteria for participants in the quantitative stage were that the organisation be registered with the South African Facilities Management Association (SAFMA) and have a valid email address. The composition of the organisations registered with SAFMA included FM consultants, contractors, property developers, and real estate investment trust (REIT) organisations, all of whom were directly involved in the FM sector in South Africa (SAFMA, 2017).

3.7.1 Factors Used in the Questionnaire Design

The questionnaires comprised of factors that influence the adoption of TIs, the impact of the adopted TIs on the core-business factors of FM employees and employee social sustainability factors. The employee social sustainability factors used in constructing the questionnaire were derived from theories documented in Chapter 2. By way of summary, Table 3.2 shows the employee social sustainability factors that were examined in Chapter 2 and the studies from which the theories were derived.

Table 3. 2: The Employee Social Sustainability Factors Examined

No	Employee Social Factors	Sources
Social relationship		
1.	Alienation	Kurland and Cooper (2002), Längle (2003), Grimshaw (2007), Barret and Baldry (2009); Amichai-Hamburger (2009) Osin (2009).
2.	Social isolation	Vega and Brennan (2000); Marshall et al. (2007); Golden et al. (2008); Bennett et al. (2010).
3.	Work and home-life balance	Wallace (2004); Nicholas and Guzman (2009), Grimshaw (2007); Wajcman et al. (2008); Nicholas and Guzman (2009); Beutell (2010); Mokyr et al. (2015); Nørgaard et al. (2015); Valtorta et al. (2016a); Zhang (2016).
4.	Social network	Fukuyama (1996); Nardi et al. (2002); Golden et al. (2008), Barret and Baldry (2009), Bennett et al. (2010); Samuel et al. (2014), Ahmad et al. (2018).
5.	Overwork	Rousseau (2006); Ilies et al. (2007); Meyer (2007); O’Driscoll et al. (2009); Kossek et al. (2009); Pfeffer (2009) Altnam (2013).
Job satisfaction		
6.	Autonomy	Stamps and Piedmonte (1986); Oduro-Owusu (2010), Pfeffer (2009).
7.	Interpersonal relationship	Stamps and Piedmonte (1986); Quan-Haase and Collins (2008), Bebbington and Dillard (2009); Oduro-Owusu (2010), Turkle (2011), OECD (2013), Rainie and Wellman (2012), Chan (2014).
8.	Job-security	Goos and Manning (2007); De Cuyper et al. (2008); Bebbington and Dillard (2009); Silla et al. (2009); Stander and Rothmann (2010); Fatimah et al. (2012); Brand (2015), Autor (2015); West (2015); Türkay et al. (2016); Gallie et al. (2017).
9.	Organisation policy	Stamps and Piedmonte (1986); Lim et al. (2002), Oduro-Owusu (2010), Gibbs (2017).
10.	Professional status	Thielke et al., 2012); Stamps and Piedmonte (1986); Oduro-Owusu (2010).
11.	Remuneration	Stamps and Piedmonte (1986); Bebbington and Dillard (2009); Oduro-Owusu (2010), Marzuki et al. (2012).

12.	Task requirement	Stamps and Piedmonte (1986); Docherty et al. (2009), Oduro-Owusu (2010), Atkin and Bildsten (2017); Gibbs (2017).
Knowledge development		
13.	On-the-job training	Deutsch (1987), Bhatt (2001), Noe et al. (2006), Bebbington and Dillard (2009); Zeytinoglu and Cooke (2009).
14.	Professional development plan	Kandampully (2002); Pathirage et al. (2008); Brödner, (2008); Bebbington and Dillard (2009).
15.	Retirement development plan	MacDonald and Weisbach (2004), Meyer (2007).
16.	Workshops and training	Bhatt (2001); Bebbington and Dillard (2009); Atkin and Bildsten (2017); Gibbs (2017).

3.7.2 Unit of Analysis

Theoretically, a unit of analysis refers to the major entity being studied (Teddlie & Tashakkori, 2009). It informs the type and focus of all data collection needed to answer the research question. Since the primary aim of this study was to examine the nature, extent and implications of TI adoption on the social sustainability of FM employees, the unit of analysis for this study was TI, FM organisations and FM employees. The study focused on those FM organisations that were registered with SAFMA as at May 2016. The questionnaire survey was designed to illustrate the various form of TIs that FM organisations utilised. The respondents were also given an opportunity to make a list of TIs that they were using in their organisations, which were not included in one of the structured questions. Due to the small study population, all FM organisations registered with SAFMA participated in the first quantitative phase of the research. However, participation in the qualitative phase of the study was based on information provided by the industry players on those organisations that adopted more TIs in their operations and the willingness of such organisations to participate in the research study.

3.7.3 Development of the Questionnaire

The questionnaire was an essential instrument of data collection from the respondents in this research. The characteristics of a good questionnaire include the following: it must be unambiguous, coherent, logically set out, free of language errors, and well-presented (Awodele, 2012; Creswell, 2014; Oyewobi, 2014; Odediran, 2016). All these rudiments of good questionnaires were considered while designing the questionnaire that was used in this study. A questionnaire can be designed to have open-ended or closed-ended questions. The open-ended questions allow the respondents to freely express their opinion in answering a question while the closed-ended questions restrict respondents to pre-determined answers supplied by the researcher (Fellows & Liu, 2008).

Several copies of the draft questionnaire were presented to the researcher's supervisor for approval, and the approved copy was cross-checked for analytical suitability by statisticians from the Statistics Departments of the University of Cape Town. For the purpose of ethical consideration, a consent form to solicit the free participation of the respondents preceded the questionnaire for this study.

There were four sections of both open-ended and closed-ended questions in the questionnaire (see Appendix C). The first section was the introductory section that elicited general information about respondents' organisations. The respondents were asked to state the name of their organisation (this was an optional question); the number of years that the organisations had existed; and the number of employees in the organisation. Further questions covered the category of FM services that the organisation was involved in; the location of the organisation headquarters and branch(es), where applicable, and the highest educational qualification of the respondent. Except for the name of the organisation, all other questions in this section were closed-ended.

The second section sought to understand the current TI available in the organisations. This section had both open-ended and closed-ended questions. The first question categorised existing TI on a global scale into five types, and the respondents were asked to tick a "yes" or "no" depending on the organisation's adoption of that specific TI. The question also had an option of "others" where the respondents could also tick if there were another TI that was known to them but not included in the categories.

The subsequent questions were open-ended. These questions asked respondents to list any other category known to them, or form of TI that their organisations were already using or intended to use. The respondents were asked how long before their organisation adopted a form of TI that they were not already using. The respondents were also asked to rank on a five-point Likert scale the percentage impact that the adoption of TI was having on some core-business factors, such as productivity, running cost, efficiency, corporate image, flexibility, and connectivity in their organisations. Lastly, in this section, respondents were asked to suggest six FM organisations, which, in their opinions, were deploying the highest level of TI in the industry known to them. This question was asked to help the researcher identify the relevant organisations for the qualitative second phase interview.

The third section examined the factors that influenced the adoption of TI in FM organisations. These factors, derived from the literature, were categorised into six categories as shown in

Table 3.3. They include performance expectancy, facilitating conditions, effort expectancy, social influence, employee resistance to change, and top management support. The items used in the measurement of the factors for Tables 3.3 are shown in Appendix C. Respondents were asked to rank on a five-point Likert scale, the factor(s) that were more critical in the decision to adopt new TI in their organisations. The rating scale ranged from “1” (not critical) to “5” (extremely critical).

Table 3. 3 : Factors Influencing the Adoption of TI in FM Organisations

No	Factors influencing the adoption of TI	Sources
1	Performance expectancy	Lunn and Stephenson (2000); Chwelos et al.
2	Facilitating conditions	(2001); Cesar-Gabriel (2003); Liu et al.
3	Effort expectancy	(2010); Talukder (2012); Sargent et al. (2012).
4	Social influence	
5	Employee resistance to change	
6	Top management support	

The fourth section examined the connections between the adoption of TI and social sustainability. The section used multiple-choice questions to rank the importance that respondents’ organisations attached to SFM. On a five-point Likert scale, respondents were asked to rank the priorities given by their organisations to the three pillars of sustainability (economic, environmental, and social). The rating scale ranged from “1” (not) to “5” (extreme). Furthermore, in a multiple-choice question, respondents were asked to state their level of agreement with the assertion that the social pillar of sustainability had received the least attention amongst the three pillars of sustainability. Based on social sustainability factors found in literature, respondents were asked to rank, as a way of validating the factors on a 5-point Likert scale, the level to which they agreed that the factors were social sustainability factors being affected by the adoption of TI. The rating scale ranged from “1” (strongly disagree) to “5” (strongly agree). The literature search showed that employees were negatively affected by the adoption of TI in organisations. Hence, respondents were asked to rank on a five-point Likert scale, the extent to which employees were negatively affected by the adoption of TIs. The rating scale ranged from “1” (very low) to “5” (very high).

3.7.4 Pilot Survey

Pilot testing was necessary to remove any ambiguity and to eliminate threats to the internal validity of data. A pilot survey is usually a small-scale study to test a questionnaire, interview checklist, or observation schedule (Creswell, 2014). The study was piloted to test the clarity of

the questions that were being asked in the questionnaire and to determine any difficulties that the respondents could face while answering the questions (Saunders et al., 2009). In the present study, the pilot was conducted on the draft questionnaire by sending the link to SurveyMonkey, to eight researchers in the built environment within and outside South Africa to examine the completeness, ease of access to the questions, and the ease of comprehension of the questions. The researcher found from the pilot survey that the questionnaire was easily accessible through the link provided, the questions were comprehensible and unambiguous. Afterwards, the survey link was sent to the email addresses of FM organisations that were registered with SAFMA.

3.7.5 Sampling Technique and Sample Size

One important decision in a research process is the determination of the sample size and technique. Sampling forms the basis for statistical inferences and key decision-making tool in quantitative research (Punch, 2005). Sampling is important because the data that will be used to represent the entire population is obtained from sampling (Fellows & Liu, 2008; Creswell, 2014). Although it is a popular assumption that it is impossible to study the entire population (Miles & Huberman, 1994), this study is an exception due to the small size of the entire study population. Hence, the Total Populations Sampling (TPS) technique was used in the quantitative phase of this study. TPS is a type of purposive sampling technique where the entire population that meet the criteria (e.g. specific skill set, experience, etc.) were included in the research (Etikan et al., 2016). Etikan et al. (2016) further argue that TPS is more commonly used where there is a relatively small population. In the case of the current study, the entire registered number of FM organisations in South Africa was 85 as at May 2016 (SAFMA, 2017). Due to this small population, the entire population of the FM organisations registered with SAFMA was selected for the study in the quantitative phase of the mixed-method design. Moreover, it was necessary to adopt the entire population in an exploratory study that sought to identify all the TIs that were currently being used in FM organisations because organisations could be using certain types of TI peculiar to their operations.

3.8 Questionnaire Administration and Collection

As earlier stated in the previous section, the study sought to determine the current TI in South African FM organisations as one of its objectives; therefore, questionnaires were administered countrywide to all FM organisations registered with SAFMA. The FM organisations were invited to participate in the research through an internet-based survey link that was sent to their

email addresses (Saunders et al., 2009). Web-based surveys have many benefits, such as, low cost, broad accessibility of survey design and application instruments, ease of execution, and sending of reminders. They also have built-in characteristics that make the process of data cleaning easy and enhance the survey knowledge for both respondents and researchers (Dillman et al., 2009; Boyer et al., 2010; Israel, 2011). However, there could be a low response rate with a web-based survey (Wiseman, 2003; Archer, 2008). Given the necessity for a nationwide survey of the TI in South African FM organisations, the researcher had no better option than the web-based study.

The current survey was run online using SurveyMonkey (www.surveymonkey.com). The link was sent to every FM organisation that was registered with SAFMA. The data collection process spanned between May 2017 to January 2018. Various challenges characterised the questionnaire administration phase. For instance, some emails bounced and never reached the participants, while some of the participants opted out of the study. According to Blaxter et al. (2006), the researcher is supposed to make telephone calls to the respondents of an online survey as a reminder strategy. Hence, there were many telephone calls to the participants almost on a weekly basis to encourage and remind participants to participate in the research.

3.8.1 Response Rate

Out of 85 questionnaires that were administered through the web-based links, 22 were returned and considerably completed; hence, they were thought valid for data analysis. The response rate was 26%. It is acceptable because many researchers have argued that the response rate for online surveys is between 20% to 30% (Akintoye, 2000; Black et al., 2000; Alreck & Settle, 2004; Takim et al., 2004; Al-Tmeemy et al., 2011; Oyewobi, 2014). Furthermore, the response rate from web-based surveys has been reported to be 11% less than postal. Moreover, in phone surveys, a response rates as low as 2% have been reported (Petchenik & Watermolen, 2011). On this basis, the current survey is presumed reasonable.

3.9 Qualitative Phase

The qualitative phase of this study was a follow-up phase to the quantitative phase. The qualitative phase sought to explain the outcomes of the quantitative analysis in greater depth and to further expand on some of the outcomes of the quantitative analysis (Ivankova et al., 2006).

The interview approach was adopted for the qualitative phase study. The interview approach can either be structured, semi-structured or unstructured. In the structured interview type, the

respondents are asked predetermined questions that are not varied, and the respondents are not required to give additional information concerning the questions (Gill et al., 2008). Consequently, they are relatively quick, easy to administer, and have little “depth” due to limited participant involvement. Unstructured interviews do not have predetermined questions and are more conversational. May (1991) argues that unstructured interviews usually start with one question from where every other question will evolve in the process of the interview based on the earlier response. Unstructured interviews are time-consuming, stretching into several hours, and the process is not easy to manage. They can often lack specific guidance on what should be discussed. Authors recommend is form of data collection in situations where significant “depth” is required or practically nothing is known about the subject area (May 1991; Gill et al., 2008). Semi-structured interviews have sets of questions which serve to define and guide the interview process with opportunity for the respondents to explain the subject matter (Kvale, 2007; Valenzuela & Shrivastava, 2008; Creswell, 2014). This study adopted the semi-structured approach because it allowed the researcher to narrow down the interview process to the phenomena of the study (Yin, 2012), while still obtaining the story of the participants on a first-hand basis (Rabionet, 2011).

According to Valenzuela and Shrivastava (2008), the stages involved in the interview research approach are:

- Thematising – designing the “why” and “what” of the investigation
- Designing – laying out the process in an orderly manner
- Conducting the interview – using the guide to conduct the interview
- Transcribing – converting the audio recordings into words that can be quickly analysed
- Analysing –the stage of using the right tool to examine the data
- Verifying –the process of ascertaining the validity of the interview findings
- Reporting – involving communicating the results of the study based on scientific criteria

3.9.1. Justification of the Semi-Structured Interview Survey Research Strategy

The flexibility of the semi-structured approach, particularly compared to structured interviews, allows new facts that were not previously thought about to evolve from the interview process (Gill et al., 2008). This study adopted the semi-structured approach because it was regarded as one that would yield the desired information within the framework of the predetermined questions while allowing new insights to emerge from the respondents’ explanations.

i.) The Nature of the Investigation

The nature of the current study needed an in-depth understanding of the influence of TI in FM organisations and the consequent implications on the social sustainability of employees. This is a two-phase study. The first phase required that the researcher determined the available cutting-edge TI in South Africa and their use. This step indicated which organisations should be approached for the interviews in the second phase.

ii.) Previous Empirical Studies in the Field

Although this was the first study that combined TI and social sustainability in a single study, several other studies have used different approaches to explore parts of this study. For instance, an empirical study on FM automation by Lunn and Stephenson (2000) used the case study approach. Grimshaw (2007), while assessing ICT and the future of FM, analysed previous studies by reviewing them. Madritsch and May (2009) examined the implementation of IT in FM by conducting interviews in a case study. Lindkvist and Elmualim (2009), in a study of workspace management through RFID technology, adopted observations and interviews in a case study approach. Furthermore, Atkin and Bildsten (2017) adopted a literature review method to evaluate the future of FM against the backdrop of advanced technologies, while Adama and Michell (2017) also adopted the literature review process to examine the implication of TI on social sustainability of employees in FM.

From the sustainability and FM aspect, Edum-Fotwe and Price (2009) used a focused group interaction approach in assessing the social ontology of construction projects and development. Elmualim (2013) used the questionnaire survey approach to evaluate sustainability trends and policies in FM. Almahmoud and Doloji (2015) adopted a combination of questionnaire survey and interviews in a case study (mixed-method) to assess social sustainability in construction projects through social network analysis. Sarpin (2015) used questionnaire survey and interviews in multiple case studies to develop people's capabilities for promoting sustainable FM practice. Furthermore, Sarpin et al. (2016) later used the questionnaire survey approach to develop a people capability framework for promoting sustainability in FM practices.

From the above overview of previous studies, it can be seen that both the single research approach (either qualitative or quantitative) and the mixed-methods approach have been used for various aspects of FM studies (TI and sustainability). Table 3.4 gives a summary of the previous studies. However, Love et al. (2002) and Dainty (2008) emphasised the use of a more comprehensive approach to address the numerous problems confronting the construction

industry (Love et al., 2002; Dainty, 2008). Against the backdrop of the literature provided, this study adopts an interview research approach as one of its approaches to enquiry.

Table 3. 4: Summary of the Empirical Research Efforts Around TI and Sustainability/Sustainable FM

Author/year	Research interest	Method
Lunn and Stephenson (2000)	FM automation	Literature review
Grimshaw (2007)	ICT and the future of FM	Review of previous studies
Madritsch and May (2009)	IT implementation in facility management	Structured Interview in a case study
Lindkvist and Elmualim (2009)	Security and Workspace management through RFID	Observation and interview methods in a case study
Atkin and Bildsten (2017)	Technology innovations	Editorial review
Adama and Michell (2017)	Technology innovation	Literature review
Edum-Fotwe and Price (2009)	Social sustainability	Focused group
Elmualim (2013)	Sustainability	Questionnaire survey
Almahmoud and Doloi (2015)	Social sustainability	Questionnaire survey and interviews in a case study (Mixed-methods)
Sarpin (2015)	Sustainable FM	Mixed-methods (questionnaire survey and case study)
Sarpin et al. (2016)	Sustainability	Questionnaire survey

3.9.2 Selection of Target Organisations for Interviews

Through the questionnaire survey, two questions were asked with the aim of providing a lead to the FM organisations that deployed more TIs in their FM operations. First, participants in the quantitative survey were asked to volunteer their participation in the qualitative second phase of the study. Secondly, a question in the survey asked respondents to suggest names of six organisations which, in their opinion, made the heaviest use of TIs in their operations. Based on the above strategy, one respondent (A) in the quantitative survey volunteered to take part in the second qualitative phase of the study. During the interview, a snowballing strategy was employed, which led to conducting interviews in four organisations.

The snowballing sampling techniques, also known as cold-calling, chain sampling, chain-referral sampling, and referral sampling, was adopted for data collection and analysis in the qualitative phase of this study (Chaim, 2008; Yin, 2012; Clark & Creswell, 2014). Chaim (2008) affirms that a sampling technique may be defined as snowballing “when the researcher

accesses informants through contact information that is provided by other informants” (Chaim, 2008:330). It is a sampling process where the researcher asks the interviewees to suggest other people who might be relevant to the study and the like (Flick, 2008).

i.) Justification of the Snowballing Research Strategy

The choice of the snowball research strategy was to ensure that the right organisations were interviewed in line with the objectives of the study. Central to interviewing the right organisations is the ability to identify the organisations that were using most TI in the sector. This assessment could only be achieved through the participants in the sector. Snowballing allows one participant to recommend the other participant that they think qualified to participate in the study to the researcher.

Snowballing consists of two main steps: (1) Identify at least one potential subject in the population. Often, only one or two subjects are identified; (2) These subjects of the population are then asked to recommend other participants that meet the criteria of the study. The merit of the snowball approach includes the following: (1) It allows for researchers to access the right participants in a study where it would have been challenging to do so; (2) it helps to discover characteristics about a population that the researcher may not be aware existed. For example, through the process of snowballing, the FM organisations, which deploy more TI than others, were revealed. One disadvantage of the snowball approach is that sampling error cannot be easily determined since the researcher depends on the experience of the industry players to determine his sample.

3.9.3 Pilot Testing

Pilot testing in qualitative research is the process of evaluating the appropriateness of the data collection instrument in terms of ability to give the right answers and minimise errors in solving the research problem (Kvale, 2007; Morgan, 2010; Turner, 2010; Jacobs & Furgerson, 2012). Pilot testing is essential in confirming that the questions in the interview protocol are free of ambiguity, errors, and have been correctly asked (Kvale, 2007; Odediran, 2016). The participants in the pilot testing were experts in academics with similar expertise to those that took part in the actual study (Turner, 2010). In this study, both the questionnaire and interview guide were reviewed by the thesis supervisor and editors from the UCT Writing Centre before it was pilot tested with the select group of experts. The copy of the semi-structured interview is attached as Appendixes C and D.

3.9.4 Instrument of Data Collection

The data collection instrument for this research was a semi-structured interview guide with few open-ended questions of “how” and “why” types to stimulate further discussions with the interviewees. The approach allowed for the interviewees to freely express their views and contribute as much information as possible with the researcher moderating the process (Turner, 2010). Hence, the researcher moderated the interviews to maintain the focus of the discussions. The participants in the face-to-face interviews were mainly nominated senior and junior FM and human resource (HR) personnel of the organisations (see Table 3.5). The interviewees discussed in greater detail, the adoption of TIs and the impact on the FM operations of the organisations in addition to the strategic approaches to the issues of social sustainability and the broad concept of sustainability.

The semi-structured interview guide contained twenty-one questions. These questions were designed based on two categories. The first category centred on TI adoptions in the organisation and their impact, while the other category asked questions about the three constructs of employees’ social sustainability discussed in section 2.6 namely, social relationship, job satisfaction, and knowledge development. The interviewees were asked at the end of all twenty-one questions to suggest any FM organisation that, in their opinion, was a leading user of TI within the industry. This question created the snowball effect for the researcher to identify the FM organisations to follow up on for the next set of interviews.

The first interview was conducted in organisation “A” with headquarters in Johannesburg and a branch office in Cape Town. A total of four interviews were conducted in this organisation: one telephone interview with an employee in Johannesburg and three face-to-face interviews in Cape Town. The participants were the operational director of the organisation, the project and facilities manager, and two housekeeping employees. The second interview was conducted in organisation “B” situated in Cape Town with two interviewees, being the contract manager for house cleaning and waste management, and the facilities manager in charge of janitor services in the organisation. The third interview was a telephone interview conducted with two employees in organisation “C” situated in Johannesburg. The interviewees were the head of utility and the head of human resources of the organisation. The fourth interview was conducted in organisation “D” which is located in Cape Town. The interviewees opted for a joint session. The employees involved were the organisation and talent manager and the facilities manager in charge of mechanical engineering services.

At the close of all the interview session, a total of nine respondents took part in the interview. This figure was deemed adequate for two main reasons. First, a point of theoretical saturation was reached after there was no more new information and the interviewees' responses became repetitive (Johnson, 2015). Secondly, previous studies argue that a minimum of six participants is ideal for qualitative research where substantial information is collected from the interviewees (Morse, 1994; Ritchie et al., 2003; Amidu & Boyd, 2018). Three out of all the interviews were conducted by telephone while the remaining six were face-to-face. The average time spent on the interviews was twenty-one minutes. The interviews were tape recorded to keep an audit track of the interview after obtaining the prior consent of the interviewees involved (Naismith, 2007). In compliance with the ethical requirement, the information recorded was kept anonymous to guarantee confidentiality. Table 3.5 shows an overview of the interview durations and the participants.

Table 3. 5: Background Information of the Respondents and an Overview of Interviews Conducted

Org.	Number of interviewees	Role of interviewee	ID	Length of interviews
A	4	Operational director	RA	24 minutes
		Facilities manager	RB	22 minutes
		Housekeeping staff	RC	18 minutes
		Housekeeping staff	RD	16 minutes
B	2	Waste and cleaning manager	RE	38 minutes
		Facilities manager	RF	31 minutes
C	2	Head of utilities	RG	20 minutes
		Head of Human resources	RH	20 minutes
D	1	Organisation and talent manager	RI	24 minutes

3.9.5 Document Analysis

The documents of the organisations that took part in the qualitative interviews were collected and analysed (Denzin & Lincoln, 2005). These documents included organisation strategic policy documents and mission statements. Furthermore, other publications on the operations, employment, human resources concern, and adoption of TI in the organisations were included. Most of the documents were obtained from the websites of the organisations while others were collected during the face-to-face interview contact period. The documents and information

obtained from the organisations were carefully managed to guarantee anonymity in compliance with ethics requirements (Yin, 2009).

3.10 Assessing the Quality of Research Design

There are different approaches that can be adopted to assess the quality of a research design at different levels. According to Yin (2009), the four criteria that can be adopted to assess the quality of research design at any stage include: construct validity, internal validity, external validity and reliability. This section provides the explanation of how the quality of the both the quantitative and qualitative design was assessed.

3.10.1 Validity and Reliability of Quantitative Research

In a research process, both the internal and the external validity of the research study should be considered. Internal validity examines the extent to which the research design and the data collected allow the researcher to draw right succinct conclusions (Fellows and Liu, 2008; Yin, 2009). The internal validity of the design survey was enhanced by ensuring that the quality of the questionnaire scores were adequate and could lead to reaching good quality conclusions from the data analysis. According to Oyewobi (2014) the researcher must consider the content, criterion-related and construct-related factors to ensure good internal validity. Content validity measures the extent to which the questionnaire items covers the construct of the study. This study achieved content validity through extensive literature review of items that were included in the study. The researcher ensured that the scores linked to the questions were similar to those used in previous studies in order to ensure criterion-related validity. The researcher ensured that each scale measured what they are intended to observe in order to achieve the construct validity (Creswell & Plano Clark, 2011).

The external validity describes the extent to which the research can be generalised to a larger population or the field within which the study was undertaken. According to previous studies, external validity can be classified as ecological validity and population validity (Creswell & Plano Clark, 2011; Fellows & Liu, 2008; Yin, 2009). Ecological validity is concerned with the extent to which the research can be generalised to other settings while the population validity is concerned with the extent which the findings from the population can be generalised to a larger population (Creswell & Plano Clark, 2011; Fellows & Liu, 2008; Yin, 2009; Oyewobi, 2014). The ecological validity was achieved by designing the questionnaires in such a way that

there were no wrong or right answers. Population validity was achieved by ensuring a non-biased approach to the survey population.

In the quantitative research, the reliability of the survey implied that the scores obtained from the survey remain consistent over time (Creswell & Plano Clark, 2011). In this study, the Cronbach’s alpha (α) was used to prove the reliability of the study. Table 4.1 shows the summary of the Cronbach’s alpha of the constructs of this study.

3.10.2 Validity and Reliability of Qualitative Research

The concepts of validity and reliability are fundamental to qualitative research (Robson, 2002). However, Lincoln and Guba (1985) argued that, when determining the credibility, accuracy and reliability of the information provided by the participants in qualitative research, greater emphasis should be placed on validity than reliability. Validity concerns the extent to which the research instrument measures what it is supposed to measure, while the reliability of qualitative research refers to the consistency of a measuring instrument to yield a result (Leedy & Ormrod, 2005). The consistency of the qualitative interview question was ensured through the development of an interview guide (see appendix D). In the context of qualitative research, reliability refers to the dependability of the research process undertaken. Creswell and Plano Clark (2011) argue that reliability is focused on the extent to which the information obtained from the interview and the document examined agree.

Previous studies argued that the quality of a research study is based on the “goodness criteria” and the terminology utilised in research reflects the epistemological position of the researcher (Miles & Huberman, 1994). Consequently, a pairing of terminology in Table 3.6 reflects the position of Miles and Huberman (1994) and Michell (2010) on the five fundamental areas of assessing the quality of a research study.

Table 3. 6: Terminology Used in Assessing the Quality of the Research

Terminology	Scope
Reliability/Dependability/Auditability	The consistency of the research process
Internal Validity/Credibility/Authenticity	The credibility of the research findings and the conclusions that were drawn
External Validity/Transferability/Fittingness	Transferability of the research findings and conclusions drawn to other contexts

Objectivity/Confirmability	Relative neutrality on the part of the researcher. Sometimes referred to as “external reliability”. Emphasis is on the replicability of the study.
Utilisation/Application/Action	Implications of the research for the participants to the study and the researcher

Source: Mitchell (2010)

According to Miles and Huberman (1994: 278–279) the necessary question to consider when ensuring the validity of a qualitative research include: 1) are research questions clearly defined and the features of the study design congruent with them? 2) are basic paradigms and analytic constructs clearly specified? 3) was the data connected across the full range of appropriate settings, times, respondents suggested by the research questions? 4) were coding checks made and did they show adequate agreements? 5) do findings show meaningful parallelism across data sources (informants, contexts, and times)? 6) Were any forms of peer or colleague review employed? Furthermore, the ethical consideration with respect to the interview process are discussed later in the chapter.

3.11 Methods of Data Analysis

Using the correct techniques for data analysis is a fundamental step in achieving a research aim. Data analysis requires that the right decisions be made on the techniques to adopt, which will help the researcher to reach some valid conclusions and communicate the results obtained correctly (Ankrah, 2007; Awodele, 2012). In this study, both quantitative and qualitative data were collected. However, multiple techniques were used to analyse and to show the validity and reliability of the sets of data collected.

3.11.1 Quantitative Analysis

In the quantitative design of this study, the data collected were generally nominal or ordinal where most of the responses were rated on Likert scales. Therefore, the normality of the data collected were examined and the data were nonparametric (see appendix E). The data collected in this study were subjected to both descriptive and non-parametric inferential statistics approaches using the Statistical Package for Social Sciences (SPSS). The descriptive statistics used in this study include percentages, mean scores, indices and the measure of relative importance index (RII) of the various factors.

The mean score is an average value of the respondents’ answers to a set of questions linked to the specified scale. Therefore, to show the significant factors of all the questions to which a Likert scale was attached, the mean score technique was used. The mean score technique was

also used to analyse some background profile of the facilities managers surveyed in this study. Several previous studies have used the mean score (Chew et al., 2008; Jusoh & Parnell, 2008; Yamin et al., 1999; Odediran, 2016). The mean score (MS) for each of the variables in the questionnaire was determined using the formula below:

$$\text{Mean Score} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{n_5+n_4+n_3+n_2+n_1} \quad [3.1]$$

- where n_5 = number of respondents who picked 5
- n_4 = number of respondents who picked 4
- n_3 = number of respondents who picked 3
- n_2 = number of respondents who picked 2
- n_1 = number of respondents who picked 1

In order to have a better understanding and in-depth knowledge on the factors responsible for the adoption of TI in FM organisations, the respondents were asked to rank each of the factors on a Likert scale of 1-5 on “level of influence” of the identified factors. 1 was coded “very insignificant”, and 5 was coded “very significant”. On the level of how critical the factors were, 1 was coded “not critical”, and 5 was coded as “extremely critical”. It offered an opportunity to assess the level of “significance” and “criticality” of the factors identified as responsible for the adoption of TI in FM organisations, based on the cumulative score of the scales used. The respondents were asked to rank each of the factors on a Likert scale of 1-5 as “it affects the organisation”, where 1 was strongly disagree”, and 5 was “strongly agree”. The question was used to validate the employees’ social sustainability factors with the employees. It was the strategy by which the factors in the literature were cross-checked with the practical experience in the field based on the cumulative score of the scale used. Also, to test whether the social factors had negative effects on the social sustainability of employees, the respondents were asked to rank each of the factors on a Likert scale of 1-5 as “negative effects on employees”, where 1 was “very low”, and 5 was “very high”. It provided the severity of the factors as they affect employees in FM organisations based on the cumulative score of the scale used.

- Frequency Index = $(\sum(f)/NF) \times 100\%$ (i)
- Importance Index = $(\sum(i)/NI) \times 100 \%$(ii)
- Severity Index = $(\sum(if)/NIF) \times 100 \%$(iii)

The formulae used to derive the severity index for each of the factors were adopted from Spillane et al. (2012). In the given equations, i represents the importance weighting, and f depicts the frequency weighting given by the respondents in the questionnaire, based on a Likert scale rating from 1 to 5. Where I and F are the highest ratings possible for each of the assigned factors (in both cases being 5). N represents the total number of respondents with usable data on that particular factor, which was 22.

3.11.2 Relative Importance Index (RII)

In order to account for the several contents that underline the constructs which are combined in a Likert scale (John et al., 2010), survey results that evolve from the Likert scale approach in construction management research are analysed using the relative importance index (RII) (Holts, 2014). RII enables the researcher to arrange the items being studied in an ordinal form that reflects perceived agreement, weight, importance, severity, and so on (Holt, 2014). In the five-point Likert-scale option, the “middle” category represents neither a negative or positive response (Jamieson, 2004; Lozano et al., 2008; Holt, 2014). Therefore, responses which fall at the middle point are lost. By using the RII strategy, responses that fall to the midpoint are captured (Jamieson, 2004; Lozano et al., 2008).

The RII method was further used for analysing employee perception in this research. Through the RII, the comparative rank of every response in this study was determined (Lundby & Fenlason, 2000; Whanger, 2002). The formula that was used to calculate the RII is shown below:

$$\text{RII} = \text{Sum of weights } (W_1 + W_2 + W_3 + \dots + W_n) / A \times N$$

where W = weights given to each factor by the respondents and with ranges from 1 to 5

where 1 is “less significant” and 5 is “extremely significant”.

A = highest weight (i.e. 5 in this case) and N = total number of respondents.

In summary, the RII in the quantitative analysis led to the development of the initial employee social sustainability framework based on the relative importance that the respondents attached to each of the social factors. However, the initial social sustainability framework did not offer deeper characteristic (driver and dependence attributes) among the factors. Where deeper characteristics among the factors are shown, the facilities manager would know the factors to prioritise so as to achieve effective social sustainability outcome. Hence, the researcher adopted

the Interpretive Structural Model (ISM) approach to differentiate the factors based on driver and dependence attributes for effective management. The following section elaborates on the ISM approach.

3.12 Interpretive Structural Model (ISM) Approach

The ISM approach is a well-known method for identifying and summarising relationships amongst specific factors. It is an interactive management tool proposed by Warfield in 1974. According to Charan et al. (2008), the ISM approach aids decision-making about complex interrelationships that exist between many elements using maps. Through the maps, unclear and poorly articulated models can be made visible and well-defined to aid decision-making (Ahuja et al., 2009). The approach further assists with the development of a hierarchy framework based on the importance of each factor - thereby providing a visual illustration of the situation. ISM was used in this research to create a better understanding of relationships between the many social sustainability factors affected by the adoption of TI in FM organisations. The employee social sustainability factors that are affected by the adoption of TI in FM organisations were derived from the literature and discussed in Chapter 2 (section 2.6).

3.12.1 Pair-Wise Comparison Study

A pair-wise comparison study is essential for developing a model using the ISM technique. Thurstone introduced the pair-wise comparison in 1927 as an inference tool for the knowledge acquisition technique in knowledge-based systems (Herman & Koczkodaj, 1996). According to Duszak and Koczkodaj (1994), the pair-wise comparison method is a knowledge elicitation technique with a consistency measure. During a pair-wise comparison, two factors are selected, and they are compared to find the relationship between them. In this research, opinions of FM experts drove the pair-wise comparison of the employee social sustainability factors. After the identification of the employee social sustainability factors from the literature, the pair-wise comparison study questions were developed and executed as shown in Figure 3.2.

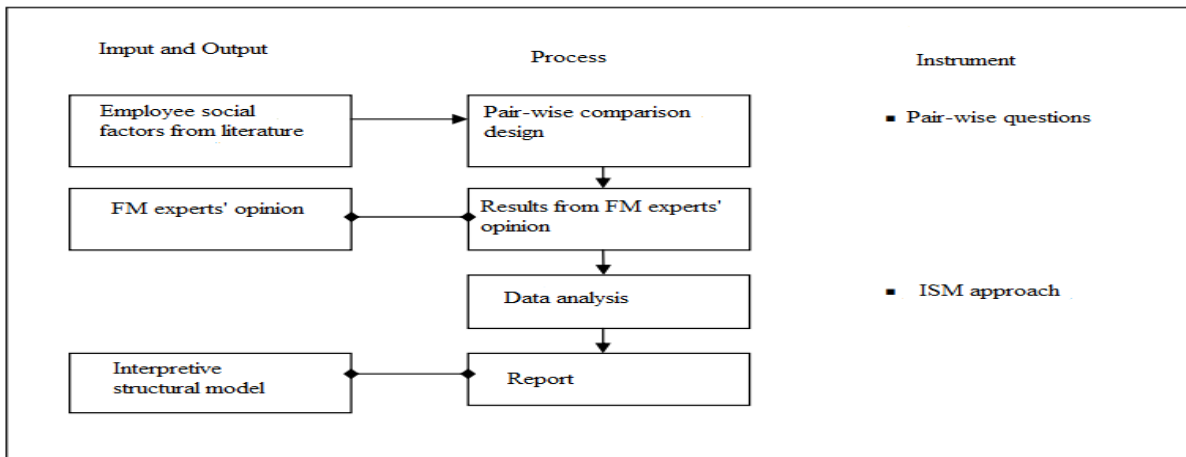


Figure 3. 2: Strategies for the pair-wise comparison study

In the pair-wise comparison study, the respondents were then asked to give their opinion on the relationships among the factors by comparing one factor to another while choosing a letter from the set of V, A, X and O to represent their opinion of the relationship between two factors at any point in time. The four letters represent the following relationships:

V: factor i will help achieve factor j.

A: factor j will help achieve factor i.

X: factors i and j will help achieve each other.

V: factors i and j are unrelated.

3.12.2 Participants in the Pair-wise Comparison Study

The participants in the pair-wise comparison were FM professionals who showed interest in the study and had relevant experience in the management of employees. Previous studies affirmed that there is no standard number of participants for the pair-wise comparison study (Sushil, 2012). However, Kingsley and Brown (2010) and Grzybowska (2012) emphasised that all the participants in the pair-wise comparison study should have fair knowledge and understanding of the topic under investigation.

3.12.3 Data Analysis

The data output from the pair-wise comparison study was analysed using the ISM approach to find the relationships among the factors and the hierarchy of the factors. Consequently, the ISM for promoting employee social sustainability in FM practice was developed. The analysis was completed through the following steps:

- Identification of the factors that are relevant to employee social sustainability
- Establishment of the contextual relationship among the several factors identified
- Development of a structural self-interaction matrix (SSIM) that shows the pair-wise relationship among the factors
- Development of a reachability matrix based on the SSIM and the calculation of the numerical mutual influence. The matrix is then checked for transitivity. The transitivity of the contextual relation is a basic assumption in ISM which states that, if element A is related to element B, and if element B is related to element C, then element A is related to element C. The SSIM format is then converted into the reachability matrix format by transforming the information in each entry of the SSIM into 1s and 0s in the reachability matrix.
- The reachability matrix is then partitioned into distinct levels.
- Based on the relationships in the reachability matrix, the transitive links are removed and a directed graph (digraph) is drawn.
- The ISM is then constructed by replacing variable nodes with the statements.
- The proposed model is reviewed by checking for conceptual inconsistency after which necessary modifications are made.

After the ISM was established, the Matrix Impact Cross References Multiplication Applied to a Classification (MIC-MAC) analysis was conducted to classify the factors. The development of the MIC-MAC analysis is based on the driving powers and dependencies of each social factor in the final reachability matrix (Faisal & Rahman, 2008; Mandal & Deshmukh, 1994). In the MIC-MAC analysis format, the factors are categorised into four clusters based on their driving powers and dependencies. Cluster 1 consists of the autonomous factors, characterised by weak driving power and weak dependence. Cluster 2 consists of the dependent factors that are characterised by weak driving power but strong dependence. Cluster 3 consists of the linkage factors which are characterised by strong driving power and strong dependence. The last quadrant, cluster 4, consists of independent factors that have strong driving power but weak dependence. The ISM analysis is discussed in greater detail in Chapter Five.

3.13 Qualitative Data Analysis

There are several approaches for analysing qualitative data. Madill and Gough (2008) categorised qualitative data analysis into four major approaches namely: discursive, thematic, structured, and instrumental. Content analysis, which can either be qualitative, quantitative or

structural, depending on the type of study, can also be used in a qualitative data analysis (Fellow & Liu, 2008; Bowen et al., 2012). The current study used the thematic and content analysis (Blaxter et al., 2006; Edwards & Holt, 2010).

3.13.1 Thematic analysis

The thematic analysis process involves conducting interviews and examining documents and reports, with a view to extracting useful information from them, summarising the data, grouping the data into themes, and making a composite summary for presentation (Blaxter et al., 2006; Fellow & Liu, 2008; Joffe, 2012). According to Sparker (2005), thematic analysis involves the breaking down of narrative material into relatively smaller units of content for descriptive purpose. Braun and Clarke (2006) affirm that thematic analysis involves searching through a document to find a repeated pattern of meaning. Daly et al. (1997) affirm that thematic analysis demonstrates which themes are important in the explanation of the phenomenon under study. Thematic analysis is suitable for answering questions about people's concerns and events, procedures, and services (Ayres et al., 2007). Furthermore, Green and Thorogood (2004) affirm that thematic analysis is also proper for conducting exploratory research where much is unknown. Through thematic analysis, a common thread can be established across an entire set of interviews (Green & Thorogood 2004; Braun & Clarke, 2006).

3.13.2 Justification for Thematic Analysis

Thematic analysis, like other qualitative methods, helps the gathering of knowledge of what the participants of the study perceive about the phenomenon under study. The perception of the participants of the study provides the required groundwork for establishing effective models of human thinking, feeling, and behaviour (Joffe, 2012). Joffe further argues that thematic analysis is among the most systematic and transparent forms of qualitative research analysis, partly because it accounts for the frequency of themes as important, without sacrificing depth of analysis. According to Braun and Clarke (2006), thematic analysis has characteristics that makes it suitable for a qualitative research study.

3.13.3 Thematic Data Analysis Process

After transcribing the qualitative interviews (see appendix F), there are six major steps to thematic data analysis as found in previous studies (Boyatzis, 1998; Joffe & Yardley, 2004; Braun & Clarke, 2006). These are:

i.) Step 1: Becoming Familiar with the Data

The first step is for the researcher to read the transcript a few times to become familiar with the data corpus (i.e. both the interview and memos that were written during the interviews), while also noting down early impressions (Maguire & Delahunt, 2017). Other studies encourage the development of a coding frame (also termed a “coding manual” or “coding book”), which has the full set of codes that are to be used on the dataset (Joffe, 2012). Joffe further argue that these codes could arise from both the content of the present data or be inspired by past studies.

ii.) Step 2: Generating Initial Codes

The second step is to organise the data in a systematic way through actual coding. According to Saldaña (2009) and Maguire and Delahunt (2017), coding reduces the data to smaller meaningful chunks. The coding approach to be adopted depends on the perspective of the researcher and the research question. Where the researcher is concerned with addressing a specific research question, a theoretical thematic analysis is adopted rather than an inductive one. A theoretical thematic analysis codes parts of documents that address the research question rather than coding every part of the document (line-by-line), as in the case of an inductive one (Maguire & Delahunt, 2017). In theoretical thematic analysis, open coding is used. The open coding means that there are no pre-set codes, but rather, codes develop and modify throughout the coding process (Saldaña, 2009). This study used Nvivo 11, a qualitative data software to process the data. Microsoft Excel can also be adopted for coding at this stage (Bree & Gallagher, 2016). According to Joffe (2012), the use of computers for qualitative data analysis allows researchers to deal with many more interviews than manual analyses can, useful comparisons between groups can be made, and patterns of codes can be easily assessed for links between codes, sequencing and co-occurrence in a highly systematic fashion, since retrieval of data is made far easier.

iii.) Step 3: Search for themes

As defined earlier, a theme captures an interesting and significant aspects of the data and/or research question (Maguire & Delahunt, 2017). Braun and Clarke (2006) affirm that there are no hard-and-fast rules about what makes a theme because the significance of a theme is in its characteristics.

iv.) Step 4: Reviewing the Themes

This stage deals with the reviewing, modification and development of the preliminary themes that have been identified, to ascertain whether they make sense (Maguire & Delahunt, 2017).

Then, all the data that are lined are thematically grouped. This process was facilitated by the use of NVivo 11.

v.) Step 5: Defining the Themes

This is the stage of defining the themes that will be used for the presentation of the analysis. The process of refining is to ensure the “essence” of what the theme is all about and the aspects of the data that the theme covers. This is because a detailed analysis is expected to be written. The overall thematic study must be in relation to the research question(s). The themes are also to be checked for the possibility of sub-themes. Sub-themes are found within a theme and are important for the purpose of giving structure to a particularly large theme.

vi.) Step 6: Writing-up

After the themes have evolved, the next stage is to do the final analysis and write up the report. The process of writing up involves telling a story with the data in ways that convince the readers of the merit and validity of the analysis. The analysis must contain interview extracts and provide a short, coherent, reasonable, non-repetitive, and interesting account of the data within and across themes. There must be enough data to show the occurrence of the theme. The extracts that are chosen from the interviews should be such that they aptly capture the ideas that are being put forth by the theme without unnecessary complexity. The extract should, as much as possible, be embedded within the analytic narrative, and try to make argument about the research question. The thematic analysis process is summarised in Table 3.7.

Table 3. 7 : Description of Thematic Analysis Process

Phase	Description of the process
1. Becoming familiar with data:	Transcribing data, repeated reading of the data, and noting of initial ideas
2. Generating initial codes:	Coding of important aspects of the data that relate to the research question and collating data that are relevant to each code
3. Searching for themes:	Gathering codes into possible themes
4. Reviewing themes:	Examining the themes in relation to the coded extracts and generating a thematic “map” of the analysis
5. Defining themes:	Analysing the themes to find the particulars of each theme, and the overall story the analysis tells; defining and naming of each theme.
6. Write up the report:	Selecting vivid, convincing extract examples that address the research question and literature, and writing a scholarly report of the analysis

Source: Maguire & Delahunt (2017)

3.14 Outline of the Research Methods Adopted in the Study

Table 3.8 shows the overall outline of the research methods, the key features of the methods, and the objectives that were achieved by the methods. The questionnaire survey was used to obtain nationwide data about current TIs in South African FM practice, the factors influencing their adoption, the effect of their adoption on the operations and the employees in FM organisations, and the validation of employee social sustainability factors that were found in literature. The RII was used to classify the employee social sustainability factors in the order of importance that the employees attached to the factors. It was the initial attempt to put the factors in a range of relative hierarchical importance. The pair-wise comparison and ISM analysis study presented the model of the factors with respect to the driving and dependent attributes of the employee social sustainability factors. The snowballing research approach preceded the interview survey. The approach pointed the researcher to the organisations that were interviewed while the qualitative interview survey revealed the practical nature of social sustainability practice in contemporary FM organisations. Finally, the thematic analysis approach was adopted in analysing the interview transcripts.

Table 3. 8: Summary of Selected Research Methods

Research method	Key features	Objectives
Questionnaire survey	<ul style="list-style-type: none"> • Suitable for an extensive population study • Useful for quantitative analysis of a considerable number of variables • Suitable for studying a geographically dispersed population. 	<ul style="list-style-type: none"> • To investigate the type of TIs that are used in South African FM organisations • To investigate the factors that influence the adoption of the TIs in FM organisations • To determine the extent of the TI effect on FM operations and employees • To validate the employees' social factors that were found in the literature
Relative Importance Index (RII)	<ul style="list-style-type: none"> • Suitable for determining the relative importance that respondents attach to factors in a survey. 	<ul style="list-style-type: none"> • To ascertain the relative importance that employees attached to each of the social factors • To determine the preliminary hierarchical importance of social factors
Pair-wise comparison and ISM analysis study	<ul style="list-style-type: none"> • Allow the researcher to analyse the relationship between critical factors 	<ul style="list-style-type: none"> • To develop a model of the interrelationships among the employee social factors

Snowballing approach	<ul style="list-style-type: none"> • Enables the researcher to discover the right participants in a study 	<ul style="list-style-type: none"> • To transform unclear and poorly articulated variables in a visual and well-defined model • To determine the organisation in which interviews were conducted
Interview survey	<ul style="list-style-type: none"> • Allows new facts that were not previously contemplated to evolve • Allows the researcher to narrow down interview process to the phenomena of study 	<ul style="list-style-type: none"> • Adopted to understand social sustainability practice in FM organisations • To establish the nature of influence that adoption of TI has on FM practice and employees
Thematic analysis	<ul style="list-style-type: none"> • Breaking down historical material into relatively smaller units of content for description purpose • Establishing a common thread of knowledge across sets of interview data 	<ul style="list-style-type: none"> • To develop themes within which the impact of TI adoption in FM organisation can be understood • For proper presentation of qualitative data analysis

Source: Author

3.15 Ethical Considerations

Ethics in research are the norms and values that distinguish between acceptable and unacceptable conduct (Shah, 2011). Therefore, obtaining ethics clearance and adhering to ethical principles improve the credibility of findings obtained in research, while protecting the privacy of the participants (Jimoh, 2012; Oyewobi, 2014; Odediran, 2016). Ethical norms are guided by the principles of honesty, integrity, informed consent, confidentiality, care, and the right to privacy (Leedy & Ormrod, 2005; Resnik, 2007; Shah, 2011). The researcher applied for and received the approval of the Ethics in Research (EiR) Committee of the Faculty of Engineering and the Built Environment at the University of Cape Town for this study on 18th April 2017, before data collection and compilation (see appendix G).

The questionnaire survey was preceded by a consent letter in which respondents were sufficiently informed about the purpose of the study and type of data to be collected (see Appendix B). Their consent to freely participate in the study was sought, and it was made abundantly clear that they could also withdraw from participating in the research at any time. It can, therefore, be inferred that the consent of those who participated in the study was gained. During the nationwide online survey, the study population of this research (FM organisations

that were registered with SAFMA) were reminded on several occasions, through emails and telephone conversations, to participate in the study. Interviewees were given the option to reject or accept participation or to opt out of the study at any point during data collection. The details of the participants were kept anonymous and remained undisclosed throughout the study. The codes used to identify each of the participants are known only to the principal researcher and the supervisor in line with keeping strict confidentiality.

3.16 Summary

This chapter has explained the methodological bedrock of the research and the various strategies used for data collection and analysis. The mixed-methods approach was used in the study. Both quantitative and qualitative data were collected using a survey questionnaire for the quantitative phase and semi-structured interview questions for the qualitative phase. The questionnaire survey, qualitative interview survey, and snowballing approach were the main instruments of data collection while RII, ISM, and thematic analysis were the methods of data analysis. The next chapter presents the results of the quantitative data analysis and discussion of the findings.

CHAPTER FOUR: QUANTITATIVE DATA ANALYSIS AND RESULTS

4.1 Introduction

This chapter contains the statistical analysis of the responses to the questionnaires that were distributed to all registered FM organisations across South Africa. The purpose of the survey was to (1) determine the categories of TI that are currently utilised in South Africa; (2) determine the factors that are responsible for the adoption of these TIs; (3) determine the impact of the adopted technology on FM practice; (4) validate the social sustainability factors that were identified from literature with the respondents; (5) determine the negative impact of TI adoption the social factors; and (6) develop a framework to manage the social sustainability factors of employees in FM organisations highlighted in the study. Each of the later sections includes the summaries of responses to specific variables in the questionnaire.

4.2 Reliability of the Questionnaire

The starting point of this analysis is the determination of the Cronbach Alpha value to establish the internal consistency of the scales that were used in providing the ratings for the listed factors. In this analysis, data reliability was set at $\alpha \geq 0.7$ as recommended (Yip & Poon, 2009). Pallant (2010) notes that an Alpha value of greater than 0.7 is considered sufficient, however, values above 0.8 are often preferred. According to Darren and Mallery (1999), when the Cronbach Alpha value is > 0.9 , it is excellent, > 0.8 , it is good, > 0.7 , it is acceptable, > 0.6 , it is questionable, > 0.5 , it is poor and values < 0.5 are unacceptable. The overall Cronbach's Alpha in this study was **0.857**. However, the Cronbach Alphas for the various factors that were rated are summarised in Table 4.1.

Table 4. 1: Summary of Cronbach Alphas

Measured variable	No of items measured	Cronbach Alpha
Factors influencing the adoption of TIs	26	0.888
Types of TI used in South Africa	6	0.880
Effect of TI adoption on organisation practices	6	0.849
Critical factors affecting the adoption of technology innovations	6	0.805
Validation of social sustainability factors	16	0.861
Adverse effects of TI on social factors	16	0.857
Overall Cronbach Alphas	76	0.857

4.3 General Information about the Organisations

4.3.1 Characteristics of FM Organisations in South Africa

Section A of the questionnaire examined the number of years the companies have been in business, the number of employees and the academic qualification of the respondent. Figure 4.1 provides the number of years the companies have been in operation. The years were categorised into four. Most of the FM organisations have been in operation for over 20 years representing 65% of the total valid response in the survey. About 10% of the organisations have been in operation for between 16 and 20 years, 5% between 6 and 10 years, while 20% of the organisations have been in operation between 1-5 years. The fact that most of the FM organisations have been operating for over 20 years is crucial to this research as the experiences of the organisations reinforce the credibility and generalisability of the findings of this study base on their ability to adopt TIs.

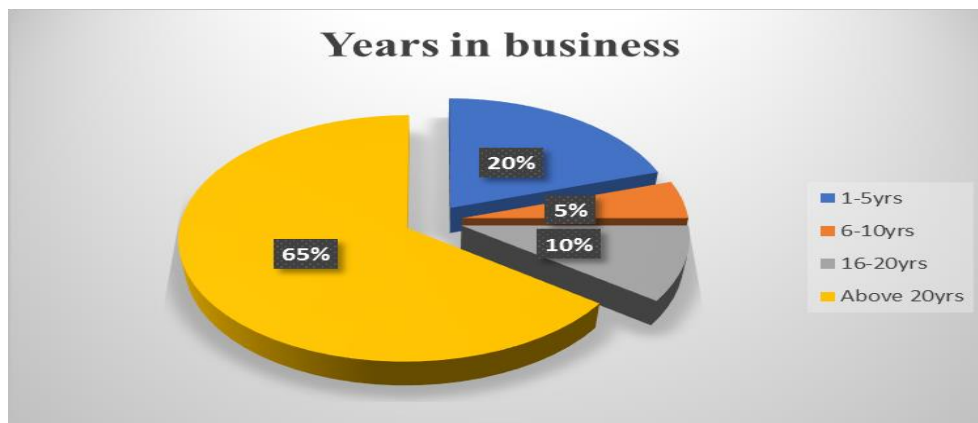


Figure 4. 1: The Number of Years the Organisations have Existed

Figure 4.2 shows the number of employees that are engaged by the FM organisations. The number of employees was categorised into four groups consisting of 1-10, 21-50, 50-100 and above 100 employees. About 62% of the organisations have above 100 employees, 14% of the organisations have between 51-100 and 21-50 employees respectively. Only 10% of the organisations have between 1-10 employees. This observation suggests that FM organisations contribute a substantial number of jobs to the employment statistics of South Africa. These results reinforce the submission that about 445,500 (2.25%) of the 19.8 million total workforce of South Africa are from the FM sector (Fernandez & Sullivan, 2016).

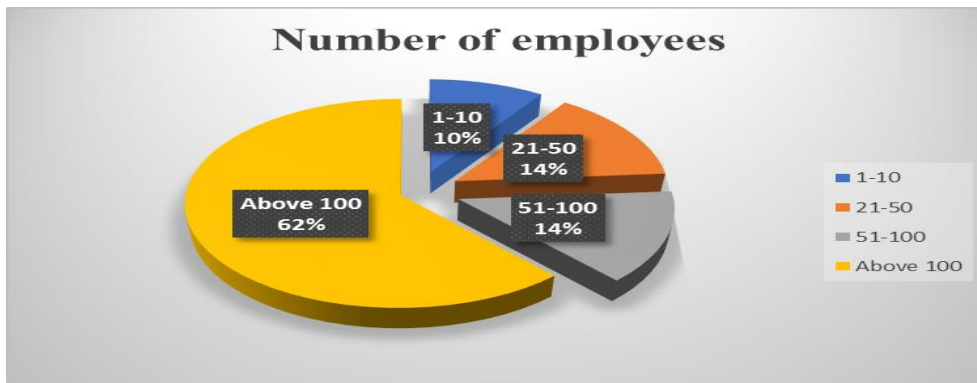


Figure 4. 2: The Number of Employees in the Organisations

Figure 4.3 shows the highest academic qualifications of the respondents in the survey. Their qualifications were classified into four categories: certificate, diploma, bachelor's and master's degrees. About 53% of the respondents have a certificate, 21% have diploma, another 21% have bachelor's while 5% have a master's degree. The analysis shows that most of the respondents FM employees have low-level academic qualifications thereby making them predominantly semi-skilled workers (Frost & Sullivan, 2012).

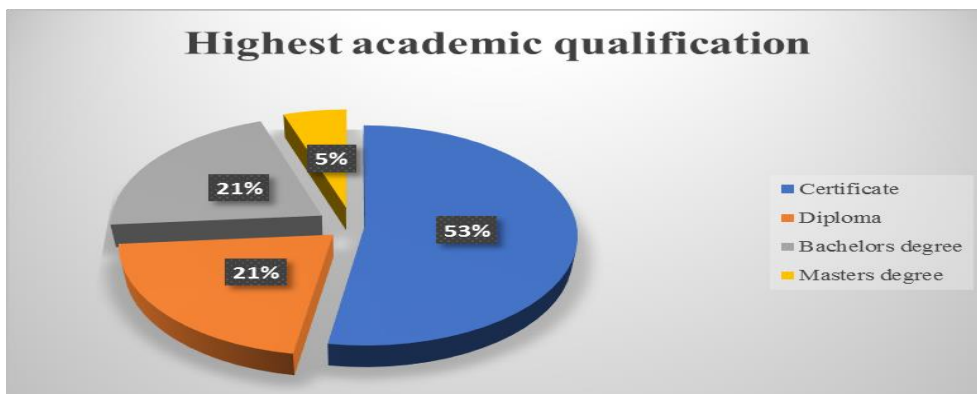


Figure 4. 3: The Academic Level of Respondents

If one analyses the general information of the organisations, a relationship seems to exist between the number of years that the organisations have existed, and the number of employees as shown in Figures 4.1 and 4.2. This relationship reflects the expectation that older companies are more likely to expand than new ones. Furthermore, it can be observed that the 53% of the employees have a certificate as their highest academic qualification. This corroborates the fact that most of the FM services in South Africa are operational based since little education is required in most operational services (Frost & Sullivan, 2012). The general information about the organisations is summarised in Table 4.2

Table 4. 2: Summary of General Information of the Organisations

Years in Business	Frequency	Valid percent	Cumulative percentage
1-5yrs	4	20	20
6-10yrs	1	5	25
16-20yrs	2	10	35
Above 20yrs	13	65	100
Number of Employees			
1-10	2	9.5	9.5
21-50	3	14.3	23.8
51-100	3	14.3	38.1
Above 100	13	61.9	100
Highest Academic Qualification			
Certificate	10	52.6	52.6
Diploma	4	21.1	73.7
Bachelor's degree	4	21.1	94.7
Master's degree	1	5.2	100

4.3.2 Categories of FM Services in South Africa

A quantitative summary of the distribution of FM services declared by participants is presented in Table 4.3. The table contains the categories of FM services obtained from SAFMA and the numbers of organisations expressed in percentages from the 22 respondents. Table 4.3 illustrates the percentage of organisations that provide each service. It is evident from the table that the most popular services provide by FM organisations in South Africa include: Cleaning Services (77%), air condition services (73%), hygiene (73%) and maintenance services (73%). While the less popular services include: relocation (14%), medical (14%) and insurance (14%). From the results, it could be deduced that FM organisations provide more operational than strategic FM services in South Africa.

Table 4. 3: Distribution of the FM Service Categories

Popularity	Category	Counts	%	Popularity	Category	Counts	%	Popularity	Category	Counts	%
1	CLEA	17	7	14	SPAC	12	55	27	QUAN	7	32
2	AIRC	16	3	15	ENGI	11	50	28	TELE	7	32
3	HYGI	16	3	16	SIGN	11	50	29	FINA	6	27
4	MAIN	16	3	17	CSLT	10	45	30	TRAI	6	27
5	CSTR	14	4	18	FSER	10	45	31	OTHE	5	23
6	PEST	14	4	19	INPL	10	45	32	FLOO	5	23
7	SECU	14	4	20	REAL	10	45	33	FSOF	5	23
8	PLUM	14	4	21	PRIN	10	45	34	R&D	5	23
9	CATE	13	9	22	ENER	9	41	35	LABO	4	18
10	PROJ	13	9	23	QUAL	9	41	36	INSU	3	14
11	LAND	12	5	24	WAST	9	41	37	MEDI	3	14
12	LIGH	12	5	25	RETA	9	41	38	RELO	3	14
13	PROP	12	5	26	GDFM	7	32				

Key: CLEA: cleaning; AIRC: air conditioning; HYGI: hygiene; MAIN: maintenance; CSTR: construction; PEST: pest control; SECU: security; PLUM: plumbing; CATE: catering; PROJ: project management; LAND: landscaping; LIGH: lightening; PROP: property; SPAC: space planning; ENGI: engineering; SIGN: signage; CSLT: consultancy; FSER: facility services; INPL: indoor plants; REAL: real estate; PRIN: printing and stationary; ENER: energy; QUAL: quality control; WAST: waste management; RETA: retailing; GDFM: genset diesel fuel maintenance; QUAN: quantity surveying; TELE: telecommunication; FINA: financial management; TRAI: training; OTHE: others; FLOO: flooring; FSOF: FM software; R&D: research and development; LABO: labour; INSU: insurance; MEDI: medical; RELO: relocation

4.4 Level of TI Adoption in South Africa

To determine the level of TI adoption in FM organisations, respondents were asked to indicate how often they use the different categories of TIs in their organisation. The results in Table 4.4 suggest that, in the ICT category, 50% of respondents confirmed to using ICT regularly in their FM practice; while 18.2% reported they did not. This shows that ICT is widely adopted in FM practice in South Africa. In the robot category, about 41% of the respondents stated they are not using robots for FM practice while 18.2% indicated that they were. This result resonates with the submission of Atkin and Bildsten (2017) who describe the robot as one of the variants of Artificial Intelligence (AI) that is gradually becoming popular in FM service. Therefore, it is not surprising that robots appeared as the least adopted TI in South African FM practice.

Under the sensor category, while 50% of respondents indicated that their organisations were using different types of sensors, only about 18.2% of respondents indicated that their organisations were not using sensors. An estimated 36.4% of the respondents indicated that their organisations were using drone technology while 31.8% of organisations were not utilising drone technology. In the category of cloud-based technology, 54.5% of respondents indicated that their organisations were using it, while only 13.6% of respondents indicated that their organisations were not using any form of cloud-based technology.

From the above results, it is obvious that cloud-based technology, ICT and sensors constitute the top three technologies that are highly adopted in South African FM organisations. This agrees with the submission of several authors on the popularity of ICT and CBT as an enabler of FM service provision (Lunn & Stephenson, 2000; Scupola, 2014; Atkin & Bildsten, 2017). Also, the TI categories indicate a complementary relationship. For example, sensors and cloud-based technologies need ICT adoption as indicated in the analysis (Grimshaw, 2007).

The questionnaire also made provision for the respondents to state any other type of technology that their organisations have been using under the category of “others”. The respondents indicated different types of TIs which include: Building information management system (BIMS), Analytics, IoT technology, Real Dynamic Route Planning and Optimisation, Call logging application, FM enterprise, Lighting communication, Wearable devices, Virtual realities with 4.5% each.

Table 4. 4: Level of TI Adoption

Technology innovations	No %	Yes %	No response %
ICT	18.2	50	31.8
Robots	40.9	18.2	40.9
Sensors	18.2	50	31.8
Drone technology	31.8	36.4	31.8
Cloud-based technology	13.6	54.5	31.9
Others			
BIMS		4.5	95.5
Analytics		4.5	95.5
IoT technology		4.5	95.5
Real dynamic route planning and optimisation		4.5	95.5
Call logging application		4.5	95.5
FM enterprise		4.5	95.5
Lighting communication		4.5	95.5
Wearable devices		4.5	95.5
Virtual realities		4.5	95.5

4.5 Evaluation of the Factors Influencing the Adoption of TIs in FM Organisations

The factors influencing the adoption of TIs in FM organisations were measured on a five-point Likert scale in the questionnaire with the lowest value 1 = very low, 2 = low, 3 = medium, 4 = high and 5 = very high as the highest value. The factors were analysed based on the RII of the variables. The RII shows the relative importance that the respondents attached to the factors. According to Hickson and Ellis (2014), the RII procedure is suitable for investigating employee perception on organisation issues; hence, it becomes a suitable approach for this research. It is used to assess the factors that influence the adoption of TI in FM organisations in this research. Furthermore, studies suggest that the RII approach shows the importance of a factor amongst group of factors under consideration thereby indicating the factor(s) that need more allocation of organisation resources (Lundby & Fenlason, 2000; Whanger, 2002; Nyoni & Bonga 2016). Investigating the existing technology models led to the development of 26 factors that were used in evaluating the adoption of TI in FM organisations. These factors were grouped into 6 categories namely: performance expectancy, facilitating conditions, effort expectancy, social influence, employees' resistance to change, and top management support (Sepasgozar & Bernold, 2013). The results are presented in Table 4.5 (see page 105), subsequent to discussions of the contents of the table.

The results show that the "performance expectancy" category with 8 factors, had the highest number of factors, while the "employee's resistance to change" category consisted of only 2 factors. All the factors in the various categories had $RII > 0.5$. These results further indicate that respondents accorded significant importance to all the factors that influence the adoption of TIs in FM organisations. An evaluation of the RII according to these categories shows that the effort expectancy category had the highest RII value of 0.71. This value implies that the category is most influenced by the adoption of TI amongst the 6 categories. The next category is the "social influence factors" category with an average RII of 0.697. "Performance expectancy" has an average RII of 0.696, "top management support" has an average RII of 0.682, and "employee resistance to change" has an average RII of 0.668 while "facilitating conditions" has an average RII of 0.65 in the consideration for TI adoption in South African FM organisations.

However, an evaluation of the RII of the individual factors showed that "apparent usefulness of technology" under the "performance expectancy" category has the highest RII of 0.752. Furthermore, this factor emerged as the overall 2nd factor amongst the 26 factors that influence the adoption of technology. "Apparent usefulness" is highlighted as a fundamental factor that

determines adoption of TI in different adoption theories. The Technology Acceptance Model (TAM) notes that “apparent usefulness” is a fundamental factor in a technology adoption decision (Davis, 1989; Talukder, 2012). The result implies that the value that a TI can add to an organisation based on the potential usefulness influences its adoption. The distinction of apparent usefulness makes practical sense because organisations are encouraged to adopt technologies because of the functions they perform, and with what ease or difficulty the system can perform those functions (Davis, 1989). Although “apparent usefulness” is important in TI adoption, the impact of this usefulness on the employees is often ignored. It is possible that the technology is useful, but at the same time, harmful to the employees (West, 2015; Atkin & Bildsten, 2017).

Following “apparent usefulness” of technology is “improved job efficiency” with an RII of 0.74. This factor also ranks as the 3rd factor overall to consider when adopting TI. The factor ensures that the adoption of TIs positively influences job efficiency. This result resonates with previous studies, which affirm that the adoption of technology provides the landscape for improved business efficiency by lowering costs and time-consuming processes as well as increasing revenues, effective operations, and creating a more attractive workplace (Logan, 2016). Logan further posits that the introduction and use of TIs help to streamline work processes and increase employee job efficiency. For instance, adopting software and service-based technologies can reduce expenses that typically take about 1-3% of revenue (Logan, 2016).

Similarly, cloud computing can leverage off-site, virtual-based technologies, which positively impacts on hardware costs with respect to maintenance and access. However, the factor of “relative advantage over competitors” was rated lowest with an RII of 0.667. A TI which is not easy to use impedes the competitive edge of a business regardless of its perceived benefits (Lourens & Jonker, 2013). Although relative advantage over competitors in business is a necessity, the ease of technology and improvement in job performance are fundamental bases for getting ahead. It was, therefore, not surprising that the factor of “getting ahead of competition” emerged after “ease of technology use” and improvement in job performance.

In the “facilitating conditions” category, the task of fully understanding the nuances of a major TI and its potential is critical to the adoption decision (Swanson & Ramiller, 2004). The inability to understand the potential of adopted TI can complicate instead of simplifying the work of the employees. It was not surprising that “simplification of work” was rated highest

with an RII of 0.733. It also ranked as the 5th overall among the technology adoption factors. The simplification of work using TIs depends on the understanding of the potentials of the technology. In the same category, “easy to train workers to understand the work” came second with an RII of 0.648. It, however, emerged as the 16th most important factor on the overall ranking. According to Armstrong (1996) and Zhao and Cziko (2001), training is a key factor that influences the adoption of TIs in organisations. From this result, it is obvious that when the work is simplified, it becomes much easier to train workers in the various aspects of the work.

One advantage of adopting TIs is to support management in decision-making through relevant information (Kokos, 2004). In the category of “effort expectancy”, the factor of “improved decision-making” had the highest overall RII of 0.781. This result reflects Atkin and Bildsten’s argument which suggests that sound decision-making is the foundation for organisation success. Management will, therefore, deploy resources that will aid the process of decision-making, including the adoption of TIs (Atkin & Bildsten, 2017).

Following the factor of improved decision-making is the “ease of technology use”. “Ease of use” is an indication that technology will be relatively free of cognitive burden (Agarwal & Karahanna, 2000). From the above result, it can be deduced that the need to reduce the burden of work is the highest factor influencing technology adoption. Agarwal and Karahanna (2000) further argue that when employees perceive that technology creates ample time for task completion, there is generally a higher acceptance of such technology. This result further agrees with the argument of other studies on technology adoption that see perceived usefulness and perceived ease of use as crucial factors of technology acceptance (Davis, 1989; Tseng, 2011; Talukder, 2012). There is no need to acquire a technology that is redundant.

“Ease of use” has an RII factor of 0.705. The “ease of use” of technology translates into making the entire “process of work easy” as the next factor with an RII of 0.7 in the “effort expectancy” category. Under the “social influence factor”, “enhancement of the organisation image” was ranked 1st with an RII of 0.724. The image of the organisation is a key factor in sustainable operations. Therefore, organisations seek to deploy technology that will enhance their corporate image. This factor is important to technology adoption in FM organisation as respondents rank it 6th on the overall ranking. “Improved comparative advantage” was ranked next in this category with an RII of 0.714 and ranked as the 8th most important factor on an overall scale.

In the “employee resistant to change” category, there were only two factors: “employees are receptive to new changes”, and “supports continuous employee innovations”. “Support for continuous innovations” amongst employees ranked higher with an RII of 0.718 and also emerged as the 7th overall most important factor that is critical to the adoption of TIs in FM organisations. In the category of “management support”, the factor of “technology is in line with the overall policy of the organisation” was ranked highest and overall 4th most important factor with an RII of 0.736. The response is understandable since organisations will not support actions that are not supportive of their strategic goals (Pfeffer, 2009). The “assurance of training and retraining” ranked 2nd with an RII of 0.682 while “assurance of after sales support” was ranked the least with an RII of 0.627.

Table 4. 5: Evaluation of the Factors Influencing the Adoption of TIs in FM Organisations

Coding	Factors influencing the adoption of TIs	Freq.	SD	$\sum w$	RII	ØRII	R	OR
Performance expectancy						0.696		
IF1	Improves job performance	21	0.51	74	0.705		3	9
IF2	Increases job efficiency	20	0.66	74	0.740			3
IF3	Increases the pace of work delivery	21	0.86	71	0.676			13
IF4	Work volume is increased	21	0.72	69	0.657			15
IF5	Work quality is improved	21	0.60	73	0.695			11
IF6	There is apparent usefulness of the technology	21	0.44	79	0.752			2
IF7	There is a possibility of relative advantage over competitors	21	1.06	70	0.667			14
IF8	Overhead cost is reduced	21	0.74	71	0.676			13
Facilitating conditions						0.650		
IF9	Simplification of work	21	0.48	77	0.733		6	5
IF10	Workers are easily trained to understand the job	21	0.70	68	0.648			16
IF11	Reduced complexity of FM operation	21	0.80	64	0.610			20
IF12	Technology is compatible with current trends in FM operations	21	1.02	64	0.610			20
Effort expectancy						0.710		
IF 13	Work is made easier	20	0.51	70	0.700		1	10
IF 14	The technology is easy to use	21	0.68	74	0.705			9
IF 15	The work is less challenging with technology	21	0.48	70	0.667			14
IF 16	The human input in operation is reduced	21	0.81	73	0.695			4
IF 17	Improved decision-making is enhanced with technology	21	0.62	82	0.781			1

Social influence						0.697
IF 18	Organisation image is enhanced	21	0.92	76	0.724	2 6
IF 19	The comparative advantage is increased	21	0.75	75	0.714	8
IF 20	The capability of the firm among competitors	21	1.12	74	0.705	9
IF 21	Employee motivation and interpersonal relations	22	0.69	71	0.645	17
Employee resistance to change						0.668
IF 22	Employees are receptive to new changes	22	0.68	68	0.618	5 7
IF 23	Supports employee continuous innovation	22	0.50	79	0.718	19
Top management support						0.682
IF 24	It is in line with the overall objective of the organisation	22	0.57	81	0.736	4 4
IF 25	Intended adequate training and retraining	22	0.89	75	0.682	12
IF 26	Assurance of adequate after sales support service from vendor	22	1.08	69	0.627	18

Freq.: frequency; SD: standard deviation; $\sum w$: weighted total; RII: relative importance index; ØRII: average relative importance index; R: rank; OR: overall rank

4.6 Impact of Adopted TI on FM Practice

This section measures the impact of adopted TI on FM core business objectives. The measurement was carried out along six core business objectives which include: productivity, running cost, efficiency, corporate image, flexibility, and connectivity. A five-point Likert scale with estimated percentage impact was adopted for this measurement. In the scale, 0-20% means level 1, 20 – 40% means level 2, 40 – 60% means level 3, 60 – 80% means level 4, and 80 – 100% means level 5. Respondents were requested to indicate the percentage that corresponded to the level that adoption of TI has affected any of the factors in their organisations. The results were analysed through descriptive statistics and reported in Table 4.6.

The findings, as summarised in Table 4.6, show that the adoption of TIs give rise to more flexibility, efficiency and connectivity. The mean scores range between 3.00 to 3.19. The mean score of flexibility is 3.19 (62%), the mean score of efficiency is 2.06 (41%) while the mean score of connectivity is 3.00 (60%). The range of these percentages is between level 2 to 4 category of impact. This result indicates that the adoption of TIs positively affects the level of connectivity, efficiency and flexibility of the organisation experience. The results are in line with previous studies that noted connectivity and flexibility as crucial factors for organisational survival and global competition (Grimshaw, 2007; Holmes et al., 2007; White & Glickman,

2007). Grimshaw (2007) similarly argues that when FM organisations adopt ICT technology, it increases connectivity amongst employees which also leads to increased productivity. Productivity is enhanced because the internet connectivity leads to “virtual office” practice thereby saving the time that would have been lost to commuting. Table 4.6 further shows that running cost, productivity and corporate image have their mean scores ranging between 2.41 to 2.94 which means that the adoption of TI in FM organisations reduces the running cost, while at the same time increases the corporate image and the productivity of the organisation by 20-40%.

Table 4. 6: Impact of Adopted TI in FM Practice

Coding	Factor	Frequency	Mean	%	Std. Deviation	Rank
FA1	Productivity	17	2.53	50	1.12	6
FA2	Running Cost	17	2.41	44	1.00	4
FA3	Efficiency	17	3.06	60	0.75	2
FA4	Corporate Image	17	2.94	59	1.03	5
FA5	Flexibility	16	3.19	62	0.66	1
FA6	Connectivity	17	3.00	60	0.71	3

4.7 Determination of the Social Sustainability Impact of TI On FM Employees

4.7.1 Confirming the Employees’ Social Factors Impacted by the Adoption of TIs

Given the subjective nature of social sustainability and its dependence on the perception of various social groups (Doloi, 2012), it became necessary to confirm the employees’ social factors developed from theoretical background with the respondents. The social sustainability factors were measured on a five-point Likert scale to confirm their authenticity as social sustainability factors, from the respondents. Respondents were asked to choose 1 if they strongly disagree, 2 = disagree, 3 = undecided, 4 = agree and 5 = strongly agree. Furthermore, the 16 social sustainability factors were grouped under 3 constructs: “social relationship”, “job satisfaction”, and “knowledge development”. The factors were analysed using RII and the results are presented in Table 4.7.

In the “social relationship” construct, there were 5 factors among which “social isolation” was ranked highest with an RII of 0.736. It was also ranked as the 5th most important social sustainability factor. This meant the respondents recognised “social isolation” as one of the

most significant factors of their “social relationships”. This result is consistent with those of previous studies that recognised “social isolation” as a major experience of people working in virtual offices (Vega & Brennan, 2000; Marshall & Marshall, 2007).

The next factors to “social isolation” were “overwork” and “work and home-life balance”, both of which had an RII of 0.733. The result about “overwork” agrees with the findings of Kossek et al. (2009) that highlighted “overwork” as a social sustainability factor which can affect employees’ social wellbeing. Furthermore, “work and home-life balance” has been identified in past studies as a critical social factor of employee social sustainability (Zhang, 2016). The factor with the least importance index is “Alienation” with an RII of 0.70.

In the category of “job satisfaction”, “job-security” was authenticated as the most important social sustainability factor. This factor also emerged as the most important factor overall with an RII of 0.827. “Job-security” as a critical social factor is fundamental to the sustainability of employees (Türkey et al., 2016). “Remuneration” was authenticated as the 2nd most important factor in this category with an RII of 0.8. It is obvious that the essence of working is to earn wages and support livelihood. It is, therefore, not surprising that “remuneration” as a social factor has this rating. “Remuneration” is also rated as the 2nd most important factor of employee social sustainability overall. The least ranked factor in this category is “task requirement” with an RII of 0.714. “Task requirement” is an important social sustainability factor because work design influences the social sustainability of human resources (Docherty et al., 2009).

In the category of “knowledge development”, “professional development plans” and “retirement development plans” were both rated highest with an RII of 0.764. In the knowledge economy, a “professional development plan” is an essential social and economic factor (Brödner, 2008). Employees are continually developing themselves professionally to stay relevant in the globalised economy (Bhatt, 2001). In the same manner, the dynamics of the global economy are displacing many employees, hence, the need to have a sound “retirement development plan” in place. These two factors, therefore, have long-term social consequences for employees. “On-the-job training” and “workshops and seminars” were ranked second with an RII of 0.709.

The following section of the analysis seeks to evaluate the negative impact of TIs on the authenticated employee social sustainability factors.

Table 4. 7: Validating Employees’ Social Factors Impacted by the Adoption of TIs

Coding	Employees social factors	Freq.	SD	$\sum w$	RII	\emptyset RII	R	OR
Social relationship						0.729		
SF1	Alienation	22	0.74	77	0.700		3	10
SF2	Social network	22	0.72	73	0.664			11
SF3	Work and home-life balance	22	0.47	85	0.733			6
SF4	Overwork	22	0.64	85	0.733			6
SF5	Social isolation	22	0.84	81	0.736			5
Job satisfaction						0.764		
SF6	Remuneration	22	0.31	88	0.800		1	2
SF7	Autonomy	22	0.49	80	0.727			7
SF8	Job-security	22	0.47	91	0.827			1
SF9	Interpersonal relationship	22	0.50	84	0.764			4
SF10	Professional status	22	0.65	87	0.791			3
SF11	Task requirement	21	0.51	75	0.714			8
SF12	Organisation policy	22	0.49	80	0.727			7
Knowledge development						0.736		
SF13	Workshops and seminars	22	0.74	78	0.709		2	9
SF14	Professional development plan	22	0.91	84	0.764			4
SF15	Retirement development plan	22	1.05	84	0.764			4
SF16	On-the-job training	22	0.86	78	0.709			9

Freq.: frequency; SD: standard deviation; $\sum w$: weighted total; RII: relative importance index; \emptyset RII: average relative importance index; R: rank; OR: overall rank

4.7.2 Negative Impacts of TIs Adoption on the Employees’ Social Sustainability Factors

This section evaluates the negative impact of TIs on the social sustainability of FM employees. As mentioned earlier, social sustainability factors were classified into three constructs - social relationship, job satisfaction, and knowledge development. The factors in each of the constructs were measured on a five-point Likert scale where 1= very low, 2 = low, 3 = moderately, 4 = high, 5 = very high. Respondents were asked to rank the level to which the adopted TIs have negatively affected their social sustainability. The factors were analysed using RII and the results are presented in Table 4.8.

Under the social relationship construct, “overwork” was ranked the most affected factor when TIs are adopted in FM organisation. This result meant that the employees of FM organisations were experiencing increased volume of work following adoption of TIs. Contrastingly, Meyer (2007), argues that the adoption of TIs should reduce the work-load on employees. However, the result resonates with the argument that the use of technology (especially ICT) leads to overwork if boundaries of work are not defined (O’Driscoll et al., 2009; Kossek et al., 2009).

When employees are compelled to be available 24/7 based on connectivity, it becomes possible for employees to be overworked. Furthermore, Rousseau (2006) and Pfeffer (2009) argue that monitoring of work processes and outcomes through technology can increase performance pressure, which results in overwork for the employees. Kossek et al. (2009) also argues that job control and boundary management can significantly moderate employee social wellbeing. Some of the services offered by facilities managers, especially those driven by network connectivity on mobile devices, require that personnel be reachable on a 24/7 basis to respond to queries that may arise and also monitor facilities. Hence, it is possible for overwork situations to arise.

“Alienation” was ranked second with an RII of 0.736. The constant engagement with technology at the workplace can separate FM employees from their social network. This result aligns with Grimshaw’s (2007) affirmation that the use of technology by FM employees alienated them from certain aspect of their lives. The other factors such as “social network”, “work home-life balance” and “social isolation” had an RII of 0.709 each and were all rated next to “alienation”. The result suggests that FM employees’ social network suffers with the adoption of TIs in their organisations. Employees are also unable to balance their “work and home-life” because work intrudes into their private lives making them socially isolated due to constant engagement with technology.

In the “job satisfaction” category, “job-security” was ranked the most negatively affected factor with an RII of 0.818. TI has increased work flexibility and many organisations cannot promise job-security. According to Clarke and Patrickson (2008:122), “many organisations are now driven by the need to be flexible and adaptable and, therefore, are no longer able to promise long-term job-security”. Furthermore, this result agrees with the findings of previous studies suggesting that technology leads to job-loss (West, 2015; Atkin & Bildsten, 2017).

“Autonomy” was ranked 2nd factor with an RII of 0.764. Most of the complex decisions that are required in the work process have been reduced to software and programs that are largely technology driven. At the operational FM level, employees are only engaged in the periodic monitoring of machines and building elements that have displaced employees. Technology, therefore, reduces employee autonomy because routine activities at the operational level have been programmed into software. The adoption of technology in most organisations reduces the burden of cognitive ability (Davis et al., 1992; Agarwal & Karahanna, 2000).

The next employee social factor that is negatively affected by TI adoption is “Professional status” with an RII of 0.745. The adoption of TIs in FM organisations puts employees under pressure to acquire new knowledge to prove their economic relevance in the organisation. Kandampully (2002) argues that knowledge and creative abilities determine the true economic value of employees. However, the level to which acquiring new knowledge will be easy is dependent on the level of education. Previous studies have found a positive relationship between the level of education and employee innovativeness in learning (Rasmussen, 2012; Støren, 2016). Putting the level of education of respondents in this study into perspective, about 73.7% of respondents have diploma and certificates while only 26.4% have bachelor’s and above. The educational level of FM employees enhances their level of creativity and innovation (Rasmussen, 2012; Støren, 2016). Hence, the less educated employees are faced with the pressure of changing their professional status.

Among the least affected employees’ social sustainability factors is “interpersonal relationship”. This can be attributed to the fact that there is a lot of interconnectivity among the employees through ICT. Then, “Organisation policies” was ranked among the least affected factor. Although the policies of organisation are constantly changing because of the need to meet the current realities of TI adoption, its effect on the employee is ranked among the least. Furthermore, TI adoption makes the “task requirement” in the organisation simple to execute. Hence, the employees ranked “Task requirement” with technology as one of the least affected.

In the “knowledge development construct”, “professional development plan” was ranked the highest negatively affected factor with an RII of 0.701. Technology influences all aspects of an employee’s career. From the hiring and selection process (via Web site applications), to the training (by means of online learning), evaluation (using computerised performance appraisals), including the type of work they do and where it is done (e.g., telework, virtual teams), all have been influenced by technology. Therefore, there is a need for training to build on the existing knowledge of the employees. However, previous studies suggest that the capacity for training and innovation is weakened by the educational level of employees (Rasmussen, 2012; Støren, 2016). Therefore, the employees will require some level of educational training upon which to build further knowledge. Employees who lack a sound education foundation upon which to build training can be negatively affected in terms of forced retrenchment.

“Retirement development plan” is ranked second with an RII of 0.636. The results revealed that organisations hardly have concrete retirement development plans for the employees that are affected by the adoption of TI. As earlier stated, the adoption of TI puts the FM employees under pressure to pursue further studies. Besides, the adoption of TIs also comes with training for the employees, thereby making it one of the least negatively affected employees’ social sustainability factors. However, anxiety arises in those with weak and diminished educational background. The demand for further training leads to much on-the-job training, which is ranked the least negatively affected with RII of 0.618. It is obvious that the huge training programmes that accompany TI adoption in organisations will make the factor least affected (Martin et al., 1998).

Table 4. 8: Social Implications of Adopting TIs on FM Employees

Coding	Social sustainability factors	Freq.	MS	SD	$\sum w$	RII	ØRII	R	OR
Social relationship							0.736		
SR1	Alienation	22	3.68	0.95	81	0.736		1	4
SR2	Social network	22	3.55	0.96	78	0.709			6
SR3	Work and home-life balance	22	3.55	0.74	78	0.709			6
SR4	Overwork	22	4.09	0.81	90	0.818			1
SR5	Social isolation	22	3.55	1.18	78	0.709			6
Job satisfaction							0.727		
JS1	Remuneration	22	4.14	0.56	91	0.736		2	4
JS2	Autonomy	22	3.82	0.80	84	0.764			2
JS3	Job-security	22	4.09	0.68	90	0.818			1
JS4	Interpersonal relationship	22	3.50	0.74	77	0.700			7
JS5	Professional status	22	3.73	0.63	82	0.745			3
JS6	Task requirement	22	3.23	0.53	71	0.645			9
JS7	Organisation policy	22	3.41	0.59	75	0.682			8
Knowledge development							0.637		
KD1	Workshops and seminars	22	3.09	0.61	68	0.618		3	11
KD2	Professional development plan	22	3.09	0.68	68	0.710			5
KD3	Retirement development plan	22	3.18	0.73	70	0.636			10
KD4	On the job training	22	2.91	0.68	64	0.582			12

Freq.: frequency; SD: standard deviation; $\sum w$: weighted total; RII: relative importance index; ØRII: average relative importance index; R: rank; OR: overall rank

4.8 Towards Developing the Framework for Social Sustainability Pursuit in FM

Through the process of validating the employees’ social factors, respondents were asked to rank the factors according to the perceived relative importance. Table 4.9 presents these results.

The overall level of the factors was determined by reordering of the RII index from highest to the lowest. The closer the relative importance index to 1, the more important the factor (Nyoni & Bonga, 2016). In Table 4.9, “job-security” with an RII of 0.827, was ranked the most important factor amongst the social sustainability factors in this study. Previous studies note that employees want to be secure in their employment because employment creates a platform for social integration (Novo-Corti & Barreiro-Gen, 2014). Job-security as the key social factor mirrors Lu et al. (2016) argument which affirmed that employee job-security was the most critical factor of sustainability in a study of container seaports in Taiwan. Remuneration is the next factor based on the analysis. Remuneration is a product of employment; therefore, it is not surprising that it was ranked the second most important factor after job-security. “Professional status”, “interpersonal relationship” and “professional development plans” were next with 0.791, 0.764, and 0.764, respectively. However, the respondents ranked organisation policy, task requirement, on-the-job training, and social network as less important factors, with relative importance indices of 0.727, 0.714, 0.709, and 0.664, respectively.

Table 4. 9: Overall Ranking of Social Sustainability Factors in FM Organisations

Coding	Employees social factors	RII	OR
SF8	Job-security	0.827	1
SF6	Remuneration	0.800	2
SF10	Professional status	0.791	3
SF9	Interpersonal relationship	0.764	4
SF14	Professional development plan	0.764	4
SF15	Retirement development plan	0.764	4
SF5	Social isolation	0.736	5
SF3	Work and home-life balance	0.733	6
SF4	Overwork	0.733	6
SF7	Autonomy	0.727	7
SF12	Organisation policy	0.727	7
SF11	Task requirement	0.714	8
SF16	On-the-job training	0.709	9
SF1	Alienation	0.700	10
SF2	Social network	0.664	11
SF13	Workshop and training	0.618	12

RII: relative importance index; OR: overall rank

4.8.1 Preliminary Framework for Social Sustainability Factors

Based on the RII figure for each of the social sustainability factors derived from literature, the study developed a preliminary framework for FM employee social sustainability (Figure 4.4). The framework is based on the relative importance attached to each of the factors by the FM

employees. It serves as a guide for FM organisations on how to manage employees’ social sustainability based on relative importance that employees attach to the factors. However, the framework lacks the ability to show the level of factor interdependence and hierarchical significance. The framework could not also show the level of, direct and indirect interrelationships that exist among the factors which could assist the facilities managers in according priorities in their management (Manoharan et al., 2010). Hence, the factors were further investigated in section 4.10.1 of this research through a pair-wise comparison study to address the issues of factor interdependence and hierarchical significance. Through the ISM approach, the study developed a hierarchical model that provided further insights on the driving powers (interdependence) among all the identified factors.

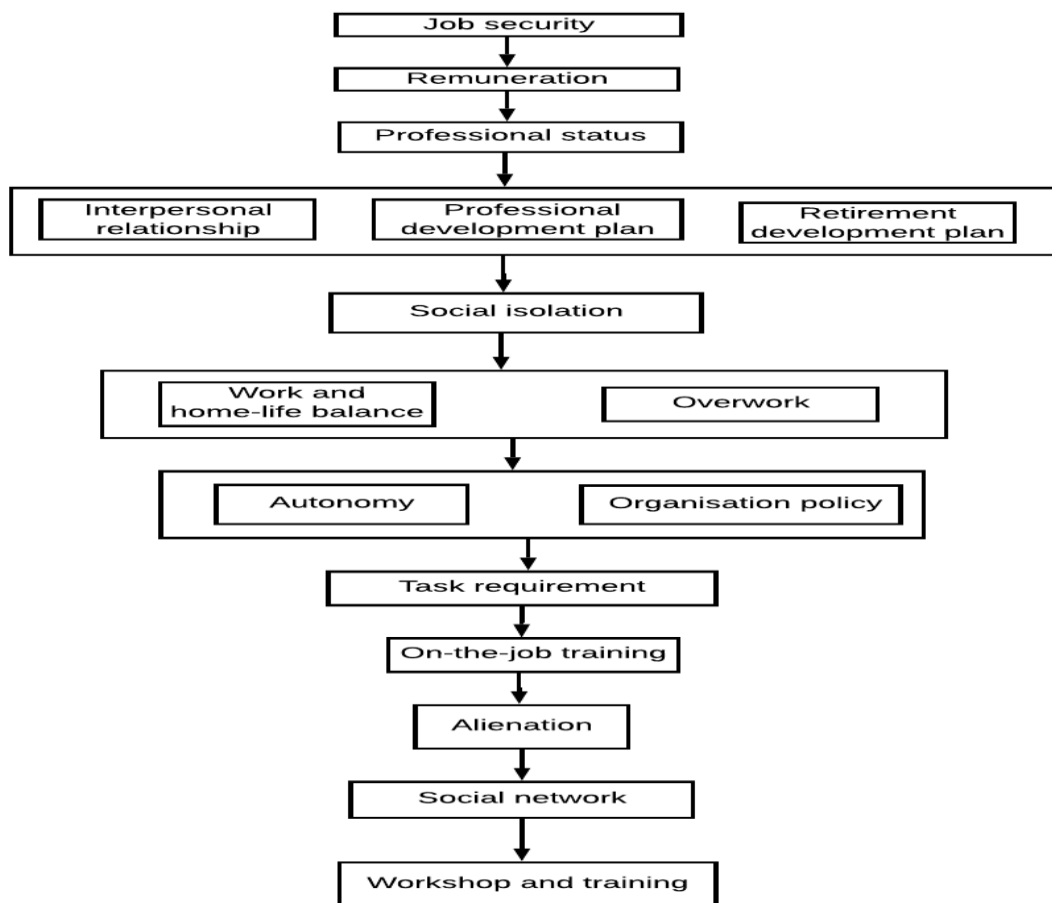


Figure 4.4: FM Employee Social Sustainability Framework Based on RII

ISM is a major step in incorporating interpretation into the structural framework (Sushil, 2012). A structural framework is a form of a diagraph that has nodes and links. Through ISM, the links are interpreted in terms of the context and direction of relationship for each pair of factors

involved. This forms the basis for articulating the structure of any ill-defined system. At the end of the process, the nodes of the diagraph are interpreted by populating them with the several factors thereby portraying a clear picture in terms of the relationships among the factors.

ISM has its mathematical foundations in many referenced works (Harary et al., 1965; Waller, 1980; Warfield, 2003). In a comparable manner, the philosophical bases underpinning the development of the ISM method and the conceptual analytical details of the ISM process have been the subject of several studies (Warfield, 1974; 1978; 1999; Malone, 1975; Haleem et al., 2012; Li & Yang, 2014). Some of the studies in which ISM methodology has been used include the application of ISM in structuring personal values and focusing on barriers to investment in a central city (Malone, 1975), and higher education program planning (Hawthorne & Sage, 1975). Furthermore, Jedlicka and Meyer (1980) use ISM for cross-cultural studies, Sharma and Sushil (1995) use ISM for waste management study, and Sushil (2005) studies ISM as an interpretive matrix and as a tool for interpretation of management and social research. Furthermore, Lin et al. (2006) use ISM for product design study and Agarwal et al. (2007) use ISM for supply chain management. Sushil (2009) examine ISM as an interpretive ranking process, Manohoran et al. (2010) use ISM in analysing the interaction of performance appraisal factors, Haleem et al. (2012) use ISM in a world-class manufacturing study, and Sandbhor and Botre (2014) use ISM to study factors affecting construction labour productivity. In construction management research, previous studies use the ISM method in research regarding technology deployment assessment (Watson 1978), assessment of the importance of perceived benefits (Ahuja et al., 2009), relationships among enablers for construction company growth (Bhattacharya & Momaya, 2009), risk assessment for public-private partnership projects (Iyer & Sagheer, 2009), waste management (Li & Yang, 2014; Liao & Chiu, 2011), and people capabilities for the promotion of sustainability in facility management practices (Sarpin, 2015).

An outline of the previous research that utilised ISM techniques confirms that ISM analyses and models can help decision-makers to visualise issues in context and hierarchical importance. ISM helps to also identify the factors that require high prioritisation and substantial effort to resolve due to the high level of influence.

4.9 Purpose of ISM

Literature specifies ISM as a proper method of analysing the interrelationships among different factors. ISM is a well-established interactive management tool that supports research through

imposing order and direction on complex relationships among the elements of a system (Mandal & Deshmukh 1994; Warfield 1974; Sushil, 2012).

The ISM process can transform unclear and poorly articulated systems into a visible and well-defined model (Farris & Sage 1975; Ahuja et al., 2009). Factors in the framework are enhanced by the ISM technique as it structures sets of different and directly related factors into a comprehensive systematic model. The resultant model can portray the structure of the complex issue being studied in a carefully designed pattern that is both graphical and textual (Ravi & Shankar, 2005).

The ISM methodology has a three-in-one characteristic, it is: interpretive, structural, and also a model (Sage, 1977; Mandal & Deshmukh, 1994; Ahuja et al., 2009). It is interpretive because the judgement of experts is interpreted to determine whether and how the variables are related. It is structural because based on the inter-relationships of the factors; an overall structure is developed from the complex set of unclearly assembled factors. It is a model because the specific relationships and overall structure are depicted in an illustrative way.

In this study, ISM is used to build a hierarchical or structural model of employees' social sustainability factors that are impacted by the adoption of TIs in FM organisations. Using the RII, the relative importance that the FM employees attach to each of these factors was decided. However, the strength of the factors with respect to driver and dependency status was still unclear. Thus, removing the uncertainty will help the facilities managers focus on key factors for the enhanced practice of social sustainability. ISM is the most suitable method to transform these unclear factor characteristics into a visible and well-defined overall framework. The analysis intends to show the driving factors that should be prioritised and actioned to tackle the social sustainability challenges facing the FM employees. The analysis further shows the dependent factors that will automatically be improved in response to the proper management of the driving factors (Ahuja, 2007).

4.9.1 Procedures for ISM

The steps involved in developing a model using ISM are shown in Figure 4.5 (Bhattacharya & Momaya, 2009; Faisal, 2010; Attri et al., 2013). This research followed the steps in the flowchart to structure a model of social sustainability factors in FM organisations.

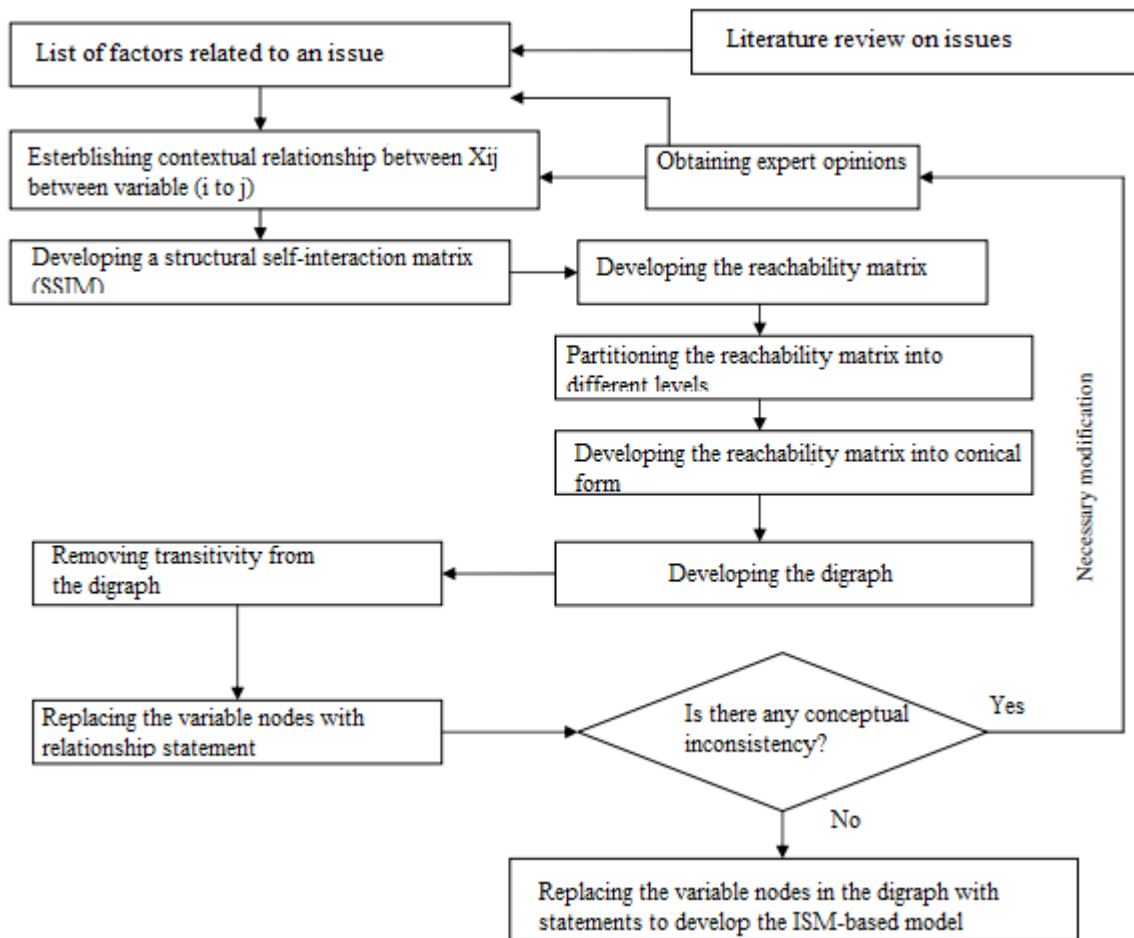


Figure 4. 5: Flowchart of ISM

4.10 Development of ISM-Based Model

This section presents the development of the ISM-based model after the pair-wise comparison study. The section begins with an explanation of the development of the structural self-interaction matrix (SSIM), followed by the development of the reachability matrix, level partition, and development of the diagraph, and MIC-MAC analysis.

4.10.1 Identification of the Social Sustainability Factors

- Through the literature review, 16 social sustainability factors that are impacted by the adoption of TIs were identified. These factors were validated through a country-wide questionnaire survey of the FM organisations that were registered with SAFMA. The output of the validation process was analysed using RII to produce an initial framework based on the level of importance of the factors, as shown in Table 4.9. Based on the hierarchy of importance established, a pair-wise comparison study to collect data for ISM analysis was conducted using facilities managers from four different FM

organisations. The pair-wise comparison study was performed on the employee social sustainability factors which include:

- Job-security
- Remuneration
- Professional status
- Interpersonal relationship
- Professional development plan
- Retirement development plan
- Social isolation
- Work and home-life balance
- Overwork
- Autonomy
- Organisation policy
- Task requirement
- On-the-job training
- Alienation
- Social network
- Workshop and training

The pair-wise comparison study was conducted to develop an understanding of the relationships among the 16 employees' social wellbeing factors. The pair-wise comparison is a method used to compare the priority of an element or factor. In this research, the inter-relationship and influence of each employees' social wellbeing factor was compared. Although there are several ways to formulate priorities, such as trade-off methods, ratings, rankings, verbal statements, and pair-wise comparisons (Duszak & Koczkodaj, 1994), the pair-wise comparison method was most suitable for this study because it enabled the participants to express the significance of the various factors. Furthermore, when comparing element(s) using the pair-wise comparison, it reduces the chances of discrepancies among the experts' judgements (Herman & Koczkodaj, 1996; Barzilai, 1997).

4.10.2 Structural Self-Interaction Matrix

The SSIM was constructed through the opinion of experts. According to Iyer and Sagheer (2009), there is no standard limit for the number of experts that should participate in this process. This study, as earlier stated, used four professionals in the pair-wise comparison study of the social sustainability factors. The experts were approached, and their opinions solicited during the 2017 regional conference of SAFMA in Cape Town. Each of these experts had more than 15 years of experience in FM practice and held senior positions in their respective organisations. This study used the contextual relationship statement of “will help achieve” for the pair-wise assessment. This relationship says whether one factor will help achieve another factor or will contribute to the achievement of another factor. The SSIM was developed based on this contextual relationship. The experts were asked to compare the relationship between two factors, (*i* and *j*). The following four symbols were used to denote the direction of relationship between two factors:

V: factor *i* will help achieve factor *j*.

A: factor *j* will help achieve factor *i*.

X: factor *i* and *j* will help achieve each other.

O: factor *i* and *j* are unrelated.

After conducting interviews with each of the four experts, a consensus on the interrelationship of the factors was derived and used in developing the structural self-interaction matrix (SSIM) shown in Table 4.10.

Table 4. 10: Structural Self-Interaction Matrix (SSIM)

Factors	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1		X	A	V	A	V	V	V	V	V	A	X	X	V	V	X
2			A	V	X	V	V	V	V	V	A	X	X	V	V	X
3				V	V	V	V	V	V	V	A	X	X	V	V	X
4					A	O	X	O	A	A	A	A	A	X	X	A
5						X	V	X	X	V	A	X	X	V	V	X
6							O	A	A	O	A	A	A	A	A	A
7								X	A	A	A	A	A	X	X	A
8									A	A	A	A	A	X	X	A
9										A	A	A	X	V	V	X
10											A	A	A	V	V	A
11												V	V	V	V	V
12													X	V	V	X
13														V	V	X
14															X	A
15																A
16																

The SSIM result presented in Table 4.10 illustrates the respondents' views on the comparison of two factors. These views are used to show the existence and nature of the relationships among the 16 social sustainability factors. The meanings of the categories V, A, X and O relationship are as follows:

The relationship between Factor 1 and Factor 2 is termed V - Factor 1 ("Job-security") will help in achieving Factor 2 ("Remuneration").

The relationship between Factor 1 and Factor 3 is termed A - Factor 3 ("Professional status") will help in achieving Factor 1 ("Job-security").

The relationship between Factor 1 and Factor 12 is coded X - Factor 1 ("Job-security") and Factor 12 ("Task requirement") will help in achieving each other.

The relationship between Factor 4 and Factor 8 is coded O if Factor 4 ("Interpersonal relationship") and Factor 8 ("Work and home-life balance") are not related.

4.10.3 Reachability Matrix (RM)

The SSIM was transformed into a binary matrix called the initial reachability matrix. This process was achieved by replacing the relationship symbols: V, A, X and O with 1 and 0. Table 4.11 presents the initial reachability matrix. The rules for the replacement of 1 and 0 are as follows:

If the (i, j) entry in the SSIM is V, then the (i, j) entry in the reachability matrix become 1 and the (j, i) entry becomes 0.

If the (i, j) entry in the SSIM is A, then the (i, j) entry in the reachability matrix become 0 and the (j, i) entry becomes 1.

If the (i, j) entry in the SSIM is X, then the (i, j) entry in the reachability matrix become 1 and the (j, i) entry also becomes 1.

If the (i, j) entry in the SSIM is O, then the (i, j) entry in the reachability matrix become 0 and the (j, i) entry also becomes 0.

Examples of the application of the substitution rules for this study are as follows:

- If the relationship between Factor 1 and Factor 2 is V, then, the matrix $(1, 2)$ is 1 and matrix $(2, 1)$ is 0.

- If the relationship between Factor 1 and Factor 3 is A, then, the matrix (1, 3) is 0 and matrix (3, 1) is 1.
- If the relationship between Factor 1 and Factor 12 is X, then, the matrix (1, 12) and matrix (12, 1) are both 1.
- If the relationship between Factor 4 and Factor 8 is O, then, the matrix (4, 8) and matrix (8, 4) are both 0.

Table 4. 11: Initial Reachability Matrix

Factors	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	1	1	0	1	0	1	1	1	1	1	0	1	1	1	1	1
2	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1
3	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1
4	1	1	1	1	0	0*	1	0*	0	0	0	0	0	1	1	0
5	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1
6	1	1	1	0	0	1	0*	0	0	0*	0	0	0	1	0	0
7	1	1	1	1	1	0	1	1	0	0	0	0	0	1	1	0
8	1	1	1	0	1	1	1	1	0	0	0	0	0	1	1	0
9	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	1
10	1	1	1	1	1	0	1	1	1	1	0	0	0	1	1	0
11	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
14	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0
15	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
16	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

*0**: There is no relationship between the factors

The initial reachability matrix was achieved by the transforming the SSIM according to the substitution rules (0 and 1). Thereafter, the transitivity links that existed between the variables were investigated. The transitivity of a relationships is a basic assumption according to the ISM method (Ahuja et al., 2009; Bhattacharya & Momaya, 2009). The rule of transitivity states that, if factor *i* influences factor *j*, and factor *j* influences factor *k*, then factor *i* should influence factor *k*. The transitive link is applied to the factors which have no relationship (O) after the initial reachability matrix.

In this research, for instance, Factor 4 and Factor 6 had no relationship in the initial reachability matrix, therefore, the cell entry for 4 and 6 was 0. After carefully examining the SSIM for transitivity link, it was found that Factor 4 helps achieve Factor 9 and Factor 9 helps achieve Factor 6. Therefore, by Step 4 of the ISM procedures, it can be inferred that Factor 4 helps in

achieving Factor 6. Hence, the final reachability matrix (in Table 4.12) for the cell entry 4 and 6 is 1. This rule was applied and all the entries without initial relationships were changed from (0*) to (1*).

In Table 4.12, the final reachability matrix was developed. The table shows both the driving powers and the dependence. The driving power of a factor includes the total number of factors which the factor helps to achieve including itself, while the dependence factor includes the total number of factors which are affected by the factor including itself. The driving powers and dependences were then used in developing the level partition and MIC-MAC analysis as discussed in the following sections.

Table 4. 12: Final Reachability Matrix

Factors	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total driving power
1	1	1	0	1	0	1	1	1	1	1	0	1	1	1	1	1	13
2	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	13
3	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	15
4	1	1	1	1	0	1*	1	1*	0	0	0	0	0	1	1	0	9
5	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	15
6	1	1	1	0	0	1	1*	0	0	1*	0	0	0	1	0	0	7
7	1	1	1	1	1	0	1	1	0	0	0	0	0	1	1	0	9
8	1	1	1	0	1	1	1	1	0	0	0	0	0	1	1	0	9
9	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	1	13
10	1	1	1	1	1	0	1	1	1	1	0	0	0	1	1	0	11
11	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	16
12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	16
13	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	16
14	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	14
15	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	15
16	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	16
Total dependence	16	16	14	14	13	13	16	15	12	12	6	10	11	16	15	9	

4.10.4 Level Partition

After the final reachability matrix was determined, the reachability set and antecedent set for each factor was identified (Warfield 1974; Sage 1977). The reachability set for each factor is a combination of the factor itself and the factors it drives while the antecedent sets is a combination of the factor itself and the factors on which it depends. Thereafter, the intersection of these sets was determined for all the factors. The intersection factor consisted of the factor(s) that have both the reachability and the intersection sets as the same. The first set of intersection factors that were determined occupied the top-level in the ISM hierarchy. The factors in the top-level of the hierarchy would not help achieve any other factors above their own level (Sage 1977; Faisal 2010). After the top-level factors were identified, the factors were deleted from the other remaining factors (Ravi and Shankar 2005). The remaining factors become the new

set of factors from which a new intersection will evolve. The same process is repeated for all other factors in the next level until the level of every factor is identified. This process of repeating the activity, to determine the level of all factors, is known as the iteration process. The outcomes of the iteration process in this study are summarised in Tables 4.13 to 4.17

Tables 4.13 to 4.17 shows the iteration process that resulted in the level of each factor. From the tables, after five iterations based on the final reachability matrix, six levels were identified in the ISM hierarchy. Factors 2, 7 and 14 are in Level I, Factors 1, 3 are in Level II, Factors 12,13, 15 and 16 are in Level III, Factors 4, 5, 6, 8, 9 and 10 are in Level IV, Factor 11 is in Level V. Identifying the levels of the factors helped to establish the digraph and the ISM.

Table 4. 13: Iteration 1

Factors	Reachability	Antecedent	Intersection	level
1	1,2,4,6,7,8,9,10,12,13,14,15,16	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16		
2	1,2,4,5,6,7,8,9,10,12,13,14,15,16	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16	1,2,4,5,6,7,8,9,10,12,13,14,15,16	1
3	1,2,3,4,5,6,7,8,9,10,12,13,14,15,16	3,4,5,6,7,8,9,10,11,12,13,14,15,16		
4	1,2,3,4,6,7,8,14,15	1,2,3,4,5,7,9,10,11,12,13,14,15,16		
5	1,2,3,4,5,6,7,8,9,10,12,13,14,15,16	2,3,5,7,8,9,10,11,12,13,14,15,16		
6	1,2,3,6,7,10,14	1,2,3,4,5,6,8,9,11,12,13,15,16		
7	1,2,3,4,5,7,8,14,15	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16	1,2,3,4,5,7,8,14,15	1
8	1,2,3,5,6,7,8,14,15	1,2,3,4,5,7,8,9,10,11,12,13,14,15,16		
9	1,2,3,4,5,6,7,8,9,13,14,15,16	1,2,3,5,9,10,11,12,13,14,15,16		
10	1,2,3,4,5,7,8,9,10,14,15	1,2,3,5,6,10,11,12,13,14,15,16		
11	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16	11,12,13,14,15,16		
12	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16	1,2,3,5,11,12,13,14,15,16		
13	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16	1,2,3,5,9,11,12,13,14,15,16		
14	1,2,3,4,5,7,8,9,10,11,12,13,14,15	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16	1,2,3,4,5,7,8,9,10,11,12,13,14,15	1
15	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	1,2,3,4,5,7,8,9,10,11,12,13,14,15		
16	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16	1,2,3,5,9,11,12,13,16		

Table 4. 14: Iteration 2

Factors	Reachability	Antecedent	Intersection	level
1	6,9,10,12,13,16	3,6,9,10,11,12,13,16	6,9,10,12,13,16	II
3	3,6,9,10,12,13,16	3,6,9,10,11,12,13,16	3,6,9,10,12,13,16	II
4	3,4,6	3,9,10,11,12,13,16		
5	3,6,9,10,12,13,16	3,9,10,11,12,13,16		
6	3,6,10	3,6,9,11,12,13,16		
8	3,6,	3,9,10,11,12,13,16		
9	3,6,9,13,16	3,9,10,11,12,13,16		
10	3,9,10	3,6,10,11,12,13,16		
11	3,6,9,10,11,12,13,16	11,12,13,16		
12	3,6,9,10,11,12,13,16	3,11,12,13,16		
13	3,6,9,10,11,12,13,16	3,9,11,12,13,16		
15	3,6,9,10,11,12,13	3,9,10,11,12,13		
16	3,6,9,10,11,12,13,16	3,9,11,12,13,16		

Table 4. 15: Iteration 3

Factors	Reachability	Antecedent	Intersection	level
4	3	3,11		
5	3	3,11		
6	3	3,11		
8	3	3,11		
9	3	3,11		
10	3	3,11		
11	3,11	11		
12	3,11	3,11	3,11	III
13	3,11	3,11	3,11	III
15	3,11	3,11	3,11	III
16	3,11	3,11	3,11	III

Table 4. 16: Iteration 4

Factors	Reachability	Antecedent	Intersection	level
4	3	3	3	IV
5	3	3	3	IV
6	3	3	3	IV
8	3	3	3	IV
9	3	3	3	IV
10	3	3	3	IV
11	3			

Table 4. 17: Iteration 5

Factors	Reachability	Antecedent	Intersection	level
11	3		3	V

4.10.5 Development of the Conical Matrix

The conical matrix is formed by clustering the factors at the new levels, across the columns and rows in the final reachability matrix. The final reachability matrix in the conical form is shown in Table 4.18.

Table 4. 18: Conical Form of Final Reachability Matrix

Factors	2	7	14	1	3	12	13	15	16	4	5	6	8	9	10	11
1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	0
2	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0
3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
4	1	1	1	1	1	0	0	1	0	1	0	1*	1*	0	0	0
5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
6	1	1*	1	1	1	0	0	0	0	0	0	1	0	0	1*	0
7	1	1	1	1	1	0	0	1	0	1	1	0	1	0	0	0
8	1	1	1	1	1	0	0	1	0	0	1	1	1	0	0	0
9	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	0
10	1	1	1	1	1	0	0	1	0	1	1	0	1	1	1	0
11	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
14	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1
15	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1
16	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

4.10.6 Development of Structural Model

The conical form of the reachability matrix forms the bases for developing the initial digraph with all the transitivity links. After removing the transitivity links and replacing all the nodes with the factors, the digraph becomes the ISM shown in Figure 4.6. The model is the representation of the inter-relationships between the factors i and j , shown by the arrow that points from factor i to factor j . In the developed ISM, Level 5 is the lowest level in the hierarchical model, while Level 1 is the highest. As previously discussed in section 4.10.4, the factors that are in Level 1 do not help in achieving other factors above them. However, the factors in Level 5 which is regarded as the lowest level of the ISM, are known as the fundamental factors that are responsible for the realisation of every other factor in the model. The ISM in Figure 4.6 shows that the most crucial factor for the actualisation of FM employees' social sustainability is the organisation policy. Organisation policy is one of the factors under

the job satisfaction construct. According to previous authors, organisation policy is a tool of governance - guiding decisions towards achieving a rational outcome for the organisation (Howlett, 2009; Husin & Hanisch, 2011). Organisation policies should be comprehensive enough to accommodate dynamic changes, such as the adoption of TIs that supports strategic and operational activities of the organisation (Doherty et al., 2011; Husin & Hanisch, 2011). Likewise, the policies of the organisation must recognise and capture the strategies that should be adopted to promote the social sustainability of FM employees. The absence of a well-articulated employees' social sustainability policy leads to activities that put the social sustainability of the employees in jeopardy. Husin and Hanisch, (2011) argue that many organisations adopt TIs before considering policy implications in detail. These authors further state that organisation policies are needed to ensure that adopted TIs do not negatively impact the employees and the organisation.

As shown in Level 4 of Figure 4.6, F11 "organisation policy" influences the F10 "autonomy" which directly influences F8 "employee work and home-life balance". Organisation policy also influence F9 "overwork" which affects F4 "interpersonal relationship" and F6 "retirement development plan" of the employees.

In Level 3, F5 "professional development plan" influences F15 "social network" that has direct interrelationship with F13 "on-the-job training" and F16 "workshop and training". Professional development also affects F12 "task requirement" of the employees.

Level 2 shows that F3 "professional status" affects F1 "job-security". While in Level 1, there is an interrelationship between F14 "job alienation" and F7 "social isolation" which also relates with F2 "remuneration". There are also relationships between factors in different levels such as interpersonal relationship in level 4 affecting social network in level 3. Social network and task requirement, in Level 3, affect job-security and professional status. While job-security in Level 2 affects remuneration in level 1, workshop and training affect alienation in Level 1 thereby creating an interconnectivity of all the factors in the framework.

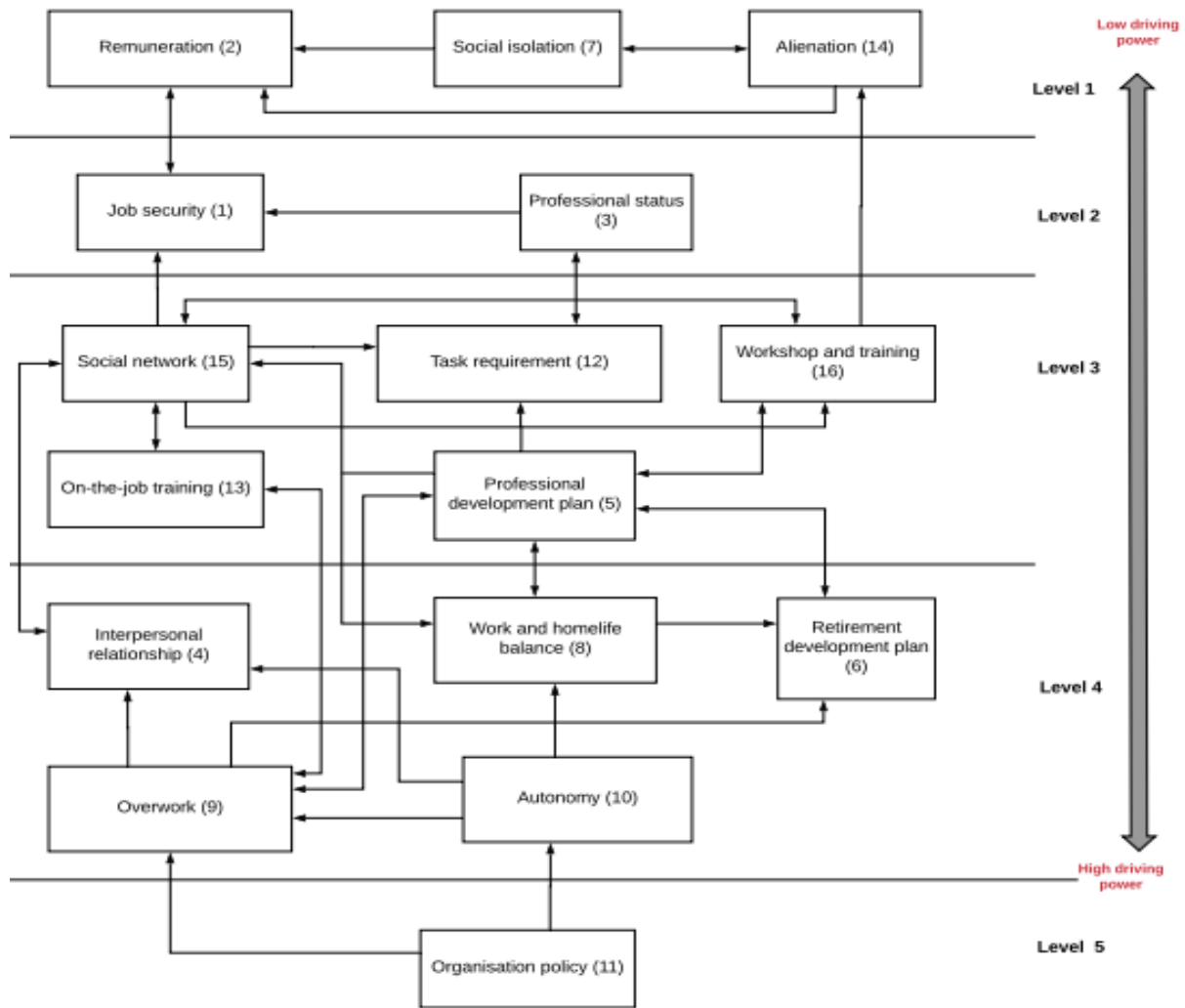


Figure 4. 6: Initial Framework for the Management of the Impact of TI on the Social Sustainability of FM Employees

4.10.7 Matriced' Impacts Croisés Multiplication Appliqué a Unclassemen (MIC-MAC) Analysis

This section further investigates the driving powers and the dependence of the factors based on the previous discussion on the development of the ISM-based model using MIC-MAC analysis (Mandal & Deshmukh 1994; Faisal & Rahman, 2008). The final reachability matrix in Table 4.13 was used in the development of the MIC-MAC analysis. The sum of the 1s in each row corresponds with the dependency power of the factors, while the sum of the 1s in each column represent the driving power for each factor. The factors were then classified into four quadrants based on their driving power and dependence, as shown in Figure 4.7. The dependence power was assigned the x-coordinate while the driving power was assigned the y-coordinate.

	16					11*			16*	12*	13*									
	15											5*	3*	15*						
D	14		Independent enablers						Linkage enablers										14*	
	13											9*							1, 2*	
	12		IV										III							
	11											10*								
	10																			
	9																4*	8*	7*	
	8																			
	7																6*			
p	6		I						II											
	5		Autonomous enablers						Dependence enablers											
	4																			
	3																			
	2																			
	1																			
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		

Figure 4.7 MIC-MAC Analysis Showing the Driving and Dependency Powers

The driving power and dependence diagram helps to order the various employees’ social sustainability factors in FM organisations. The first quadrant contains the social sustainability factors with weak driving power and weak dependence, which are referred to as “autonomous enablers”. The factors in this quadrant are normally disconnected from the system, with limited linkages to other factors in the system (Faisal, 2010). There is no factor of this study that is classified in this quadrant which means that none of the social sustainability factors derived in this study can be isolated from the entire system and, therefore, attention must be given to all the identified social sustainability factors. The second quadrant contains the social sustainability factors with weak driving power and strong dependence, known as the “dependence enablers”. One factor in this study, namely F6 “retirement development plan”, matched this profile.

The third quadrant includes the social sustainability factors that have strong driving power and strong dependence. The factors in this quadrant are known as “linkage enablers”. These factors are unstable because any action on one of the factors will influence others creating a feedback effect (Ahuja et al., 2009). The majority of the factors in this study are classified in this quadrant. The factors in this linkage quadrant include F12 “task requirement”, F4 “interpersonal relationship”, F13 “on-the-job training”, F15 “social network”, F3 “professional status”, F14 “alienation”, F5 “professional development”, F2 “remuneration”, F9 “overwork”,

F1 “job-security”, F10 “autonomy”, F7 “social isolation”, F16 “workshop and training”, and F8 “work and home-life balance”. The factors in this quadrant need proactive and careful consideration from FM organisations because these factors have a high driving power and are, at the same time, dependent on the other factors. It means that, by trying to promote one of these factors, other factors are positively affected and vice versa. The fourth quadrant includes the social sustainability factors with strong driving power but weak dependence. They are referred to as “independent enablers”. There is only one factor classified in this quadrant, which is F11 “organisation policy”.

The MIC-MAC analysis suggests that “organisation policy” in the job satisfaction construct (the independent enabler) has high driving power and is regarded as a fundamental social sustainability factor. Also, 14 factors emerged in the linkage enabler quadrant, which shows that they have a high driving power, and at the same time, they are also dependent on the other factors. Therefore, to support social sustainability practice in FM organisations, the strategic intentions of the FM organisations, which are reflected in organisation policy, must be designed in ways that enhance the pursuit of employees’ social sustainability. Through the deliberate pursuit of social sustainability, every other social sustainability factor will be captured in the organisation policy.

4.11 Quantitative Research Findings

The following are the findings from the quantitative data analysis:

- The five most dominant FM services in South Africa in order of their dominance are cleaning services, air conditioning, hygiene, maintenance, and construction.
- The least popular FM services in South Africa in descending order are: research and development, labour outsourcing, insurance, and relocation services.
- A significant number of FM organisations in South Africa employ more than 50 employees in their organisations.
- The most visible impact of TI adoption in South African FM organisations is a high level of flexibility in operations.
- None of the employees’ social sustainability factors had less than 0.5 RII value. This implies that the FM employees in South Africa recognised all the factors as crucial for the promotion of employees’ social sustainability.

- Based on the RII assessment, “improved decision-making” was rated as the primary factor influencing the adoption of TI in FM organisations in South Africa. “Compatibility with the current trends in FM operations” was rated as having the least influence on TI adoption in South Africa.
- Based on the RII, “job-security” and “overwork” are the two employees’ social factors with the most negative impact in FM organisations following the adoption of TIs.
- Based on the ISM analysis, most of the employees’ social sustainability factors are linkage enablers. This means that these factors are highly interdependent, interlinked, and highly unstable. Improving any one of the factors will help to improve others.
- The management of the linkage enabler factors must be proactive because of their high driving and dependence power.
- From the result of the MIC-MAC analysis, the fundamental factor in the study is organisation policy. This factor has a strong driving power but weak dependence on other factors in the study.

4.12 Summary

This chapter identified a hierarchical framework of the social sustainability factors in FM organisations. This framework is valuable because it provides the facilities managers with a better understanding of the social sustainability pillar that has remained undeveloped over time. This finding can help FM organisations to understand the strategies for maximising social sustainability through the hierarchy and interrelationship between the social sustainability factors that have been studied. From the ISM result, it was found that “interpersonal relationship”, “professional development plan”, “retirement development plan”, “work and home-life balance”, “overwork”, and “autonomy” are the critical factors for the promotion of employees’ social sustainability. Furthermore, analysis through the MIC-MAC method revealed that “organisation policy” has a high driving power and low dependence which qualifies it as an independent enabler. The other fourteen factors have strong driving power but also strong dependency, making them linkage enablers.

CHAPTER FIVE: QUALITATIVE DATA ANALYSIS

5.1 Introduction

This chapter presents and discusses the findings of the study obtained through the interviews that were conducted in FM organisations. The data was analysed through a thematic approach using NVivo 11, see Chapter Three (section 3.13.1). The aim of the qualitative analysis was to obtain deeper understanding of the influence of TIs on employees and the processes within social sustainability practices. Hence, themes freely emerged from the coding of the interview analysis. Appendix H presents a complete listing of the emergent themes with their associated nodes. This chapter discusses the themes that developed from the coding of the data. A few selected quotes from the interview transcripts are included to highlight key points in the evolution of the emergent themes.

5.2 Theme 1: Technology Adoption and Influences

This theme shows that adoption of TI in organisations is preceded by indicators that show the necessity for such adoption. Technology adoption indicators are the factors that point to the need for the adoption of TIs in FM services (Willcocks & Lester, 1997). The researcher wanted to know some of the factors that drive the adoption of TIs in FM organisations. The following section identifies some of the indicators that emerged.

5.2.1 Types of TIs in FM Organisations

The analysis of the interviews revealed that the advancements in technology have made different TI options available for many aspects of FM operations. According to the respondents, the availability of diverse technologies plays a significant role in their adoption. These TI ranges from Roof-top Solar Panels, Personal Device for Identification (PDIs), Basic Programming Software, Team Viewer, Distinct types of Smart Meters, MY-MCS, NICOR, ZKTCO and different types of sensors. According to respondents B, C, D, F, and G (RB, RC, RD, RF and RG), their organisations deploy occupancy sensors, while for RE, “green building” spec sensors are adopted in the organisation:

RE: *“The sensors that we deploy from a technical point of view is [sic] more of the green building spec; that will be sensors in terms of efficiency services. It could be lighting sensors, lighting that automatically detect [sic] whether people are in the area or not, and we also have temporary installation of air quality sensors but that is not on a permanent basis, it’s only on a temporary basis, and the sensors store data around different levels of air quality.”*

In addition, RB, RC and RG's organisations use cloud-based services. From the above, one can deduce that all the organisations use at least one type of TI for their operations. While, these organisations have named these TIs differently, an assessment of the use of the TIs shows that they are more internet-enabled type of TIs. An extract from RG's interview highlights the level of internet deployment in various FM organisations:

RG: *"...internet is everywhere on the premises and ... we've got internet access even to the people currently working on the floor like the horticulture guys, the electrical guys, the mechanical guys because those are the guys that are currently on the floor working and it will be nice to have a different means of communication. We've actually just doubled their cell phone allowance to allow them to communicate well and if anything, else, we want more internet speed, faster, terabits per seconds!"*

5.2.2 Factors Influencing the Adoption of TIs

From the literature review in section 2.4, several factors have been shown to influence the adoption of TIs in FM organisations. However, during the interviews, it was discovered that "necessity" also influences the adoption of TIs in FM organisations. For example, Cape Town's prevailing water crisis and drought conditions have led to the adoption of different water management technologies in FM. This point was emphasised in the response of RA:

RA: *"You know with the water crisis in Cape Town, what has happened is that they've have turn [sic] the water down, levels down so that it's not gushing through, so it's down instead of the normal level of 8. It's down to level 5, so in a big building like this where you've got 10 storeys, sometimes the water pressure doesn't go all the way to the top to flush the toilets, so we've had to put in various systems and that's where the technology also comes in where they can now check the various metres of the water meters in different buildings to see which one is emptying, how fast its emptying and they can react on it."*

Other factors that can influence the adoption of TIs revolve around the benefits that can be derived from the adoption of such TIs. For example, the use of TIs results in better job performance that is driven by leveraging on historical data generated from previous operations. Facilities manager can easily refer to data from earlier operations to solve some current or future operational problems. The use of TIs also enhances the accurate management of information and minimises the rate of errors in an operation, as reflected in the extract from RA:

RA: *"...accurate management of information and then less labour-intensive way. Somebody has got to report, and you know we've got the human error; they*

record the numbers back-to-front or they leave [out] other digits and then your records are a little bit skewed. So that will be a more accurate and also instantaneous report, so I can at any stage see what was gone off site, how much PET, or how much LDP or how much white paper for instance.”

The adoption of TIs also affords the FM professional great operational flexibility and supports multi-tasking because of the high level of connectivity derived from internet technology. RB acknowledged the support of multi-tasking and flexibility by Tis:

RB: *“...with the technology that exist, you can easily get an alert and check your phone and sort out the problem and can still continue to do what you were doing, so it actually kills time. There is more efficient use of time; more effective, I will say, especially with the BMS on the phone or accessible and close at hand. It makes your fault finding also much easier because normally, especially with the air-conditioning, if there is a problem here, rather than go back to the BMS, you can check on the phone and in the five minutes you take to come back, conditions have changed already. But now, you sit here, you control the fuse, make it open or close, you put the heater on and you [sic] standing here you can see what the fuse is doing. So that helps out with fault finding.”*

From the interviews, it became apparent that TIs also enable the efficient management of energy and water resources. This leads to improved operational costs for the organisations. RB reiterated that the presence of lighting sensors in the rooms help to efficiently manage energy consumption:

RB: *“[In] most of the buildings we’ve actually got local control with the light sensors with which we can totally actually control this light or that light, but we say why when you come in, the light is on, when you go out the light is off. We use the systems to control and it is nice to have.”*

Furthermore, RE states that smart-metering technology deployed throughout the buildings enables facilities managers to effectively monitor the energy that is being used at any of the properties or facilities. Furthermore, this technology also provides the facilities manager with the ability to switch over customers to a prepaid metering system quite easily with no additional hardware requirement, thereby managing energy more efficiently from the operational point of view.

The analysis shows how the adoption of TI in FM organisations is more operationally driven. However, the analysis of the interview transcripts also shows that the adoption of TI in FM organisations also affects the employees.

5.2.3 Effect of TI Adoption on the Employees

Almost all the FM organisations that were interviewed are involved in building operations, maintenance and routine services (operational FM). The implication of dominant operational FM practices is that employees are predisposed to job insecurity given that most routine operational services are prone to TI displacement (Atkin & Bildsten, 2017).

Employees also face different challenges from the adoption of TIs in their organisations. From the analysis of the qualitative data, it is evident that the employees face the challenge of not understanding the technologies and also lacking the skills to operate them. Therefore, there is need for professional development, on-the-job training, workshops, and seminars. This is clear from the extract from RC:

RC: *“At onset, it is a challenge because of the lack of understanding and the lack of skills, so there is a lot of up-front kick-off trainings that needs [sic] to take place.”*

Furthermore, the adoption of TIs alters the requirement for skills demand in organisations. Employees, who are not able to meet the demands of upskilling, are laid off because they are not able to meet with the professional development and task requirements. According to RD:

RD: *“... it’s a host of different skills and opportunity set, that we need, so what I will start looking [for] from the outset is to determine how the people profile supports the business strategic objectives, and how would our people profile support whichever strategic business objectives.”*

FM employees often lack the requisite skills-set to match up with the current trend of technological advancement. As a result, employees face pressure to bridge this skills gap. Barret and Baldry (2009) argue that personal anxieties that result from the adoption of TIs in organisations could lead to different changes that can affect the nature of jobs, employees’ morale, isolation, task requirement, interpersonal relationships (improve or worsen), and levels of work performance. According to RA:

RA: *“...some people might feel threatened by technology which is the negative side because what do you need me for. I think there is that fear that technology is going to take over, which inevitably it will.”*

Additionally, employees come under the pressure of behavioural change in line with the demands of certain TIs. RA, the cleaning manager in one of the organisations, said:

RA: *“Employees is [sic] a problem because it’s a behavioural challenge to get people to give up their best to co-operate, also to change old habits.”*

Moreover, the adoption of ICT in FM organisations enables flexibility that sometimes puts some strain on the employees in terms of work and home-life balance. Technology blurs the balance between work and family life. For instance, RA said:

RA: *“A lot of people have got laptops, they take them home, and if you are a dedicated worker and you’ve got deadlines or your work pressure are [sic] heavy, you gonna go home, your family life is gonna suffer because you need to get the report that you need to do something, laptops come out. Also, with telephones these days, everything is in smart phone, it can do a lot of things for you and I think that does on the technology side; it does interfere because you want to message colleagues about something. You just remembered something or putting something up, a note on your phone, whatever, it is that you need to do tomorrow, your diary, your calendar, I think it does affects[sic] people’s family lives on a negative side.”*

5.3 Emergent Theme 2: Awareness of Potential Technology Capability

TIs are altering the traditional work patterns and transforming organisations. The transformation comes with both negative and positive consequences. One major downfall of some TIs is the displacement of employees. According to Bainbridge and Finch (2009), facilities managers are yet to come to the full realisation of TI capabilities in terms of human displacement. Therefore, the respondents were asked whether they were aware that technology could displace them from their roles in the organisation. Their responses indicated gross ignorance about the prevailing TIs and their capabilities in the FM profession. One response that aptly captured the summary of their responses was that of RF:

RF: *“I don’t think I can be replaced, am being personal, not anytime soon.”*

Some of the managers who acknowledge that TIs could have some consequences on the employees are of the view that the impact will occur at the operational level of FM. From the response of RC, an operational director in one of the FM organisations, it can be inferred that the nature of technology adoption in FM organisation can be categorised into two parts. The one category can be termed as “destructive or displacement” while the other category is the “supportive”. The displacement categories of TIs are adopted at the operational level of organisations with the primary motive of reducing the cost of operations. The supportive aspects are adopted at the strategic level with the aim of supporting strategic decision-making. Therefore, it can be inferred that the TIs that FM organisations adopt in South Africa displaces semi-skilled and unskilled FM operators while it supports the higher-level professionals. This can be inferred from the RC’s sentiments:

RC: *The technology that we do incorporate within the business is operational focus, so, ...em, the technology that we employ or that we develop or that we implement on the managerial CEO, CSO, and COOs levels are usually in the sense of making life easier and it will be management programs that we introduce. So, technology wise, I don't see that as a threat now".*

This response resonates with the assertion that technologically driven job -loss tends to occur more frequently at the operational level than any other level of FM (Atkin & Bildsten 2017; Adama & Michell, 2017). RA, a cleaning and waste contract manager in one of the organisations, further argues that the operational level is targeted for displacement and that the strategic level is supported by the adoption of TIs in FM organisations:

RA: *"I don't think it threatens my job but that of the people that are sorting because, I would still have to manage the contract whether it is robot that is doing it or not, I still have to manage that aspect of the contract."*

Respondents were generally ignorant that the advancement in TIs, especially in robotics, threatens their employment. Sachs et al. (2015) affirm that a rise in "robotic productivity," can completely substitute human beings. In the same manner, other studies have highlighted that, in the future, 2% of the world's current labour force will be needed to produce all the goods and services necessary for total demand (Mokyr et al., 2015). On the other hand, Atkin & Bildsten, 2017) argue that both managerial and operational levels of FM are likely to see their ranks substantially thinned because no segment of the workforce is going to be immune to the impact of technological advancement. Against this backdrop, there is a proven ignorance within the FM professionals circle about the capabilities of TIs.

5.3.1 The Changing Work Pattern

The adoption of TIs is changing the work pattern in FM organisations. A smaller number of employees is needed to execute FM jobs with TIs advancement (Adama & Michell, 2017; Atkin & Bildsten, 2017). This low FM employee demand is coupled with a changing set of skills requirements for FM jobs. RE categorically states that *"the type of skill we recruit have [sic] changed"*. It means not every building technician qualifies to work in FM organisations. Furthermore, it suggests that the FM task requirement and organisation policy is changing with advancement in TIs. The changing FM employee task requirements, organisation policies, and skill-sets are reflected in the submissions of RB:

RB: *"Yeah, if I think of the guys that use [sic] to work here, we are talking about more than 100 people just in facilities management, the technical staff, and the*

cleaning staff, basically, but in the department now, on the facilities side, we are 3, but now I can also say that 100 is [sic] now contracted, if you understand.”

Emphasising the changing organisation policy, RB, who works in a building that accommodates over 9,000 people in peak hour and has over 6,000 employees at other periods, states:

RB: *“...the facilities management team doesn’t have people working for them, so I don’t need somebody that reports to me, that actually comes to fix light. No, I get a contractor.”*

Similarly, RE notes that:

RE: *“...the type of skill we recruit changed. So instead of having to have 10 electricians, you’ve got two people that you know manages [sic] the building in the utilities office from our main work head office.”*

RF highlights the new realities of FM employees’ social sustainability with respect to job loss:

RF: *“...that is unfortunately the case. Take for example, with the INFOR system now, you just have one scheduler loading all the preventive maintenance schedule or preventive maintenance work on the system. If you don’t have INFOR, you need at least 3 or 4 people to actually go and plan this and shape it together. So, if I can put it differently, we might have had to employ more people had there not been the increases in technology.”*

The above responses reflect the reality of the FM profession and professionals given the advancement in technology. All the submissions resonated with the assertion of Atkin and Bildsten (2017) who argue for the possible elimination of operational semi-skilled FM jobs through a combination of TIs and the redesign of facilities/assets to eliminate labour-intensive facility management. The fallout of TI adoption as narrated above increases due to economic insecurity, which negatively affects both the psychological and physical wellbeing of employees (Pfeffer, 2009).

The effect will impact on the social sustainability of the FM employees who will lose their jobs. Technological advancement and adoption also have implications for future FM employees, who maybe undergoing training for jobs that do not exist. Hence, attention must be paid to the current realities in the FM profession with regard to the social sustainability.

5.3.2 Workshops and Seminars

The results of the mixed-methods approach show that the adoption of TI in FM organisations leads to training of employees through workshops and seminars (Bhatt, 2001; Gibbs, 2017).

Hence, the frequency of the trainings makes “workshop and seminars” one of the least factors that is affected with the adoption of TI in FM organisation. Furthermore, the employees’ social sustainability perspective shows that the training received is often directed at employee wellbeing and not necessarily the job that they perform:

RA: *“We have certain courses that you can do for your own benefit. In fact, [I] am nominated for [a] course in next month that is called personal mastery and that is about looking at yourself and how you can overcome things and also that will help you give an understanding of you are not the only one with problems. So, on a personal level, yes, there is [sic] also courses that people can learn very basic things about... writing, business writing.”*

RD: *“We do have [an] employee wellbeing programme which is supported by various interventions whether it is training or information sessions, and our employees are taken through sessions dependent on financial wellbeing, emotional wellbeing and physical wellbeing; so that is the integrated programme that we use for our employees.”*

RE: *“As part of the wellness programme, training is often offered to employees. So, there [are] aspect[s] where one can be on personal finance, for example, teaching employees how to better manage and improve their personal finances. Yeah, there is training on soft skills such as emotional intelligence. I don’t know whether to call them training, rather workshop. Yeah that are [sic] definitely programmes to improve employee personal goals and wellbeing rather than just professional. “*

5.3.3 On-the-Job Training

This is the employees’ social sustainability factor least affected on account of TI adoption in FM organisations in South Africa. It obtained the lowest RII in the quantitative analysis. From the qualitative interviews, it was obvious that recognised training remains a component part of TI adoption in FM organisations (Armstrong, 1996; Martin et al., 1998; Zhao & Cziko, 2001; Noe et al., 2006; Zeytinoglu & Cooke, 2009). The extracts from RB, RC RF reflect the training efforts that exist in South Africa FM organisations:

RB: *“We have a lot of external training, relation training, technology training and seminars and stuff. So, there are opportunities for training. It’s also first for personal mastery for me and they are all in my backpack”.*

RC: *“Whenever we adopt new technologies, it comes with educational drive. With the introduction of new technology, the need to upskill, the need to train and, in that regard, we make sure that we explore...the implementation and the mobilisation of the new technology. We ensure that this was actually part of the*

project. We make sufficient arrangement for training specifically on the technology, that goes like envelop with the introduction.”

RF: *“We try and attend conferences; we’re going to the SAFMA conference on Wednesday. So yes absolutely, any opportunity you get, you try and develop them and of course your tradesmen on the ground, you try and upskill them in planning in their tiling that type of thing.”*

5.4 Emerging Theme Three: Social Wellbeing

Promoting social wellbeing has a positive impact on social sustainability. However, from the responses in this study, there seems to be no deliberate management of social sustainability in all but one of the organisations. Most organisations took an *ad hoc* approach to social sustainability issues within the workplace. From the interviews conducted, social sustainability can be categorised into three approaches. These can be described as: *ad hoc* approach, social events approach, and wellness program approach.

5.4.1 Wellbeing Strategy

i.) Ad hoc approach

This approach occurs where there is an apparent lack of a social sustainability plan. In one of the organisations, employees are allowed to salvage whatever was going to the waste dump like mugs, cups and plates, which they felt could be useful for them in the name of social sustainability. RA highlights this while answering the question on the social sustainability strategies within the organisation:

RA: *“We have a lot of disadvantaged people here like our cleaning staff, waste staff that do things and often there is a lot of stuff that goes into the waste area that you will be surprised about, which for me it might not just be worth it and I just dump it but for them it is a whole lot of stuff. So, from a social aspect, my approach is rather than them see something like a mug in there, just a simple thing like a mug plate, whatever, and it’s going to waste and they think ah, I could do with that, I would rather that they can get permission to take it out and give them a green slip... so, we then have opportunity to improve people’s lives at home by giving them these things, so that is one aspect of the staff. They can’t afford these things; we understand it so rather that it goes to somebody that can use it than it be dumped and go to landfill.”*

i.) Social Event Approach

Another approach that was common in the organisations was to organise social events that bring the employees together in a relaxed atmosphere. These functions are usually tagged as expos, end-of-year parties or get-togethers. This approach helps the enhance social networks

and interpersonal relationships among the FM employees while minimising staff. RA and RF discuss this strategy:

RA: *“I know there are various departments amongst themselves have a function just to boost staff morale, chat about things in [a] more relaxed environment. We have a yearly function, whatever manner it might be that people connect. We also have networking functions with other companies. So, we have instances... I can tell that we have electronic expos here which we have in city of Cape Town and other people, eh, there is a networking thing that can happen their way; you meet like-minded people swap ideas, swap business cards, brochures, question things, which I think does also help with that sort of thing. So, yes, while you are isolated to a point with technology, you can be bug [sic] down but I think also, it opens up other doors to be connected with other people. Experts in other fields, maybe.”*

RF: *“We have a yearly function so we all get together to say thank you to everyone, we sit down, we have a meal, even the very low level staff, we maybe have some games for them, at the end of the year, play some football, play some rugby, that sort of thing for us to say thank you to them, also have big braai for them, so we do those things, we appreciate enough for them to stay we try and do ... people can dress up if they want to and have little prize or something like that, unfortunately they don't, play long today... yes we certainly try and do things absolutely.”*

ii.) Wellness Program Approach

The third approach that was common amongst the respondents was the wellness programs approach. The approach was used in the organisations of RA, RD, RE, RF, RG. These organisations have different wellness and fitness programs for their employees to promote their social wellbeing. The programs help the FM employees to enhance their social integration and social network and reduce social isolation and alienation. For instance, a typical wellness approach is found in the extract from RE:

RE: *“This organisation has [an] employee wellness program. That program looks at all aspect[s] of employee wellness and it provides employees access to different forms of emotional support bases whether it be from catering services to trauma counselling or something like that. On the physical side, the organisation is partnering with Discovery [medical aid]; we visit with, I think it's every month or every other month, we visit the hospital so that we are able to do their basic health check and get results on that and check in on their physical wellbeing as well. Yeah, there is [sic] a number of aspects from a social point of view that the organisation has to ensure that employees remain engaged in the organisation.”*

The programs are primarily designed to make employees fit for the organisations' activities and also enhance their own personal abilities. For instance, RD notes that the organisation gives

the employees extra skills that can help them in starting and running their own successful business if they wanted:

RD: *“We also give them the opportunity to gain extra skills if they want to set up their business after they are retired. We also, from [an] emotional point of view supports them. It gets quite tough with people when they retire, to help them emotionally to deal with the changes.”*

Additionally, RG highlights the well-structured social sustainability strategy of their organisation. The organisation set up different committees to reach out to the employees on issues of social concern - both at a personal level and community level:

RG: *“We have a social committee, a corporate social committee, we have [an] environmental committee. Under the social committee, employees can bring their own needs from their community to the committee and it will get approved and funded; we have done a lot of it. We have also paid for each and every staff member’s child that want[sic] a study bursary; we cover that cost. I think it is going back to Standard 8 and it is under review. Also, they can bring a project from their community, painting, kitchen, for instance. Somebody can say my child is in XYZ school, they are in desperate need, somebody’s house or community burn down, you bring it to the committee and they more than likely, 95% of the time they will approve it. Yeah, I use [sic] to work with autistic children, so I will go back to them and say I know that this school is really in need of paint.”*

5.4.2 Remuneration

Remuneration is an important social sustainability factor. Employees’ social and economic needs depend on their income. The interviewees’ responses on remuneration highlight mixed reactions. While the senior facilities managers were of the view that their earnings were commensurate with the prevailing sector earnings, the unskilled, lower level, personnel were unhappy with their remuneration. When asked whether they were happy with their pay, RH, a cleaner in one of the organisations responded as below:

RA: *“...no, because things are getting too high and we must budget for everything. They should improve our salary.”*

RI, another lower level officer, states:

RI: *“Sometimes my husband told me that money is too little. I have two kids and a house to pay. I must pay everything now, and sometimes I can’t do things that I want to do, and I feel when I buy food from that money, I can’t buy things like clothes... There is [sic] a lot of things you can do with money.”*

RA and RF, managers in their respective organisations, argue:

RA: *“I would say yes am paid adequately for my knowledge and for my job. So am carrying a lot of knowledge for having been here for thirty-three years.”*

RF: *“I think everyone would love to be paid better, but if I look in the market, I am on pack compared to the market.”*

5.4.3 Retirement Development Plan

Retirement is an inevitable occurrence which affects social sustainability and the life of any employee. Hence, the researcher wanted to identify the organisational strategies in place for retirement given the adoption and consequences of TIs. Three scenarios could be deduced from the responses. The one is that some organisations have a structured retirement plan for their employees as explained by RD:

RD: *“People are identified five years prior to their retirement and then we offer them the opportunity to engage with financial institutions so that they are looked after and get their retirement plan sorted. We also give them the opportunity to gain extra skills if they want to set up their business after they’re retired. We also, from [an]emotional point of view, support them. It gets quite tough with people when they retire, to help them emotionally to deal with the change.”*

Other organisations do not have any clear retirement plans for their employees:

RC: *“That is a very interesting question because that was actually one of the topics in one of the discussions in one of our fixed sessions. To my disadvantage, I quite admit that there wasn’t up until now much focus on that, but it was identified that as one of our strategic growth moving forward. So, in answering the question, if I have to state the status quo as it is the moment, there is not much in that regard that I can offer, but I can tell you that it has been identified as one of the key areas going forward.”*

The third view is that of RG’s organisation. This company does not believe in retirement, as seen in the response of RG:

RG: *“We don’t believe in the normal sense of retirement. We have got a couple of staff members that have passed their retirement age and we actually encourage it because we know that there sit a lot of knowledge within that people; and people and communities... the social component has changed so much that we don’t want to put pressure on people to retire. Who decided you have to retire at 63? We’ve got people at 70 years old here because we know they sit with a lot of experience and wisdom, so we actually don’t conform to, “Listen you are 63; you need to go.”*

This practice reflects the submission by Myerson (2008) who argues that the demographics of organisations changing. Older aged groups are dominating employment and continuing to work beyond the prevailing retirement age.

5.4.4 Work and Home-life Balance

The adoption of TI in organisations has created a situation whereby employees are unable to balance the work and home-life because of work intruding in employees' homes. The inability to balance work and home-life is a stress factor that leads to social sustainability challenges for employees. It is evident that the respondents were experiencing stress due the imbalance of work and home-life:

RA: *"...a lot of people have got laptops, they take them home, and if you are a dedicated worker and you've got deadlines or your work pressure are [sic] heavy, you gonna go home, your family life is gonna suffer because you need to get the report, or you need to do something, laptops come out. Also with telephones these days, everything is in smart phone, it can do a lot of things for you and I think that does on the technology side, it does interfere because you want to message colleagues about something, you just remembered something, or putting something up, a note on your phone, whatever, it is that you need to do tomorrow, your diary, your calendar... I think it does affects [sic] people's family lives on a negative side."*

RB also presents a case of alienation from family:

RB: *"What makes me happy is being with my family. But being with my family is actually countering what I'm here for; I need to be at work."*

RE acknowledges that there are worries about the work/home balance and that their organisation is taking steps to address the issue:

RE: *"...we try to instil corporate principle in terms of work life balance. I do think that from time to time, you know the fact that you do have access remotely, so the systems might interfere in your personal life, but I don't think employees are trained well enough."*

5.5 Qualitative Research Findings

- The adoption of TIs in FM organisations is driven by the need to enhance operational efficiency by reducing the time required to carrying out operations and create more flexibility in organisation.
- There is a general lack of education and skills on the part of FM employees to stay relevant in FM practice against the backdrop of TI advancement.
- The adoption of TI in FM organisations has both displacement and supportive characteristics.

- There is a high level of ignorance about the capabilities of TI in South Africa FM organisations.
- Unforeseen circumstances also influence the adoption of TI in FM organisations.
- All the FM organisations in South Africa are using at least one form of TI in their operations.
- The most common type of TI in South Africa's FM practice are the internet-dependent types.
- The adoption of TI enables multi-tasking among FM employees.
- FM organisations in South Africa generally lack the framework for promoting employees' social sustainability.
- The adoption of TI in FM organisations leads to work and home-life imbalance.

The analysis of the interview survey enabled the researcher to have a more practical understanding of the type of TIs that are adopted in FM organisations and the impact of these TIs on the employees of the organisations. The interview survey also enabled the researcher to understand the social sustainability practices that are operational in FM organisations. The outcome of the analysis led to the emergence of three themes under which the impact of TI in FM organisations can be examined alongside social sustainability. The qualitative interviews also substantiated the employees' social sustainability factors. The researcher also validated the findings of the ISM analysis during the interviews. The following section shows some of the observations and recommendations.

5.6 Validation of the Initial Framework for the Management of the Impact of TI on the Social Sustainability of FM Employees

In the process of the qualitative interviews in FM organisations, the initial framework of employee social sustainability management was presented to the respondents for their observations. Based on the observations of respondents as shown in Table 5.1, changes were made to the framework leading to the development of the final framework for the management of FM employee social sustainability.

Table 5. 1: Changes to the Social Sustainability Factors after the Qualitative Interviews

Factor	Changes
F10 Autonomy	The factor was adjusted to read “job autonomy”
F8 Work and home-life balance	The factor was adjusted to read “employee work and home-life balance”
F5 Professional development plan	The factor was adjusted to “professional plan”
F12 Task requirement	The factor was adjusted to “employee task requirement”
F15 Social network	The factor was adjusted to “employee social network”
F1 Job-security	The factor was adjusted to “employee job-security”
F7 Social isolation	The factor was adjusted to “employee social isolation”
F14 Alienation	The factor was adjusted to “job alienation”

5.7 Document Analysis

In order to corroborate the findings of the qualitative interviews and not to miss any salient issues, the documents (reports, policy documents periodicals) both electronic and hard copies of the participant organisations were analysed. The focus of this section includes the history of organisations, their areas of specialisations, geographical locations and other issues that concerns the adoption of TIs and sustainability. The analysis shows that all the FM organisations rely on modern technologies to drive their strategic objectives and to create value for all stakeholders. The analysis of the documents revealed that the FM organisations are involved in environmental sustainability that is driven by the need to promote “green building” initiatives and lower the operating cost. However, there were no issues of social wellbeing or sustainability of the organisations that could be found in the content analysis. A summary of the document analysis is found in Table 5.2

Table 5. 2: Summary of the Document Analysis

Organisation	History	Specialisation	Geographic Location	TI Adoption Issues	Sustainability Issues
A	Founded 2001	<ul style="list-style-type: none"> • Security Services • Parking Management • Pest Control • Cleaning and Hygiene • Canteen and Catering 	Operating in South Africa. Intends to spread to some African countries	The organisation delivers integrated property services using TIs. The strategy of integrated property services allows the organisation to achieve strategic organisational objectives and create sustainable value for all stakeholders.	The organisation is more inclined to environmental sustainability strategy. To this extent, it has collaborated with the Green Star SA Accredited Professionals and formulated a comprehensive green operational strategy.
B	Founded 1999	Develop and manage offices, industries, retail and commercial properties.	Head office – Johannesburg. Regional offices in Cape Town, Durban, Nelspruit, and Polokwane	The organisation uses technologies to optimise operational efficiency, achieve good design and attract blue-chip tenants.	The organisation is focused on promoting green building initiative as a strategy for enhancing employees and occupant experience, cut down on power, reducing carbon footprint and optimise operational cost.
C	Founded 1845	Specialise in the provision of office buildings, insurance and investment services	Johannesburg, Cape Town, Durban,	<p>The organisation uses technology to enhance:</p> <ul style="list-style-type: none"> • Office cooling using through water-based system. • Lighting control using motion sensors to limit energy consumption. • Solar water heating for hot water systems in apartments and restaurants • Solar power generation initiative. • Waste management systems provide for recycling. 	The organisation adheres to the Green Building principles, to develop properties that are energy-and resource-efficient, as well as environmentally friendly. These principles incorporate design, construction and operational practices that significantly reduce or eliminate the negative impacts on our environment.

D	1988	mixed-use development, comprising residential and commercial property, hotels, retail stores, dining, leisure and entertainment facilities	Cape Town	<p>Technology is adopted in this organisation to support and promote resource efficiency. The organisation has used technology to set the pace in efficient management of resources such as water, waste and energy efficiency measures.</p> <p>With technology, the organisation has implemented green business practices in all its properties. In 2016, the organisation reduced its total water consumption by 25%, approximately the size of 152 Olympic size swimming pool.</p> <p>Some of the resource management strategies include: drip irrigation, introduction of sea water cooling in their buildings, recycling of air condition water into grey water system, use of different pressure-reducing valves on main incoming water lines and individual meters at the various point of usage. Introduction of waterless urinals and water efficient plumbing systems.</p>	<p>Some of the strategic initiatives that the organisation has developed with regards to sustainability includes:</p> <ul style="list-style-type: none"> • recycling of approximately 45% of total waste that is generated in the organisation. • 24/7 waste management operations. • Encouraging tenant to recycle their waste by developing an incentive scheme that charges zero levy for effectively recycled waste. • Significant reduction in carbon emission against the backdrop of growing property development. • Ensuring that all new buildings in its portfolio achieve a minimum of 4-star GBCSA rating. • Operation of green lease system with at least 24% of its tenants. The green lease allows the organisation to measure tenants' behaviour in water and energy consumption and waste recycling practices.
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5.8 Summary

This chapter presented the analysis of the qualitative interviews that were conducted in FM organisations that participated in the research study. The data was analysed using the data management software NVivo 11. The analysis presented a deeper understanding of the TIs that are adopted in FM organisations operating in South Africa. The analysis also revealed the social sustainability practices in the FM organisations. Through thematic analysis, the interview transcripts were coded leading to the emergence of three key themes: technology adoption and influences; awareness of potential technology capabilities; and social wellbeing. The analysis of documents collected from the interview visits and the websites of participant organisations were presented in this chapter along with the changes that were made to the initial ISM framework of FM employee social sustainability.

CHAPTER SIX: DISCUSSION OF RESULTS AND FINDINGS

6.1 Introduction

This chapter discusses the findings of the questionnaire-survey, ISM and the qualitative interviews. The issues arising from each of the analyses and findings are discussed in detail in line with the objectives of the study.

6.2 Background Profile of the FM Organisations and the Respondents

The result of both the qualitative and the quantitative surveys show that more than half of the organisations that took part in the research have been in FM operations for more than 20 years. The number of years the organisations had operated was put in the questionnaire to measure organisation's years of existence with the level of technology adoption. Therefore, many of the FM organisations have considerable experience in South Africa's FM industry and to a considerable extent, adopt one form of technology or the other in their operations. Furthermore, almost two-thirds of the organisations that participated in the research engaged over a hundred employees. This employment statistics is considerable and directly links organisations with TIs operations. The size of the workforce in FM organisations also indicates the profession's considerable stake in the employment statistics of South Africa. Given the scope of the industry, it is more significant than ever to study the social sustainability of these employees.

The results of the survey also show that more than two-thirds of the FM employees in South Africa hold diplomas and certificate qualifications, while only one-third of FM employees have bachelor's degrees and above. Due to the educational qualifications of FM employees, as indicated by the result of this study, FM practice in South Africa is predominantly semi-skilled and operationally based (Frost & Sullivan, 2012). There are different opinions regarding whether the qualifications of employees are more important than their experience. For instance, Goedhuys and Veugelers (2012) argue that the experience of employees is more important than their educational qualifications. Kamdampully (2002) affirms that technological advancement has made experience limited in value as new knowledge is needed to cope with innovative technologies. Furthermore, Lubit (2001) and Abu Bakar et al. (2011) maintain that a relationship exists between the innovative ability of employees and their educational qualifications. Therefore, the predominantly low educational level of FM employees in South Africa impacts their innovativeness and resilience to the destructive capabilities of technological advancement, and invariably, their social sustainability.

6.3 Determination of the TIs that are Prevalent in FM Organisations Operating in South Africa

The study revealed that the most prevalent TIs in South African FM organisations are the cloud-based technologies, ICT and the sensors, in order of prevalence. The result confirms the submission of several authors on the many applications of ICT in FM services (Lunn & Stephenson, 2000; Grimshaw, 2007; Atkin & Bildsten, 2017). The results further show that the application of ICTs takes different forms in FM organisations. The questionnaire-survey revealed that ICT is the bedrock for using BIMS, analytics, IoT technology, real dynamic route planning and optimisation, call logging application, FM enterprise, lighting communication, wearable devices, and virtual realities. From the qualitative interviews, ICT is also seen to be used in supporting different FM management packages, such as, PDIs, Basic Programming Software, Team Viewer, and Different Smart Meters. It further supports different ranges of organisation-specific software such as MY-MCS, NICOR, ZKTCO, and different types of sensors. The diverse use of ICT collaborates the position of previous studies which describe ICT as an enabler in FM operations (Lunn & Stephenson, 2000; Grimshaw, 2007; Atkin & Bildsten, 2017).

Given the quantity of data that is generated with ICT-enabled devices, the need for effective data-storage makes the cloud-based technology a complementary demand. Moreover, the popularity of the cloud-based technology may not be unconnected to it being the most economic and efficient form of data storage (Lau et al., 2013). Although some respondents indicated that they were using drones in their organisation, this claim could not be confirmed in the qualitative interviews. RG stated that the organisation is unable to deploy drones due to their proximity to a hospital and a helipad. However, the drones remain the least popular TI in South Africa is robots. Unlike developed economies, where robots are deployed for cleaning, security and other FM services, the use of robots has not gained traction among FM organisations operating in South Africa. It means that the FM sector in South Africa is behind the advanced economies in TI adoption.

6.4 Determination of the Level of TIs Adoption by FM Organisations in South Africa

The cloud-based technology emerged as having the highest level of adoption, with more than half of the respondents indicating its use in their organisations. The result may be attributed to the fact that cloud-based technology has been recognised as one of the most efficient and economic data storage formats (Lau et al., 2013). ICT and sensors were also identified as having a high level of adoption, after the cloud-based technology. About half of the respondents

recognised that their FM organisations were using one or more forms of ICT or sensor technologies. On the other hand, the cloud-based technology is dependent on ICT (Lunn & Stephenson, 2000; Scupola, 2014). This result shows that FM organisations in South Africa are highly dependent on sensors and ICT. The high dependence on ICT and sensors can be attributed to the growing numbers of “smart buildings” in South Africa and the need to integrate the building elements using sensors and the internet. The building elements that are usually integrated include lights, windows, HVAC units, doors, and CCTV to enhance efficiency. The supportive role of sensors in the integration of building elements makes it increasingly popular in FM practice. During the qualitative interview, RE emphasised that different types of sensors are deployed to enhance the green building development strategies of FM organisations. The green building works on the interconnectivity of the building elements by creating an IoT of the elements.

The respondents also indicated that their organisations were using robots in FM operations. Although robots have been ranked as the least-used TI in South Africa, when it came to the level of adoption, it ranked higher than the drone technology. The different applications of robots include: meet-and-greet functions (“automated receptionist”) and easing the movement of visitors. The results show that drone technology has the lowest level of adoption in South Africa. The use of drones is subject to various restrictions and therefore it will be more difficult to fly the drone than use any of the TIs that are under consideration in this research.

6.5 How TI Impacts on FM Organisation’s Practice

The impact of TI on FM organisations was assessed from both the core-business factors and the employee (social) perspective. From the core-business perspective, the questionnaire-survey shows that the adoption of TIs improved the connectivity, efficiency, and flexibility of the operations of organisations’ by almost two-thirds. The results from the qualitative interviews also corroborated the findings of the quantitative phase about the positive increase in the core-business factors - connectivity, efficiency, and flexibility (see Chapter 5 Section 5.2.2). It is instructive to note that previous studies argue that survival in the competitive global market relies on flexibility and increased connectivity (Grimshaw, 2007; Holmes et al., 2007; White & Glickman, 2007).

The study also shows that the adoption of TIs in FM organisations brought about one-third improvement in the running cost, productivity, and corporate image of the organisations. In the qualitative interview, RB and RE acknowledged that the use of the various lighting sensors and

smart metering devices have led to reduction in the running cost due to decreased energy and water consumption (see Chapter Five, section 5.2.2.) In a nutshell, the adoption of TIs positively affects the core-business factors of FM organisations.

However, from the employee perspective, the adoption of TI in FM organisations shows that employee social factors are affected in diverse ways. To set the pace for the evaluation of employees' social factors, the employee factors were first validated to ensure that the employees agree that the factors are representative and that the factors are affected with the adoption of TIs in their organisations. This step became necessary to create a uniform basis for evaluating employees' social sustainability, given the subjective nature of social factors (Doloi, 2012). The respondents validated all the sixteen factors with no factor having less than 0.5 value of RII. Based on the validation and analysis of the RII, the factors were categorised according to the level of importance from the most important to the least important as shown in Table 4.11.

6.6 Evaluating the Factors Influencing the Adoption of TI in FM Organisations

An evaluation of the listed factors influencing the adoption of TI in FM organisations in South Africa all had an RII of > 0.5 indicating that the factors were all significant. However, the top three factors influencing the adoption of TI in South Africa FM organisations based on RII are: "improved decision-making", "apparent usefulness of technology", and "increased job efficiency", while the top three categories that influence the adoption of TI in South Africa are: "effort expectancy", "social influence", and "performance expectancy". The findings in this study are at variance with those of other studies in the literature where the "performance expectancy" category emerged as the strongest factor that influences the adoption of TIs in organisations (Thompson et al. 1991; Davis et al. 1992; Compeau & Higgins 1995; Taylor & Todd 1995; Agarwal & Pras 1998; Venkatesh & Davis 2000). The deviation from the previous studies supports the argument of Gururajan et al. (2004) that UTAM may not be enough in proving factors that influence technology adoption under an emerging economy situation such as South Africa. For instance, the FM industry in South Africa is more operational in nature and relies on manual labour for its operations, hence, it is still emerging with regard to technology adoption. However, the result agrees with the study by Nassuora (2012) in which "effort expectancy" emerged as the strongest influencing factor in a study assessing students' acceptance of mobile learning technology.

The data was further subjected to a one-way ANOVA test to see if there were any significant differences among the means of the factors affecting TI adoption. It was found that there were no statistically significant differences between the group means of the variables “work quality is improved”, “there is apparent usefulness of the technology”, “overhead cost is reduced”, “simplification of work”, “reduced complexity of FM operation”, “technology is compatible with current trends in FM operations”, “the human input in operation is reduced”, “improved decision-making is enhanced with technology”, “supports continuous innovation from employees”, “it is in line with the overall objective of the organisation”, and “intended adequate training and retraining”.

However, there were statistically significant differences between the group means of “increase job efficiency”, “increase of pace of work delivery”, “job volume is increased”, “there is possibility of relative advantage over competitors”, “workers are easily trained to understand the job”, “work is made easier”, “the technology is easy to use”, “the work is less challenging with technology”, “organisation image is enhanced”, “the comparative advantage is increased”, “the capability of the firm among competitors”, “employee motivation and interpersonal relations”, “employees are receptive to new changes”, and “assurance of adequate after sales support service from vendor”. This means that actual differences exist between the means of the factors.

In the qualitative interviews, it was found that the adoption of TI in FM organisations can also be driven by “necessity” that is caused by prevailing conditions. For instance, the prevalence of a water crisis in Cape Town influenced the adoption of different water technology initiatives, as elaborated by RA in Chapter 5 (see section 5.2.2). The factor of “necessity” has been stressed in other fields. For instance, in the field of business, Gururajan et al. (2004) acknowledge that customer preference for clean and green technology has created the necessity to invent and innovate clean technology for the environment. In the food production sector, Matatala et al. (2010) and Habiba et al. (2012) argue that the changing pattern in environmental conditions gives rise to the necessity of adopting technology in the farming sector.

Therefore, this study found that, in addition to the traditional factors that influence the adoption of TIs in organisations – “performance expectancy”, “facilitating conditions”, “effort expectancy”, “social influence”, “employee resistance to change”, and “top management support” – “necessity” evolved as a crucial factor that also influences the adoption of TIs in

FM organisations. This study also found that “effort expectancy” in contrast with “performance expectancy” is the strongest factor that influences the adoption of TIs in FM organisations.

6.7 Social Implications of the TI Impact on the Social Sustainability of FM Employees

As stated earlier, the adoption of TIs in FM organisations affects sixteen social factors. These factors are categorised in three major constructs: “social relationship”, “job satisfaction”, and “knowledge development”. The social factors were further validated with the employees to achieve a uniform basis, given the subjective nature of social factors (Doloi, 2012).

Through a nationwide questionnaire-survey, data was obtained for the analysis of these factors. The factors were measured on a five-point Likert scale and the responses were analysed using the RII formula. The outcome was the development of a relative importance framework of employees’ social sustainability factors shown in Figure 4.6. The figure shows that the first three social factors (job-security, remuneration, and professional status) are crucial to the employees’ social sustainability. Employees see job-security as the basis for an enduring social relationship by scoring it as the most crucial social factor. This result resonates with Lu et al. (2016), who assessed the employees of a container seaport in Taiwan and affirmed employee job-security is the most crucial factor to the employees. Hübler and Hübler (2006) affirm that job-security comes with remuneration as a complementary factor. Therefore, employees see job-security as primary to remuneration, hence, remuneration was ranked second to job-security. In previous studies, job-security has also been seen as a significant social factor since employees with lower risks of job-loss are generally more remunerated, especially in countries with higher unemployment rates and greater income inequality (Yu, 2017). The third important factor for the employees was “professional status”. The importance of “professional status” cannot be overstated because previous studies have affirmed that employees are pressurised by the adoption of TIs in the knowledge economy to justify their economic value to an organisation (Kandampully, 2002; Rasmussen, 2012; Støren, 2016). One of the ways by which employee justify their relevance is to be professionally updated.

The three least important factors, in descending order, are “alienation”, “social network”, and “workshop and training”. The employees ranked these factors as least important to their social sustainability drive. Although the adoption of TIs in organisations is known to cause employee alienation, employees need remuneration to live. This hierarchy of needs seems to be responsible for the low ranking of “alienation”. Given South Africa’s high unemployment rate and prohibitive cost of living, employees will be compelled to trade off some of their social

rights to achieve their means of livelihood. Furthermore, social network is ranked after alienation. This is logical, because once employees are alienated through their work, they are unable to keep their social network active (Bailey & Kurland, 2002; Kurland & Cooper, 2002; Grimshaw, 2007; Shantz et al., 2015). “Workshop and training” was the least important factor in the framework of employees’ social sustainability based on RII. The result means that, since training is always a component of TI adoption, the issues of “workshops and training” is well accommodated and less negatively affected compared to the other employees’ social sustainability factors.

An assessment of the impact of TI adoption on the sixteen employees’ social sustainability factors revealed that the factors experience different consequences. The factors are discussed under the three constructs in the order of how they are impacted, starting with the most impacted factor.

6.7.1 Social Relationship

i.) Overwork

Both the quantitative and qualitative surveys indicate that more work is being demanded from employees with the adoption of TIs in FM organisations. The results of the study are in line with previous studies that have related weak work boundaries with overwork in TI adoption (Rousseau, 2006; Pfeffer, 2009; O’Driscoll et al., 2009; Kossek et al., 2009). Overwork, as a stress factor, can lead to poor employee health and therefore decreased social wellbeing and productivity in FM organisations (Sparkes et al., 1997; Krantz et al., 2005; Bickford, 2005; Ilies et al., 2007). The result also resonates with the submission of Grimshaw (2007) that virtual office employees are logged on to the internet for excessive periods to prove that they are working as hard as office-based staff. These employees are particularly at risk of overwork situations.

ii.) Alienation

The study found that FM employees are not fully in control of their work due to the adoption of TI. This condition can affect employees’ social sustainability because, as previous studies suggest, work alienation leads to stress for FM professionals (Längle, 2003). Studies that have also found a significant relationship between alienation, psychological wellbeing, and a fulfilled existence with the use of the internet (Kraut et al., 1998; Osin, 2009). Long hours of online work, as mentioned by RA, can cause a state of alienation for employees.

Increasing automation, machine-to-human relationships and resultant work patterns in FM organisations encourage work alienation. Most operational processes have been programmed into the machine software and hand-held devices. Automation has control of the work processes (Bailey & Kurland, 2002; Kurland & Cooper, 2002; Grimshaw, 2007; Osin, 2009; Barret & Baldry, 2009). As a result, facilities managers are increasingly being reduced to mere monitors of self-operating TIs. For instance, Kraut et al. (1998:1029) argue that “the internet is a social technology used for communication with individuals and groups, but it is associated with declines in social involvement and the psychological wellbeing that goes with social involvement”. Therefore, the more alienated employees are, the more their psychological wellbeing is affected and ultimately, their social sustainability.

iii.) Social Network

The analysis of the quantitative data shows that the adoption of TI in FM organisations affects employee “social networks”, “work and home-life balance”, and “social isolation” in equal manner by the RII scoring of the factors. TIs, such as the communication networks and robots, are reducing the social network of employees by decreasing human-to-human contact and enhancing machine-to-human and machine-to-machine contact. FM, being a profession that leverages good relationships for added value (Jenson et al., 2012), should improve the social network of FM employees as a factor of their social sustainability. Previous studies emphasise that enhanced social networks affects the health, wellbeing, job opportunities, financial security, and physical safety of people (Cattell, 2001; Kahneman & Krueger, 2006; Putnam, 2000). Furthermore, the opportunity of employment creates the platform for employees to connect to their social world while satisfying their economic needs (Fukuyama, 1996; Barret & Baldry, 2009).

The changing pattern of work affects the social relationship of FM employees. Virtual work spaces decrease employees’ experiences and social realities since they are always connected through technology or faced with job demands. This study confirms the assertion of Samuel et al. (2014) who states that the intrinsic benefits and emotional attachment that enhance the social relationship are affected with the adoption of TIs. Building Management System (BMS) in FM organisations exemplifies this argument as its introduction has reduced the number of employees that should have been in physical contact with clients and fellow employees. BMS uses the process of IoT to enable communication between machines rather than machine-to-human or human-to-human. Furthermore, the use of different types of sensors in buildings also impacts the social network of employees that should have been enhanced by physical

interactions. However, because the building elements are interconnected by IoTs, the employees that should have been physically connected are no longer required. Therefore, the influence of TI in FM organisations is changing the social networks of the employees by making building operations more machine-to-human than human-to-human. Although technologies such as ICT are enhancing communication among FM employees, the aspect of social involvement has been greatly reduced along with psychological wellbeing and feelings of a fulfilled existence (Kraut et al., 1998).

iv.) Work Home-Life Balance

The findings from the mixed-methods approach also show that the adoption of TI in FM organisations influence the ability of the employees to balance their work and home-life. This finding confirms that the work and home-life factor as being impacted by the adoption of internet-enhanced TIs in organisations (Wallace 2004; Wajcman et al., 2008; Nicholas & Guzman 2009; Nam, 2014). The qualitative interview in Chapter 5 (see Section 5.2.3) suggests that employees that have laptops and other internet-connected devices have blurred the boundary between their work and home-life. Employees are compelled to bring out these devices in their homes to respond to work demands (Grimshaw, 2007; Nicholas & Guzman, 2009; Beutell, 2010; Mokyr et al., 2015; Nørgaard et al., 2015; Valtorta et al., 2016a; Zhang, 2016). The blurred boundaries between employees' work and home-life affect the social sustainability of employees given the link between psychological wellbeing and increased mental or physical stress (Westman, 2001; Evans & Steptoe, 2002).

Despite this, debate exists around the benefits and drawbacks of work and home boundaries. For instance, some studies argue that unbalanced work and home-life is a source of job dissatisfaction (Allen et al., 2000; Frone, 2003) and an unfulfilled life (Adams et al., 1996; Kossek & Ozeki 1998). Other scholars argue that the blurring of work boundaries promotes work patterns that enhance higher productivity, higher morale, increased flexibility, and more critical job satisfaction (Hill et al., 1998; Tremblay, 2002; Nam, 2014). Therefore, facilities managers are expected to find a balance between the argument on work and home-life balance with a view to finding what works for the employees.

v.) Social Isolation

Although “social isolation” ranked as the least affected factor in the quantitative analysis along with “social networks” and “work and home-life balance”, the qualitative interviews highlighted that almost all the organisations have some form of programme aimed at reducing

“social isolation” among employees. Some of the programmes include periodic social gatherings for employee integration at all levels of the organisation. These social events help to connect and boost the morale of the employees. This kind of programmes reinforces the tenets of stakeholder’s theory. Other programs include employee wellness programmes which include basic health checks and anything to do with wellness such as a counsellor, psychologist or psychiatrist. RG in Chapter 5 (see Section 5.4.1) emphasises the corporate social sustainability drive of the his/her organisation given its strategy to promote social inclusivity within employees’ broader communities. Employees are encouraged to present social issues from their community to the organisation for consideration. The action elicits a sense of social inclusiveness for the employees in the affairs of the organisations and their communities.

All these programs in the various FM organisations show recognition for both formal and informal employee social events on the part of the organisations (Nørgaard et al., 2015; Valtorta et al., 2016a). Kasim and Hudson (2006), also note that facilities managers should promote social inclusivity amongst their employees to bolster employees’ relationships and social ties.

6.7.2 Job Satisfaction

i.) Job-security

The job-security factor was rated the most negatively affected by the adoption TIs in FM organisations. Technology increases flexibility which in turn makes it difficult for organisations to promise any form of job-security to their employees (Grimshaw, 2007; Clarke & Patrickson, 2008; West, 2015; Atkin & Bildsten, 2017). Authors have classified job-security as a crucial factor of social sustainability among employees because of the various negative effects of job-loss (Wilson & Musick, 1997; Rotolo & Wilson, 2003; Gallie et al., 2017). Job-security influences the psychological wellbeing of employees (De Cuyper et al., 2008; Silla et al., 2009; Stander & Rothmann, 2010; Fatimah et al., 2012; Brand, 2015). It also causes different stresses which results in acute economic, social, and emotional strain (Pearlin et al., 1981; Burgard et al., 2007). The most common form of job-loss in FM organisations in South Africa include outright displacement due to the adoption of a TI and changing skills requirement due to the redeployment of an employee whose role has be taken by TI adoption. Hence, there is conformed job insecurity in FM organisations due to TI adoption.

ii.) Autonomy

Autonomy is crucial for employee job satisfaction and psychological wellbeing (Pfeffer, 2009). Employee engagement and a high sense of wellbeing at work is related to their level of autonomy, whether they are given learning opportunities and well-defined work goals (OECD, 2013). The quantitative analysis shows that adoption of TI in FM organisations has made the employees' assignment monotonous, with little opportunity for innovation given the rate of automation. The increasing level of autonomy also plays out in the number of employees that are required for a given job. Since the processes are highly automated, few employees are needed to carry out monitoring and data input.

iii.) Professional Status

“Professional status” is one other employee social factor that is highly affected by the adoption of TIs in FM organisations. FM employees are required, with the adoption of TIs, to prove their professional proficiency in order to keep their jobs. “Professional status” is an indicator used to determine which employee stays or get fired when innovative technologies are adopted. Employees use their professional status as evidence of their relevance because experience is becoming limited in value with the adoption of TI in organisations (Kandampully, 2002). For instance, in the quantitative interview, RB notes that over 100 employees were terminated in the FM department and only highly professional and key employees were retained to oversee the affairs of the department. The adoption of TI in FM organisation is changing the nature of jobs and other professional requirements (Barret and Baldry, 2009).

iv.) Remuneration

The results of both the quantitative and qualitative analyses show that the employees' remuneration is affected by the adoption of TIs in FM organisations (Marzuki et al., 2012). From the interviews, it was clear that senior facilities managers were more satisfied with their remuneration than junior employees. Outsourcing, following TI adoption, impacts remuneration. According to Hummels et al. (2010) outsourcing has both positive and negative effects on employees. Hummels et al, concludes that the outcomes of outsourcing are always negative for the lower-level employees. RB affirms that many of the lower-level employees in his organisation were outsourced in the wake of TI adoption (see Chapter 5, Section 5.3.1).

v.) Interpersonal Relationship

The results of the quantitative survey acknowledged that the adoption of TIs, especially ICTs, in FM organisations affected the interpersonal relationships of FM employees. FM employees are constantly connected through the internet to monitoring and communication devices, which

are known sources of stress and social instability (Quan-Haase & Collins, 2008; Mieczakowski et al., 2011; Chan, 2014). However, the level of impact is midpoint between the high and the low bands with a standard deviation of 0.50. This standard deviation confirms the divergent views concerning internet connectivity and interpersonal relationship. For example, some scholars argue that the “virtual office” practice reduces interpersonal relationship amongst employees (Boase et al., 2006; Chan, 2014). Other scholars argue that ICT and internet related devices enhance employee interpersonal relationships by enhancing their interconnectivity (Rainie & Wellman, 2012; Chan, 2014). In the context of FM employees’ social sustainability, a lack of interpersonal relationship amongst employees can reduce employees’ ability to manage work pressure and the emotional demands of work (OECD, 2013).

vi.) Organisation Policy

According to the employees, the adoption of TI in FM organisations influences the policies of the organisation. Organisation policies are constantly altered depending on the TI adopted and its impact the operations and processes in the organisation. Competition of any sector can also cause organisation policy to be altered to meet the realities of the times. For instance, in the technology driven era, Lim et al. (2002) and Grimshaw (2007) argue that FM organisations are investing more resources in communication networks than physical assets and employees. One negative organisation policy effect is the issue of job displacement. The policies of organisations also change with respect to the type of TIs adopted. With the aim of lowering cost and enhancing efficiency, most of the FM organisations adopt technologies that reduce their operational cost.

vii.) Task Requirement

Most of the operational FM services are experiencing automation to promote efficiency and minimise cost (Docherty et al., 2009). As a result, employees are regularly reassigned to different tasks within the organisations to meet new operational demands that may arise due to TI adoption (Atkin & Bildsten, 2017; Gibbs, 2017). Employees are also displaced by the adoption of TIs, retrained and assigned new tasks within the ever-changing organisation.

6.7.3 Knowledge Development

i.) Professional Development Plan

The adoption of TIs in FM organisations comes with several professional developments, as experience alone is not sufficient (Kandampully, 2002; Pathirage et al., 2008). It is the most impacted employee social factor under the knowledge development construct. According to

Kandampully (2002), knowledge becomes increasingly obsolete as new knowledge is required to operate or perform with new TIs. This may be the reason that employees with experience but without current knowledge requirements are affected by TI adoption (Kandampully, 2002). From the analysis of the responses in this study, it is evident that mandatory training follows the adoption of TIs in FM organisations so that employees can maximise the innovative technology (see Chapter Five, section 5.2.3).

ii.) Retirement Development Plan

According to traditional human capital models (MacDonald & Weisbach, 2004), at some point in the life of employees, human capital may become obsolete given technological change or age. Hence, individuals are replaced and require organisational support in the form of retirement development plans. With technology change, the quantitative results show that the retirement plans of employees are disrupted with the adoption of TIs. The claim was partly confirmed in the qualitative analysis which presented three different scenarios of retirement development plans in FM organisations. Some organisations did not have any form of retirement plans for their employees and, therefore, the shock of technology job-loss affects their social sustainability greatly. Others have well-structured retirement development plans through which the employees are prepared ahead of time for their retirement. Another scenario is the disbelief in retirement. In this organisation, employees are free to work until they are tired and autonomously choose to leave the workforce. This organisation adopts the philosophy that the longer the years of service, the better the individual's experience (Myerson, 2008).

iii.) Workshops and Seminars

The results of the mixed-methods approach show that the adoption of TI in FM organisations culminates in training through employee workshops and seminars (Bhatt, 2001; Gibbs, 2017). With the frequency of trainings that happen with the adoption of new TIs, “workshop and training” emerged as the least factors that is affected with the adoption of TI in FM organisation. Furthermore, the employees' social sustainability perspective shows that some of the training that employees participate in are directed at employee wellbeing and not necessarily the job that they perform (see Chapter Five, section 5.3.2). For instance, employees are given training in personal mastery which is about looking at oneself and how to overcome challenges. These courses also help individuals gain a better understanding of him/herself. There are also other programs like financial wellbeing, emotional wellbeing and physical wellbeing that are organised to help employee awareness and promote their social wellbeing.

iv.) On-the-Job Training

On-the-job training, as a social sustainability factor in FM organisations, was rated with the lowest RII in the quantitative analysis. Thus, it is considered to be the least affected organisational aspect of TI adoption. From the qualitative interviews it was found that most TI adoptions have training components. This practice of attaching a training component to TI adoption supports the observation of previous studies that recognise training as a crucial component part of TI adoption in FM organisations (Armstrong, 1996; Martin et al., 1998; Zhao & Cziko, 2001; Noe et al., 2006; Zeytinoglu & Cooke, 2009). The extracts from RB, RC RF reflect the training efforts that exist in South Africa FM organisations.

6.8 Framework for Management of TI Influences on the Social Sustainability of FM Employees in South Africa.

A framework for the management of social sustainability in FM organisation was developed by first finding the factors that influence the social sustainability of the employees when TIs are adopted in FM organisations. These employees' social sustainability factors were identified through a multidisciplinary literature review, hence the need to validate the factors by FM employees. The factors were validated by FM employees through a process of a country-wide questionnaire-survey, the employees identified the social factors as reflective of their social sustainability. The data from the survey was analysed in the first instance using the RII, which is a perception of the relative importance that is attached to any factor by respondents (Lundby & Fenlason, 2000; Whanger, 2002; Hickson & Ellis, 2014; Nyoni & Bonga 2016). All the factors had an RII of more than 0.5, indicative of the fact that they are crucial to the attainment of employee social sustainability in FM organisations. Based on the result of the relative importance, an employee social sustainability framework was developed (see Figure 4.6).

However, the hierarchical importance and dependence among the factors could not be determined from the framework. Hence, a pair-wise comparison of the employee social factors was performed to determine interdependences and hierarchical importance of the factors (Mandal & Deshmukh 1994; Warfield 1974; Sushil, 2012). The ISM approach was used in analysing the result of the pair-wise comparison leading to the development of the initial ISM for employee social sustainability in FM organisations in South Africa (see Chapter Four, Figure 4.6). The initial ISM framework was introduced to FM experts for validation through qualitative interviews. The framework was largely accepted by the experts with some suggested

adjustments. After implementing their suggestion, the final ISM framework of FM employee social sustainability was developed and presented in Figure 6.1.

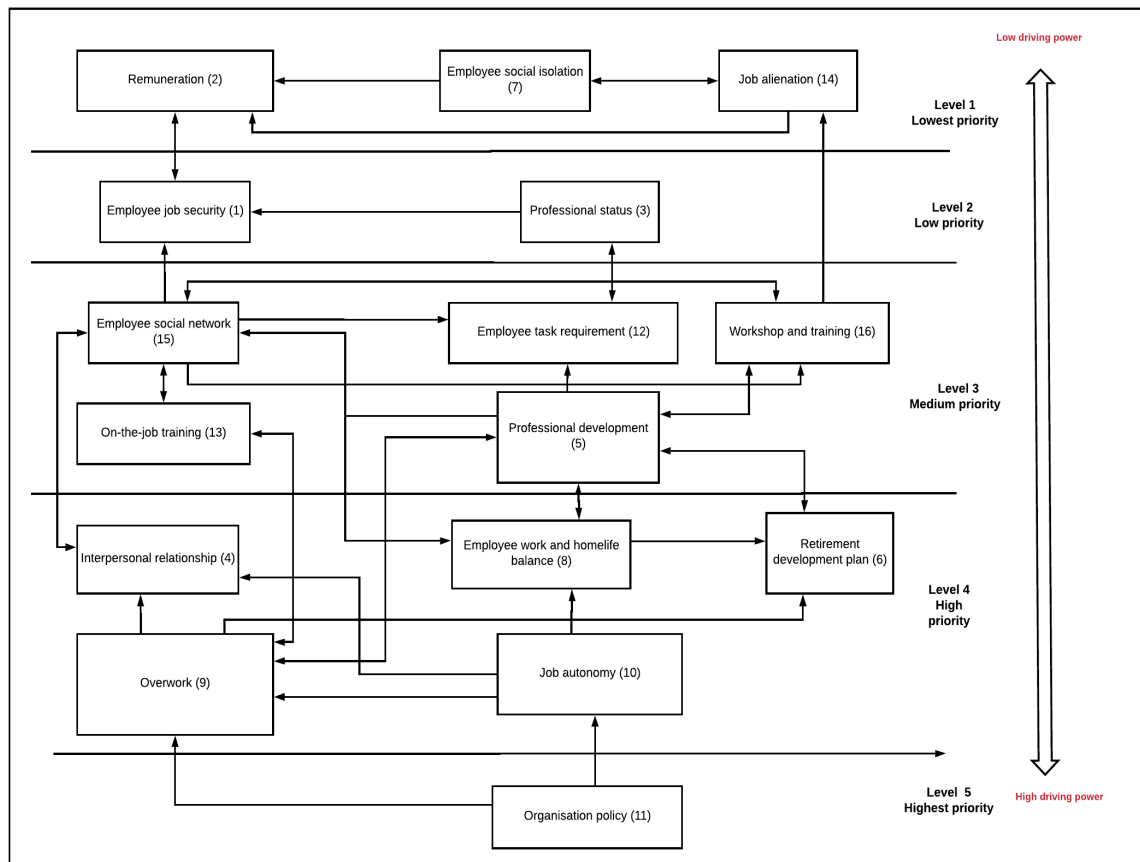


Figure 6.1: Final Framework for the Management of the Impact of TI on the Social Sustainability of FM Employees

Through an iteration process and using the rules discussed in Chapter Four (section 4.10.4), five hierarchical levels were found. The factors in Level 1 cannot help in achieving any other factor above their own level. However, the factors in Level 5, which is the lowest level of the model, are described as the root-factors which are crucial to the achievement of all other factors in the model. The final ISM in Figure 6.1 suggests that the top driving factor in the model is “organisation policy”, which emerged as having the strongest driving power. This resonates with the fact that government driven policies and statutory enforcement mechanisms have emphasised the environmental pillar of sustainability more than any other pillar (Elmualim et al., 2008). Under these policies, there are consequences for any organisation that violates environmental laws in its business operations. In comparable manner, social sustainability should be driven by organisational policies that support the course and there should be

consequences for organisations that undermine the course. Therefore, achieving employees' social sustainability in South African FM organisations must be backed by "organisation policies" that promote such intention.

Level 4 contains the factors with the next highest driving power that need to be given adequate consideration when promoting FM employees' social sustainability. The factors include "overwork", "autonomy", interpersonal relationship", "work and home-life balance", and "retirement development plan". The factors at this level are known as the root-factors for promoting social sustainability of FM employees, and are reflective of the three constructs of this study. Two of the factors are found in the social relationship construct, two in job satisfaction, and one in knowledge development. The combination of factors from the three constructs in this study indicates the broad spectrum of social factors and the need for facilities managers to be more holistic in their approach to the management of employees' social sustainability.

However, the result of ISM at this level is at variance with the questionnaire-survey. The findings from the ISM indicate that "autonomy" and "work and home-life balance" are not significant. The difference might be due to the nature of the ISM which is designed to reflect the practical interrelationships, driving power, and dependences of each of the factors.

Level 3 has factors that demand medium priorities from the facilities managers pursuing employees' social sustainability because of their location at the middle point of the model. The factors include "on-the-job training", "professional development plan", "social network", "task requirement", and "workshop and training". The findings from the ISM suggest that only "task requirement" is not significant. All other factors in this level are significant. It means that all the factors at these levels are important for the attainment of employees' social sustainability.

The factors at Level 4 and those at Level 3 require medium attention for the management of employee social sustainability in FM. The position of both Levels 3 and 4 in the model indicates that the factors have low driving power and, at the same time, high dependence. Therefore, the factors in Level 3 are mainly achieved by the help of Level 4 factors. The high interdependence shown by the concentration of factors in Level 4 and Level 3 suggests that any positive impact on one of the factors creates a positive effect on every other factor in these two levels and beyond. For instance, a positive impact on "workshop and training" will not only affect the factors in Levels 3 and 4 but also directly affect the alienation in Level 1. Similarly, when task requirement is positively affected, it helps in achieving "professional status" and "job-

security”, which are found in Level 2. It means that the more the “professional status” of FM employees is enhanced, the better “job-security” and, invariably, social sustainability.

Level 1 has factors that cannot help in achieving any other factors above their level. The factors in this level are “remuneration”, “social isolation” and “alienation”. It can be inferred from the factors in Level 1 that remuneration is not the ultimate aim of most employees when it comes to their social sustainability. There are several other factors that are critical and form the bedrock of employee job satisfaction and social sustainability. This agrees with the assertion that employees’ value meaningful lives above income (Fukuyama, 1996; Layard 2005; Barret & Baldry, 2009).

In summary, the ISM provided an opportunity to map out the complex interrelationships among the social sustainability factors and represent the final framework for driving social sustainability of FM employees in South Africa. It categorises the different factors into levels of priorities, indicating that factors in Level 5 should be given the highest priority, while the factors at Level 1, with low driving force, require less priority. The model also shows a concentration of the factors at the middle level depicting that the factors have high dependence and low driving powers, hence they can significantly influence themselves. One major finding of the ISM is that “organisation policy” is most the crucial employee social factor instead of “job-security” (Figure 4.4) in the initial RII-based social sustainability framework. The ISM analysis provides a direction for facilities managers to determine what social factor(s) to prioritise with the adoption of TI in FM organisations. It is a map of social sustainability.

6.9 Summary

This chapter discussed both the quantitative and qualitative findings. It provides further insights on the questionnaire-survey, ISM and the qualitative interviews. It also discussed the outlook of the TIs that are adopted in FM organisations operating in South Africa. The analysis also revealed the social sustainability practices in the FM organisations. Through thematic analysis, the interview transcripts were coded leading to the three themes, which include: “technology adoption and influences”; “awareness of potential technology capabilities”; and “social wellbeing”. The analysis of documents collected from the interview visits and the websites of the organisations were presented in this chapter along with the changes that were made to the initial ISM framework of FM employee social sustainability.

CHAPTER SEVEN: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

7.1 Introduction

This research examined the influence of TIs on FM practice and how the social sustainability of FM employees is affected. The study focused on whether the adoption of some TIs by FM organisations affects the social wellbeing of the employees. Since TIs are transforming the way organisations function and the structure of the workforce, among other things, the study examined the type of TIs that are influencing FM practice in South Africa, the level of adoption, and the impact of the TIs on employees and their social sustainability. The study started by reviewing the available literature, both within the core FM discipline and related disciplines. The literature review provided an insight into the social sustainability factors that are impacted by the adoption of TIs in organisations. Due to the need to examine employees' social sustainability, the study analysed the social factors within a psychosocial context. The primary research question that the study answered was: “*What is the nature and extent of the impact of adopting TIs on the social sustainability of FM employees?*”. This question proved essential for understanding the implications of TIs on the employees of FM organisations. Furthermore, a mixed-methods research approach was adopted to elicit both quantitative and qualitative data. This method used questionnaires and interviews to answer the question.

This chapter reviews the study by relating the critical findings from the research with those of the literature review. This chapter also presents the contributions of the study to the body of FM knowledge, states the practical implications of the study, highlights the study limitations, and recommends areas for further research.

7.2 Review of Research Aim and Objectives

This study aimed to *examine how the adoption of TIs affect FM practice and the social sustainability of FM employees*. The objectives that were explored to achieve the aim are discussed below.

7.2.1 Research Objective 1: Identify the Current Utilisation of TIs in South Africa FM Practice

From the literature review, various TIs in FM operations were found and classified into five categories. The choice of the TIs for this study was influenced by the ability of that TI to minimise overhead costs through substitution. Consequently, the TIs that have this capability include: ICT-based technologies, cloud-based technologies, drone technologies, different sensors, and robots. The study sought to examine the use of these categories of TIs in South

Africa through a nationwide questionnaire-survey. From the questionnaire, it was found that all these TIs were adopted for different FM service-provision by FM organisations in South African. Although the TI categories mentioned in this study were not found in all the FM organisations as mentioned, in some cases, variants of the technology were found. The different variants were identified by the option of “others” that was included in the questionnaire. Through this question, respondents were requested to mention any other utilised technology that was not in the list. Based on this strategy, the results indicated that all the TIs were already being used by FM organisations in South Africa. However, the findings of the qualitative survey contradicted the quantitative study because not all the categories of TI or their variants were found in the organisations where the interviews were conducted.

It is important to recall that the qualitative interviews targeted the FM organisations that deployed the highest TIs in South Africa. The result of the interviews shows that ICT, cloud-based technologies, and various sensors are the TIs that are currently in use among the FM organisations where interviews were conducted. However, drone technology and robots have not gained traction in South African FM organisations.

7.2.2 Research Objective 2: Determine the Level of TI Adoption by FM Organisations in South Africa.

The results show that, while the categories of TIs adopted in this study already existed in the developed economies, it is not the same in a developing economy such as South Africa. The quantitative data analysis show that cloud-based technology is the most adopted TI in FM organisations, with about 55% prevalence. ICT and sensors were the next with a 50% level of adoption amongst the FM organisations. Robots and drones were the least adopted TIs, with 41% and about 32%, respectively. The result of the qualitative interviews contradicts the quantitative survey as both the robots and drone technologies were not available in the organisations where interviews were conducted. Furthermore, the results of both the quantitative and qualitative analyses show several hand-held devices that are ICT-dependent which have been customised to the use of the FM organisations.

In the final analysis of the level of TI adoption in FM organisations, a hierarchy of adoption becomes apparent. In descending order is cloud-based technology as the most adopted, followed by ICT and sensors, which are at the same level. FM organisations are currently not adopting robots and drones in South Africa.

7.2.3 Research Objective 3: Identify the Factors that Influence the Adoption of the Technological Innovation by South African FM Organisations

The factors that influence the adoption of TI were grouped into six categories based on the UTAM model. The categories are: “performance expectancy”, “facilitating conditions”, “effort expectancy”, “social influence”, “employee resistance to change”, and “top management support”. The six categories consist of twenty-six factors which were analysed using the RII approach. The analysis of the questionnaire-survey shows that all the factors have an RII of >50%. The top three factors that influence the adoption of TI in FM organisations based on the RII analysis are: “improved decision-making”, “apparent usefulness of technology”, and “increased job efficiency”. Furthermore, the top three categories that influence the adoption of TI in South Africa are: “effort expectancy”, “social influence” and “performance expectancy”. The findings in this study are at variance with those of other studies (Thompson et al., 1991; Davis et al., 1992; Compeau & Higgins, 1995; Taylor & Todd, 1995; Agarwal & Pras, 1998; Venkatesh & Davis, 2000). The deviation from the previous studies could have emanated from the fact that the FM industry in South Africa is more operational and currently relies on manual labour. However, the result agrees with the study by Nassuora (2012), in which “effort expectancy” emerged as the strongest influencing factor.

The three factors that least influence the adoption of TI in FM organisations are: “reduced complexity of FM operations”, “compatibility of TI with current FM trend” – both of which are under the “facilitating condition” category – and “support employee continuous innovations” under the “employee resistance to change” category. From the analysis of the qualitative interviews, it was found that “necessity”, which does not fall into any of the known standard technology adoption indicators, evolved as a significant factor that influences the adoption of TI in FM organisations. Therefore, in addition to the popular UTAM factors, this study found that “necessity” is a factor that significantly influences the adoption of TI in FM organisations.

7.2.4 Research Objective 4: Determine the Impact of the Adopted Technology on the FM Practice

The core-business factors of FM organisations that were examined in this study include: “productivity”, “running cost”, “efficiency”, “corporate image”, “flexibility”, and “connectivity”. These factors were initially analysed using the means of the factors to determine how they are affected by the adoption of TIs in FM organisations. The analysis showed that the three most impacted core-business factors were “flexibility”, “connectivity”,

and “efficiency”, while the three factors that are less affected by TI adoption were “running cost”, “productivity”, and “corporate image”.

Based on the analysis of the qualitative interviews conducted, the adoption of TIs also affected the core-business factors of FM organisations. For instance, respondents RA, RB, and RE stated that the sensors adopted in the various operations of the organisation enhanced service efficiency. Similarly, respondent RB emphasised the enhanced flexibility and efficiency based on the fact that many FM operations are programmed on BMS and could be operated with a phone from any location without necessarily coming to the site. In conclusion, the adoption of TIs in FM organisation affects all the core business factors in various degrees.

7.2.5 Research Objective 5: Examine How the Adoption of TIs Affects Employee Social Sustainability in South Africa FM Organisations

The study developed 3 employee social sustainability constructs that are affected by the adoption of TI in FM organisations based on the literature review conducted. These constructs include: “social relationship”, “job satisfaction”, “knowledge development”. The factors under the “social relationship” construct includes: “alienation”, “social network”, “work and home life balance”, “overwork”, and “social isolation”. The factors under the “job satisfaction” construct includes: “remuneration”, “autonomy”, “job-security”, “interpersonal relationship”, “professional status”, “task requirement”, and “organisation policy”. While the factors under the “knowledge development” construct includes: “workshop and seminar”, “professional development plan”, “retirement development plan”, and “on-the-job training”. All the factors were validated through the questionnaire-survey and proven as employees’ social sustainability factors with the RII ranging between 0.664 and 0.827, which is between the threshold of “partly agree” and “agree” on the Likert scale graduated interpretation. The RII range indicates that the factors are indeed social sustainability factors of the employees.

The analysis of the level of impact that the adoption of TIs in FM has on each of these factors shows that the factors under the “social relationship” constructs are the most impacted. These factors have an average RII of 0.736 which stands for “high social implications” on the graduated Likert scale of interpretation. The factors under the “job satisfaction” constructs are also in the range of “high social implications” on the graduated Likert scale interpretation, with an average RII of 0.727. The factors under the “knowledge development” construct have an RII of 0.637, corresponding to the category of “moderate implications” on the graduated Likert scale of interpretation.

From the analysis of the qualitative interviews, the study found that the adoption of TIs is not creating new jobs as argued by some studies. It is, instead, promoting a kind of “job reassignment” whereby employees who were doing jobs that have been automated are reassigned to other parts of the organisation under some new employment terms and job descriptions. The new terms are always less than the employees’ terms prior to their job automation. Furthermore, the qualitative interviews revealed that the automation of FM practice is encouraging the creation of temporary jobs. Some of the senior employees who lost their jobs establish sub-contracting firms to service their former organisations. These sub-contracting firms negotiate new terms (often lower) and conditions with other displaced employees to serve in their former employment. It was reflected in the submissions of respondent RB Chapter 5 (see Section 5.3.1).

The evidence from the qualitative interview analysis shows that the social sustainability factor of FM employees in South Africa have deteriorated with the adoption of TI in FM organisations. Employees are displaced and compelled to accept renegotiated employment terms that are less than their original jobs to be able to keep their employment. Unfortunately, cleaning is one of the most popular FM jobs (see Table 4.3) in South Africa that is highly outsourced to sub-contractors.

7.2.6 Research Objective 6: Develop a Framework for the Management of TI Influences on the Social Sustainability of FM Employees in South Africa

The study explored the ISM approach as a tool to develop a framework for managing employees’ social sustainability factors alongside TI adoption. The model was developed to provide a clear hierarchy between social sustainability factors. Through further investigation of the interrelationships between the individual employee social sustainability factors, the level of influence of each of the factors was determined. A pair-wise comparison study of the social sustainability factors was conducted using FM experts, and the ISM technique was adopted to analyse the data. Following the analysis, an ISM of FM employees’ social sustainability factors was developed to help facilities managers make decisions that promote employee social sustainability. The identification of the hierarchies of each of the factors enables the facilities managers to prioritise the factors on the basis of the driver and dependence characteristic of each factor.

The ISM framework that was developed and shown in Chapter 6 Figure 6.1 presents five hierarchical levels. As shown in the model, Factor 11 “organisation policy” was in Level 5.

Factor 4 “interpersonal relationship”, Factor 6 “retirement development plan”, Factor 8 “work and home life balance”, Factor 9 “overwork”, and Factor 10 “autonomy”, were in Level 4. Factor 5 “professional development plan”, Factor 12 “task requirement”, Factor 13 “on-the-job training”, Factor 15 “social network”, Factor 16 “workshop and training” were in Level 3. Level 2 had Factor 1 “job-security” and Factor 3 “professional status”. Finally, Level 1 is comprised of three factors, namely Factor 2 “remuneration”, Factor 7 “social isolation”, and Factor 14 “alienation”.

Furthermore, a MIC-MAC analysis was conducted to determine the level of driver power and factor dependence of the employee social factors. From the MIC-MAC analysis output, it was shown that the factors that contribute to employee social sustainability are highly linked and interdependent with strong driving power. Hence, any effort to promote one of the employee social factors will have a positive effect on the others.

7.2.7 The Main Research Question

What is the nature, extent, and implications of adopting TIs on the social sustainability of FM employees?

The nature of TI adoption in FM organisations operating in South Africa is diverse and particular to the needs of the FM organisations. Although most of the TIs that the organisations adopt are within the same categories, the TIs are named differently and customised to suit the needs of their organisations. For instance, different ICT-based TIs are used for similar functions but are known by different names in different FM organisations. Similarly, the extent of TI adoption varies amongst the FM organisations. While some organisations are more technologically adept by having many variants of the TIs performing FM operations, the others have limited variants. Generally, the extent of TI adoption in FM organisations operating in South Africa is less than developed economies. Out of the five categories of TIs in this study, the cloud-based technology and the ICT-based technologies are the most popular TIs while the sensor-based TIs are next based on popularity and adoption. Service robots such as sensors and laser scans exist in some of the FM organisations operating in South Africa, while the drone is the least adopted technology in South Africa.

The adoption of different TIs leads to different social sustainability implications for employees. While the ICT-based TIs have made flexible work patterns possible, they are also cause overwork and aid the intrusion of work into home-life. Employees are hardly able to draw a

boundary between work and home life thereby leading to overwork conditions in most cases. The ICT based TIs have also impacted the social life of the employees, causing “alienation”, “social isolation”, and “social network” problems. Furthermore, sensors and robots have led to job losses amongst the FM professionals. The combination of the sensors and internet connectivity have also led to the creation of ambient intelligent environments. Since buildings are self-operation, many operational based FM professionals are becoming redundant. The new capabilities of the TIs have led to changes in “organisation policy”, “job-security”, “employee task requirements”, the “remunerations” that employees receive, the level of “autonomy” that employees have on their jobs, “interpersonal relationships” amongst the employees and clients, and a higher requirement for “professional development” in many organisations. Furthermore, there is an increasing need for “professional development”, “workshops and seminars” and “on-the-job training”.

The implications of job loss and overwork on the employees have led to wellbeing and health-related issues as elaborated in the thesis. In order to manage the social sustainability issues arising from the adoption of TIs in FM organisations, an ISM based approach was adopted. The result was the development of an ISM based framework that could be used to prioritise factors with regards to employee social sustainability in FM organisations.

7.3 Reflecting on the Reliability and Practicability of the Research Process

As earlier mentioned in Section 3.10.1 and 3.10.2, both the internal and external validity of the research study is crucial for the reliability of the research process and the replicability of the research findings. Internal validity is concerned with the extent to which the research design and the data collected leads to logical conclusion. Additionally, the reliability of a study stresses the consistency of the measuring instrument to yield results. Therefore, reflecting on both the validity and reliability of this research is essential. Some of the steps taken by the researcher in this study to ensure the reliability include: conducting an extensive literature review to ensure that correct factors and constructs were found and used in designing the questionnaire instrument.

Furthermore, the questionnaire design was such that there were no wrong or right answers. Online survey strategy using *SurveyMonkey* was adopted to ensure a non-biased approach of reaching the target population. During the quantitative data analysis, the Cronbach’s alpha value(α) was used to prove the reliability of the study. The main research question was clearly defined to ensure the consistency and validity of the of the qualitative phase, and the study was

designed to answer the research question. Furthermore, the constructs of the study were clearly defined to avoid any ambiguity. An interview guide was designed (see Appendix D) to ensure that the respondents answered the same set of questions. Furthermore, the study adopted a snowball strategy to ensure that the organisations with more TIs in their operations participated in the interview. During the analysis of the qualitative data, the study adopted the triangulation approach by coding the data using the NVivo 11, a qualitative data software to process the data. Through the NVivo software, auto-coding was performed to ensure that the responses and the questions showed satisfactory agreement with the research question. The interview guide was subjected to process of peer and supervisor review before the commencement of the process.

7.4 Conclusion

Based on the findings from the empirical mixed-methods approach and the literature review in this study, the following conclusions were drawn:

- ICT, the cloud-based technologies, and sensors are the most utilised categories of TIs among the FM organisations operating in South Africa, while the drone and the robots are the least utilised categories.
- The level of TI adoption among FM organisations in South Africa shows that cloud-based technologies are the most adopted TIs followed by ICTs and sensors. Robots and drone technology are the least adopted form of TI categories for FM operations.
- In addition to the known factors that influence the adoption of TIs in organisations, (“performance expectancy”, “facilitating conditions”, “effort expectancy”, “social influence”, “employee resistance to change”, and “top management support”) this study found that “necessity” is a crucial factor that also influences the adoption of TIs in FM organisations operating in South Africa.
- “Effort expectancy” emerged as the strongest factor that influences the adoption of TIs in FM organisations in South Africa. This outcome does not agree with many previous studies that found “performance expectancy” as the most influential factor for technology adoptions.
- The impact of TI adoption of on enhancing the core-business factors of FM organisations ranges between 20-60%, depending on the factor under consideration.
- The study found that FM operations in South Africa are more routine than strategic in nature. Since the routine jobs are dominated by semi-skilled professionals, their

automation lead to the displacement of the employees and consequently expose the employees to social sustainability issues.

- It can also be inferred from the study that the increasing adoption of TIs in FM organisations leads to the de-skilling of manual labour as technology replaces the skills of the operational FM employees.
- TI adoption help to minimise overhead cost on employees in FM organisation thereby making employees more vulnerable to social sustainability consequences. The numbers of employees required to carry out any task is reduced with automation.
- The social sustainability of FM employees in South Africa is deteriorating with the adoption of TI in FM organisations. The qualitative interview illustrated that the adoption of TIs leads to job-loss. In situations where the jobs are not lost, the employees that are retained often have their jobs re-defined under new and less favourable terms and conditions.
- FM organisations rely on TI adoption for the material benefits to business owners rather than the psychosocial impact on employees.
- Based on the pair-wise comparison analysis and the development of the ISM framework for managing social sustainability of FM employees, “organisation policy” which is a factor of the “job satisfaction” is the most critical social sustainability factor in FM organisations. It should be given the highest priority when promoting FM employee social sustainability as it is the only factor with strong driving powers and weak dependence.
- The employee factors that require the lowest priority are Factor 2 "remuneration", in the “job satisfaction” construct, Factor 7 "social isolation", and Factor 14 "alienation", both of the “social relationship” construct. These factor factors are in level 1 and cannot help any other factor above their level. It is instructive to note that “remuneration” is not the ultimate desire of the employees seeking social sustainability. The study shows that factors for ensuring social there are several other critical factors that influence the social sustainability of FM employees in South Africa.
- The root-factors which are next to the top critical factor include: “overwork”, “autonomy”, “interpersonal relationship”, “work and home-life balance” and “retirement development plan”. These factors have low driving power and high dependence. These root-factors are representation of the three constructs of the study.

- The factors requiring medium attention among the employee social sustainability factors in this study include: “on the job training”, “professional development plan”, “social network”, “task requirement” and “workshop and training”.
- None of the employees’ social sustainability factors in this study fell within the 1st quadrant of the MIC-MAC analysis with weak driving power and weak dependence. Therefore, none of the factors can be ignored in the promotion of employee social sustainability. Moreover, the linkage enabler quadrant is a fair representation of the three constructs of the study.
- The MIC-MAC analysis shows the factors that contribute to employee social sustainability in this study have strong driving power and strong dependence with 14 out of the 16 factors sitting in the 3rd quadrant, “linkage enabler”.
- Only one factor “retirement development plan” fell in the 2nd quadrant (dependent enabler” with weak driving power and strong dependence.

7.5 Contribution to Knowledge and Practical Application of the Research

From a general perspective, the study has situated TI in FM organisations operating in South Africa within the global context. Outlined within the sustainable FM perspective, the contribution of this thesis is enormous given the underdeveloped nature of the social pillar of sustainability and the paucity of academic literature that evaluates issues on FM employee wellbeing. The study provides significant theoretical insight for the development of the social pillar of sustainability in FM practice. The result of the study contributes to better understanding of the impact of TI on the social sustainability of FM employees in South Africa. this is based on the description of the impact of TI on the “social relationship”, “job satisfaction” and “knowledge development” that constitute the three constructs of this study. Furthermore, the study relates the concept of technology adoption in FM to the social sustainability of the employees. It is unlike the previous studies in FM, which were more focused on the operational aspects of technology adoption. By this development, there is more holistic view of the impact of TI in FM organisations.

Also, the study developed employee social sustainability constructs and the factors that are affected by the adoption of TI in FM organisations. This contribution is crucial because social factors are subjective and difficult to study, a condition that has left the social pillar of sustainability undeveloped for a long time. Therefore, this empirical study of social

sustainability factors provides some understanding that will enhance the development of the social pillar of sustainability in practical terms.

This study also contributes to theoretical body of knowledge by identifying and categorising the strategies that FM organisations are currently utilising to manage the social sustainability of FM employees. This finding is against the backdrop of the fact that previous studies merely emphasised that the social pillar of sustainability is undeveloped. However, after analysing the interviews that were conducted in this study, it became obvious that FM organisations in South Africa adopt strategies that can be categorised as “*ad hoc* approach”, “social event approach”, and “wellness programme approach” towards managing employee social sustainability. These strategies are unique and thematically vital to the development of the theory of FM social sustainability. These strategies can be further developed to form the bases for evaluating employee social sustainability practice within an FM organisation.

One area of contribution of this study is in assessing the level and types of technology adoption in South Africa FM practice. The study undertook a nationwide survey with the South Africa FM Association as the study population. The assessment enables FM practitioners to have an insight on the type of TI that are available in South Africa and the extent of their adoption. The information is essential for planning, pair-wise comparisons and benchmarking among FM organisations.

Another contribution this study makes to FM body of knowledge relates to the displacement of the human input in organisations which is common with the adoption of TIs. This phenomenon is described as the negative effect of technology and it is well reported in other disciplines. However, FM discipline portrays technology as an enabler with little or no information about any negative consequence. The situation has made the holistic knowledge of TI impact in FM organisation unclear. Hence, this study contributes to FM practice by examining how technology affects FM employee wellbeing. It further contributes a theoretical perspective to FM literature by synthesising literature reviews from different fields of study, empirical data from the questionnaire-survey, the pair-wise comparison study, and a qualitative interview survey to understand the impact of TI adoption. This study notes that the adoption of TIs in FM practice is making some FM roles redundant and impacting the social wellbeing of FM employees. Through thematic analysis of the qualitative interviews, the research also

developed themes that encompass the processes that are involved in the adoption of TI in FM organisations regarding social sustainability. These themes are prominent in discussing strategies for promoting employees' social sustainability against the backdrop of technology adoption and the broader aspect of the social sustainability pillar in FM.

By using the ISM approach in this study, the study contributes a methodological approach for understanding and managing issues of social sustainability in FM. The social sustainability framework that was developed using ISM approach is a practical tool that contributes to the understanding and implementation of employee social sustainability in FM organisations. The model is significant to FM practice because it outlines the factors of the social sustainability construct that are of priority to FM employees. Hence, this model can aid strategic decision-making processes in FM organisations when there is a plan to adopt TIs. Policy makers can also use the framework as a guide to understanding employee social sustainability in FM organisations. For instance, the framework indicated that “organisation policy” is crucial to promoting employee social sustainability in FM organisation, hence, an FM organisation dedication to promoting employee social sustainability can be assessed through the content of the “organisation policy” document.

The fact that the study provides insights from a developing economy perspective to the issue of TI in FM organisation through an empirical study contributes to a profession where most of the empirical studies reflect the scenarios of the developed economies. For instance, the study found that “necessity”, which is not among the known factors that influence technology adoption in the literature, is a crucial factor for TI adoption in FM organisations of developing economies.

In summary, this research is a pioneering attempt in assessing the impact of TI on the social aspect of the FM profession. Both its methods and outcomes are derived from theory and aim to better the FM discourse. Hence, this study provides a theoretical framework on the promotion of FM employees' social sustainability and provides a roadmap for the development of the social pillar of sustainability in FM practice.

7.6 Research Recommendations

Based on the findings of this research and some of the practical implications that have been mentioned in earlier sections, the following strategies are recommended.

- There should be regulations to compel FM practitioners to promote the development of the social pillar of sustainability just as the environmental pillar.
- Given the obvious level of ignorance among FM professionals about the capabilities of the current technological advances in FM, there should be continuous professional development that updates FM employees on the latest TIs in the field of FM.
- The FM profession should evolve beyond operational level services to more strategic level services. This would provide stability given the displacement of operational tasks on the account of automation.
- Considering that globalisation reduces barriers to the internationalisation of businesses, facilities managers in South Africa need more training that corresponds with global practices as opposed to the current manual operational services.
- There should be strategies that help manage FM employees that are displaced from their jobs due to TI adoptions.
- FM professionals should be more open to research participation to gain new knowledge and perspective. It appears that the FM professionals in South Africa are currently averse to research participation based on the response rate to the quantitative online survey.
- The education level of the FM professionals in South Africa should go beyond meeting the operational level needs of FM. There is a need for reskilling of the current FM employees in line with the changing technological advancement to remain relevant while maintaining their social sustainability. The low education level creates significant risk of job loss against the backdrop of increased automation of the operational level FM service.
- There is need for synergy between the industry and academia with regard to the development of FM professionals towards TI. Managers need to understand the complexities associated with the introduction of TIs, especially the impact on employees before embarking on significant programmes of technological change.

Promoting employee social sustainability will stimulate the employees towards better commitment to their organisations. Therefore, facilities managers should ensure the social sustainability of employees to maximise their productivity with the adoption of TI.

7.7 Research Limitations

Despite the contributions of this study, there were some limitations that should be pointed out:

- This research is constrained by the low response rate from the FM professionals in South Africa. The FM professionals were not welcoming or willing to participate.
- Although the researcher acknowledges the availability of more TIs in FM services, the findings in this research are limited to those TIs that can displace FM employees from their jobs.
- The findings of this research are more applicable to FM organisations registered with SAFMA. However, insights from the study could be a useful reference for other FM professionals both in South Africa and in other countries.
- The research did not consider FM service providers that were not registered with SAFMA.

7.8 Future Research

This research highlights more opportunities for exploring the effect of TI on the social sustainability in FM by focusing on the wellbeing of the employees. Hence, the following recommendations will help future research:

- The influence of TI in this study focused on the social sustainability of the FM employees. Future researchers could consider exploring the three pillars of sustainability.
- Given the subjective nature of social factors, future researchers could consider more factors by expanding the criteria in the area of technology choice.
- Future studies could consider exploring the influence of TIs in FM generally without restrictions to TIs that can displace employees.
- The choice of population study was restricted to FM organisations registered with SAFMA. Future researchers could expand the stakeholder base by considering other organisations that may not be registered with SAFMA but involved in FM services.
- Future studies could also examine the role that remuneration plays in the promotion of employee social sustainability seeing that it emerged at level 1 with low driving power and weak dependence.

7.9 Summary of the Chapter

This chapter summarised the findings of the study. The study established that there are significant influences of TI adoption on FM practice and the influences have implications for the FM employees in South Africa. In this chapter, the TIs that are adopted in South Africa and the level of adoptions have been stated. The impact of the adopted TIs on both the core-business and the employees was also reported on given the various qualitative and quantitative analyses. Furthermore, the contributions of benefit the discourse by identifying the employee social sustainability factors and developing an ISM hierarchy for the factors presented. The theoretical and practical implications of the study, and the recommendations to the FM practitioners and policymakers in South Africa were highlighted. Finally, the recommendations, research limitations, and the areas for further study were identified.

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Appendices

Appendix A: List of Peer-Review Journals

- Facilities
- Automation in Construction
- Advanced Engineering Informatics
- Journal of Information Technology in Construction Itcon
- Journal of Computing in Civil Engineering
- Journal of Construction Engineering and Management
- Building and Environment
- Visual Computer
- Structure and Infrastructure Engineering
- International Journal of RF Technologies
- Building Services Engineering Research and Technology
- Journal of Global Information Technology Management
- Proceedings of the IEEE
- International Journal of Computer Science and Applications
- IEEE Systems Journal
- International Journal of Product Lifecycle Management
- International Journal of Environment and Pollution
- Journal of Management in Engineering
- Journal of Civil Engineering and Management
- Structural Survey
- International Journal of 3D Information Modelling
- Australasian Journal of Construction Economics and Building
- Scientometrics
- Construction Management and Economics
- International Journal of Project Management
- Harvard Business Review
- Computer and Civil Engineering
- Built Environment Project and Asset Management
- Buildings
- The Scientific World Journal

- IIE Transactions on Healthcare Systems Engineering
- International Journal of Civil and Structural Engineering
- Advances in Civil Engineering
- Construction Research Congress
- Computer in Civil and Building Engineering
- Science and Technology for Built Environment

Appendix B: Consent form

What technology innovation are you using: Are you ahead of the curve or lagging behind?

CONSENT FORM

This section of the questionnaire is aimed at obtaining the consent of the respondent in participating in the research.

PLEASE NOTE:

All the information provided by you on behalf of your organisation will be treated as strictly confidential.

The result of the survey will be presented in an aggregate format and no individual disclosures will be made.

1. I have read the covering letter and understand what kind of information the researcher is seeking from me.

YES

AGREED

2. I understand that my participation is voluntary and that I am free to withdraw at any time without offering reasons.

YES

AGREED

3. I agree to take part in this study.

YES

AGREED

What technology innovation are you using: Are you ahead of the curve or lagging behind?

SECTION A: GENERAL INFORMATION ABOUT THE COMPANY

Previous researches have shown that certain aspects of a firm's capabilities are particularly relevant for its success in international business. Of these, the current research is looking at company revenues, financial worth of company assets, number of years of international experience and total number of permanent employees in the company.

Please provide the following information about the capabilities of your company:

Appendix C: Questionnaire

1. What is the registered name of your organisation (optional)?

2. How many years has your organisation being in existence?

- 1 - 5 6 -10 11 - 15 16 - 20 Above 20

3. What is the number of employees in your organisation?

- 1 - 10 11 - 20 21 - 50 51 - 100 Above 100

4. Kindly tick the category(ies) of FM practice that you undertake (Multiple choices allowed)

- | | |
|---|---|
| <input type="checkbox"/> Air Conditioning | <input type="checkbox"/> Medical |
| <input type="checkbox"/> Catering Services | <input type="checkbox"/> Pest control |
| <input type="checkbox"/> Cleaning services | <input type="checkbox"/> Property management |
| <input type="checkbox"/> Construction | <input type="checkbox"/> Quality |
| <input type="checkbox"/> Consultancy | <input type="checkbox"/> Signage |
| <input type="checkbox"/> Energy | <input type="checkbox"/> Space planning |
| <input type="checkbox"/> Engineering | <input type="checkbox"/> Quantity surveying |
| <input type="checkbox"/> Financial | <input type="checkbox"/> Telecommunication |
| <input type="checkbox"/> Flooring | <input type="checkbox"/> Real estate |
| <input type="checkbox"/> FM service | <input type="checkbox"/> Training |
| <input type="checkbox"/> FM software | <input type="checkbox"/> Waste management |
| <input type="checkbox"/> Genset Diesel Fuel Maintenance | <input type="checkbox"/> Relocation |
| <input type="checkbox"/> Hygiene | <input type="checkbox"/> Research and development |
| <input type="checkbox"/> Indoor plants | <input type="checkbox"/> Printing and stationery |
| <input type="checkbox"/> Insurance | <input type="checkbox"/> Project management |
| <input type="checkbox"/> Labour outsourcing | <input type="checkbox"/> Retail |
| <input type="checkbox"/> Landscaping | <input type="checkbox"/> Security |
| <input type="checkbox"/> Lightning | <input type="checkbox"/> Plumbing |
| <input type="checkbox"/> Maintenance | <input type="checkbox"/> Others |

5. Kindly tick the location of your organisation and the headquarter (if application) in the following table

	Branch(es)	Headquarter
Eastern Cape	<input type="checkbox"/>	<input type="checkbox"/>
Free State	<input type="checkbox"/>	<input type="checkbox"/>
Gauteng	<input type="checkbox"/>	<input type="checkbox"/>
KwaZulu Natal	<input type="checkbox"/>	<input type="checkbox"/>
Limpopo	<input type="checkbox"/>	<input type="checkbox"/>
Mpumalanga	<input type="checkbox"/>	<input type="checkbox"/>
Northern Cape	<input type="checkbox"/>	<input type="checkbox"/>
North-West	<input type="checkbox"/>	<input type="checkbox"/>
Western Cape	<input type="checkbox"/>	<input type="checkbox"/>

6. What is your highest academic qualification?

- Certificate
 Diploma
 Bachelor Degree
 Master Degree
 Doctoral Degree
 Other (please specify)

What technology innovation are you using: Are you ahead of the curve or lagging behind?

SECTION B: CURRENT TECHNOLOGICAL INNOVATIONS IN FACILITIES MANAGEMENT PRACTICE

1. Please tick the category of technological innovation that is already in use in South Africa

	No	Yes
TC1 Information Communication Technology (ICT)	<input type="radio"/>	<input type="radio"/>
TC2 Robots	<input type="radio"/>	<input type="radio"/>
TC3 Sensors	<input type="radio"/>	<input type="radio"/>
TC4 Drone technology	<input type="radio"/>	<input type="radio"/>
TC5 Cloud-based technology	<input type="radio"/>	<input type="radio"/>
TC6 Others	<input type="radio"/>	<input type="radio"/>

2. If you answered 'No' to any of TC1 to TC5 above, kindly make a time projection of when you think your organisation will adopt it.

	Never	1 - 5	6 - 10	11-15	16-20
TC1 Information Communication Technology (ICT)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
TC2 Robots	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
TC3 Sensors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
TC4 Drone technology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
TC5 Cloud-based technology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
TC6 Others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

3. Kindly list any other category of technological innovations not listed in question 2 above that your organisation is already using:

- (a)
- (b)
- (c)
- (d)
- (e)
- (f)

4. Please list any other technological innovation that is not listed in question 2 above and your organisation is not currently using but plans to adopt in the near future:

- (a)
- (b)
- (c)
- (d)
- (e)
- (f)

5. For every technological innovation listed in Question 4 above, kindly make a time projection of when you think your organisation intends to adopt it

	1-5	6 – 10	11 – 15	16 – 20	Above 20
(a)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
(b)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
(c)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
(d)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
(e)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
(f)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

6. By what percentage has technological innovations increased any of the following factors in your practice of FM?

	0-20%	20-40%	40-60%	60-80%	80-100%
FA1 Productivity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
FA2 Running Cost	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
FA3 Efficiency	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
FA4 Corporate Image	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
FA5 Flexibility	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
FA6 Connectivity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

7. For the purpose of the second phase of this study, if you don't mind, can you please provide the names of six FM organisations that in your opinion uses the heaviest technological innovations?

1	<input type="text"/>
2	<input type="text"/>
3	<input type="text"/>
4	<input type="text"/>
5	<input type="text"/>
6	<input type="text"/>

What technology innovation are you using: Are you ahead of the curve or lagging behind?

SECTION C: IDENTIFICATION OF FACTORS RESPONSIBLE FOR THE ADOPTION OF TECHNOLOGICAL INNOVATIONS

1. Kindly tick to rank how the following factors influence the level to which your organisation adopts technological innovations in facilities management.

	Very low	Low	Medium	High	Very high
IF1 Improves job performance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
IF2 Increases job efficiency	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
IF3 Increases the pace of work delivery	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
IF4 Work volume is increased	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
IF5 Work quality is improved	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
IF6 There is apparent usefulness of the technology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
IF7 There is a possibility of relative advantage over competitors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
IF8 Overhead cost is reduced	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
IF9 Simplification of work	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
IF10 Workers are easily trained to understand the job	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
IF11 Reduced complexity of FM operation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
IF12 Technology is compatible with current trends in FM operations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
IF13 Work is made easier	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
IF14 The technology is easy to use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
IF15 The work is less challenging with technology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
IF16 The human input in operation is reduced	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Very low	Low	Medium	High	Very high
IF17 Improved decision making is enhanced with technology	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
IF18 Organisation image is enhanced	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
IF19 The comparative advantage is increased	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
IF20 The capability of the firm among competitors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
IF21 Employee motivation and interpersonal relations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
IF22 Employees are receptive to new changes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
IF23 Supports continuous innovation from employees	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
IF24 It is in line with the overall objective of the organisation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
IF25 Intended adequate training and retraining	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
IF26 Assurance of adequate after sales support service from vendor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

2. Please rank the following factors according to how critical they are in the decision for the adoption of technological innovations in your organisation.

	Not critical	Fairly critical	Critical	Very critical	Extremely critical
CF1 Performance expectancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
CF2 Facilitating conditions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
CF3 Effort expectancy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
CF4 Social influence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
CF5 Employee resistance to change	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
CF6 Top management support	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

What technology innovation are you using: Are you ahead of the curve or lagging behind?

SECTION D: TECHNOLOGICAL INNOVATION AND SOCIAL SUSTAINABILITY

1. How important is the concept of sustainable facilities management in your organisation?

- Not important Less important Neutral Important
 Very important

2. Kindly tick to indicate the level of priority in your opinion that each of these sustainability pillars receives in your organisation.

	Not	Low	Medium	High	Extremely high
PS1 Economic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PS2 Environmental	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PS3 Social	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

3. Kindly tick to indicate the level to which you agree with the assertion that social sustainability has received the least attention amongst the sustainability pillars.

- Strongly disagree Disagree Undecided Agree Strongly agree

4. Please tick to express your opinion on whether these social factors affect social sustainability in your organisation

	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
T11 Alienation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
T12 Social network	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
T13 Work and home life balance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
T14 Overwork	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
T15 Social isolation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
T16 Remuneration	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
T17 Autonomy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
T18 Job security	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
T19 Interpersonal relationship	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
T110 Professional status	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
T111 Task requirement	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
T112 Organisation policy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
T113 Workshops and seminars	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
T114 Professional development programs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
T115 Retirement development plan	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
T116 On the job training	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

5. Kindly tick to indicate your opinion the level to which these factors negatively affect employees in your organisation.

	Very Low	Low	Moderately	High	Very high
T11 Alienation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
T12 Social network	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
T13 Work and home life balance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
T14 Overwork	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
T15 Social isolation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
T16 Remuneration	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
T17 Autonomy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
T18 Job security	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
T19 Interpersonal relationship	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
T110 Professional status	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
T111 Task requirement	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
T112 Organisation policy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
T113 Workshops and seminars	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
T114 Professional development programs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
T115 Retirement development plan	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
T116 On the job training	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

6. If you wish to participate further in this research and be available for an interview, please provide your contact details below:

Name:

Tel no:

Email:

Appendix D: Interview Guide

Greetings

Introduction of the interviewer

Principal Researcher: Mr. Unekwu Jonathan Adama

Supervisor: Associate Professor Kathy Michell

Research Title: A study of the impact of technological innovations on the social sustainability of FM employees in South Africa.

General information about the company and the responding officer

Can I meet you sir/ma/introduce yourself?

Name (optional):

Position in the organisation:

Years of service in the organisation:

Region or province of the interview (organisation):

Start and finish time of interview:

Section A: Adoption of TIs in the organisation

1. Has this organisation adopted modern technological innovation (TIs) for facilities management lately?
2. Can you mention some of them?
3. In what ways are the new technologies affecting your operations?
4. Are there challenges that have come up with the adoption of these TIs either with the staff or the operations.
5. Can you say that the adoption of the TIs has allowed your organisation to achieve more task completion from your employees?

Section B: Social sustainability and social relationship

6. Is there any way in which your organisation compensates for this increased volume of task?
7. Do you agree that perhaps, if there is any incentive to compensate for the increased volume of work, that your employees will be more committed?

8. Sustainability has become an important aspect of facilities management practice. Can you elaborate on sustainability practice in your organisation?
9. Do you get feedback from the employees about the use of TIs with regards to their operations,..... and their wellbeing?
10. What are some of the wellbeing related complaints?

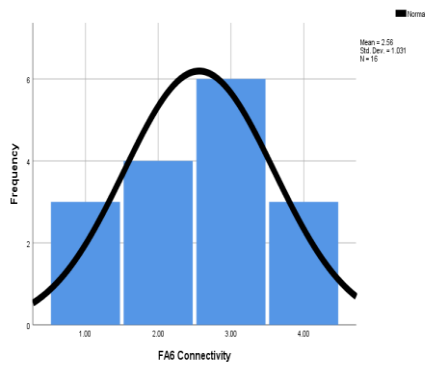
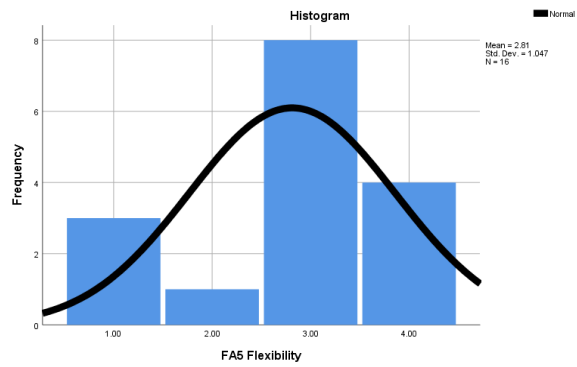
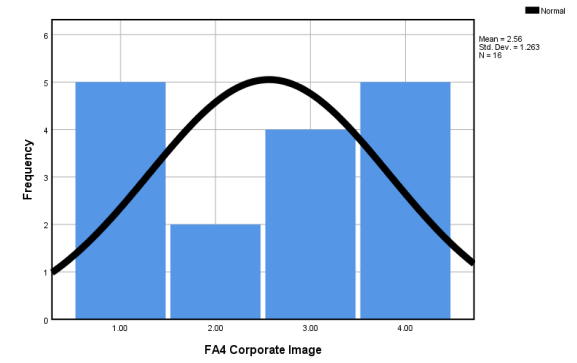
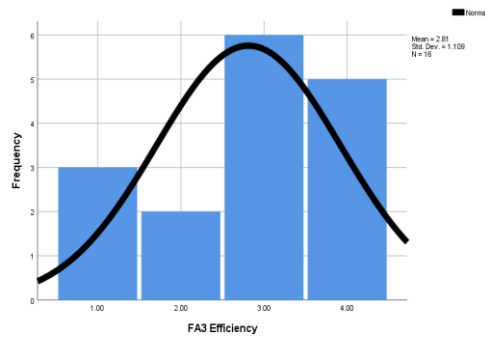
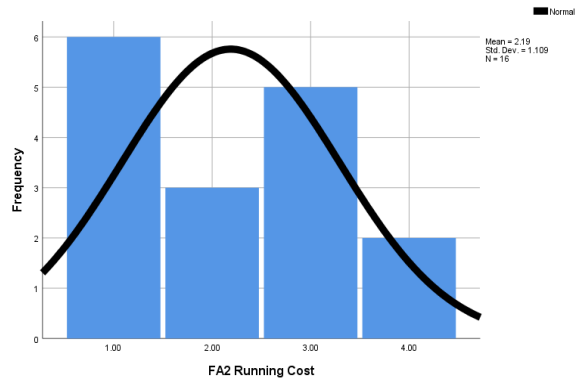
The social pillar of sustainability is identified as lacking adequate attention, moreover, the adoption of TIs has been identified to cause some social problems to the employees

11. what are the challenges that you have had in your organisation with regards to TIs that are of social nature and how did you resolve the challenges?
12. Do you have activities that are targeted at enhancing the social relationship among your employees?
13. In what ways does your organisation demonstrate social responsibility to the community?
14. Do you agree that the social wellbeing of the employees translates to the social wellbeing of society?
15. Are there staff members of this organisation that have been laid off on account of TI adoption?

Knowledge Development

16. Is there any form of professional development training for staff members that are tailored towards enhanced use of technological innovations?
17. Is there other form of training in the organisation that are not towards achieving the core business objectives?
18. Does the organisation organise any form of retirement training for the employees?
19. Is there anyone in the industry you would like to recommend that I should interview?
- 20. Thank you for your time.**

Appendix E: Normality



Appendix F: Sample of Transcribed Interview

Respondent A

Question 1

How long have you been working in this organisation?

Respondent

I have been in this building for 33 years, but I haven't done the same thing for 33 years because it is a big organisation. I have moved around, coming at a very low level, I have moved around, I have been in facilities management for the last... actually since 1996 but I have been doing waste and cleaning for the last 10 years. it is always leaning, new leaning and its fine.

Question 2

Has this organisation adopted technological innovations lately for FM practice?

Respondent

yes we have lately, more on the technical side of solar panels and now with the current crisis, we are looking at further advancement in that area, my technical manager will be talking to you I think after me at least on a technical side and will be able to give you more explanation of the technology that they using with the solar panel where they can track the energy use to the building which comes through to your phone as well as the water consumption because we've had areas, you know with the water crises, in Cape Town, what has happened is that they've have turn the water down, levels down so that it's not gushing through, so it's down instead of the normal level of 8, it's down to level 5 so in a big building like this where you've got 10 stories, sometimes the water pressure doesn't go all the way to the top to flush the toilets so we've had to put in various systems and that's where the technology also comes in where they can now check the various metres of the water meters in different buildings to see which one is emptying , how fast its emptying and they can react on it. So, on that side there is a lot more than on my side.

On my side, cleaning is very much a labour-intensive thing, so the technology isn't that great but what we are looking at to do in this building because we have 172,000 square meters of

grounds that and we have to have a lot of cleaners to manage it to keep it looking tidy. We have 163 cleaners on the site during the day, that's inside and outside, cleaning offices, toilets etc. what we would like to do to make it simpler is instead of having supervisors manually checking various areas, they can go with technology thing which is attached to your phone to scan and they can do the reports that way instead of writing on a clip board and paper, so that's where we would like to see it go so that I can see at the drop of a button on my phone where there've been.. so, somebody says oh there is a problem on 6H, that's gonna sound like Greek to you, I can actually say that it was checked recently, we are aware of the broken window, whatever it is, and we are acting on it. in the waste area we also try and do that, at the moment, we've only been sorting the waste ourselves for the last year, previously we had another company that was doing it and they were benefiting from whatever they recycled, now, oldmutual has taken a different approach, we've renovated the area and technology is not that great there, we have a scale now so that we can weigh whatever waste is going out so that we can make sure that when it leaves our site and it goes to the recycler, that it kind of ties up, so we can make sure that 2 tonnes, that that recycler is given 2 tonnes so that we are not short changed. And what we would also like to do is to put a kind of a PDA system in the waste area so we can scan the waste, particular brand of waste, different kind of plastics for instance and see that it weighs 500 kilos and we can get a report of that on your phone on my desk, my PC instantly and then we can manage that way. It's just a better follow-up to sending it to the recycler and waiting for a month to get report on how much of certain plastics was recycled.

PDA is a personal device for administration, so it basically scans the barcode, and it will pick up the weight and it's the same as what they are using on the electric meters and the water so it goes through to your phone and it will do a recording of the particular barcode for the plastic say it's a PET plastic and then it will pick up the weight then I can get that on a report and then it gives you instantaneous report on your phone or on your computer.

Question 3

How does the adoption of technological innovations affect this organisation?

Respondent

eehh.. I won't answer for the technical side, eeh what I would say for my side, the way that it's going to enhance it is going to be more accurate management of information and then less labour intensive way, somebody has got to report and you know we've got the human error,

they record the numbers back to front or they leave other digits and then your records are a little bit skewed, so that will be a more accurate and also instantaneous report so I can at any stage see what was gone off site, how much PET, or how much LDP or how much white paper for instance. Because that is the different categories of waste.

You've got your LDP plastic which is a low-density polyethylene, then you've got the HDP which is the high-density plastic, you get PET which is your bottles, your properly something. There is a various range of plastics according to the triangular code at the bottom of the plastic container or plastic bags that causes the LPDE, we have news prints, glossy magazines, whether it's eh glued spine or whether it's a ring spied and there are different values attached to it and of course your office papers which is very good if it's not damaged, it has hard money coming in, and then we've got cardboard which is classified as a K4. So, we've got different categories of office waste that comes up. Then we also have food waste, and that food waste goes to fly farm in Philippi where they turn it into fish food and chicken food and also into compost.

we are trying to avoid as much going to the land fill, now last year when we didn't experiment, when we took it on, we only managed 75% of our waste going to land fill. I can say now that we are somewhere close to about 63% and as constant reduction as time come along because we are educating people in the building as well to recycle so we have activation days, we constantly put on TV screen throughout the building so that when you stand and look at the TV screen you can see how much waste we have recycled or how you can separate your food waste from the other waste. So, it's also educating.

Question 4

Has this organisation met any challenges with the adoption of technological innovation both in operations and employees?

Respondent

employees is a problem because it's a behavioural challenge to get people to give up their best to corporate, also to change old habits, you know when you get into certain age, most people are so ingrained with old habits that they do the same thing so the need to change that habit and the behaviour is also a thing of laziness but with the technology it is more accurate so you have better records and less error which is the advantage and some people might feel threatened by

technology which is the negative side because what do u need me for.. I think there is that fear that technology is going to take over, which inevitably it will.

I will tell you why because I've got a child who is in high school and there has been a lot of articles in the newspapers now and is about how children are making subject choices and that they are going to be doing a job that isn't even invented yet in the near future. So, to make a subject choice to go to the university, they are going to be making robots, they are going to be making boarding parts and that kind of thing, so technology is changing the world and of course sustainability will come into that as well. Because we will use a lot of recycled parts I hope

Question 5

Has the adoption of technological innovations helped this organisation to perform better?

Respondent

Yes, I think so, its gradual process and we are constantly learning, eh but yes I think we are sending less to land fill, we are making more people aware of the negative sides of land fill and how technology is helping us, I think it is also giving people scope to realise that if am technical kind of person, there is something for me in the future, so its growth in many ways for people whether with their job now or in the future and technology is effective, its more accurate generally if done properly.

Question 6

Has the adoption of technological innovations increased the volume of work for the employees?

Respondent

No, I wouldn't say so, technology actually makes tasks easier because there are more accurate data bases for them to work with, you know if you have to manually weigh stuff and record it, you have to keep checking and I think with technology it's just a fast one, read it and record it and move on and do the next one.

Some people who are uneducated that don't understand, and they think technology is going to take over. That debate has been around for many years even when I was in school. And I think that we are going to be replaced but we always need the human factor. Machines cannot sort

things as easily, but it can weigh the thing and record it in the waste side I refer to that, we still need a form of manual cleaning in the cleaning industry. You can't have a robot yet.

Question 7

Is there any way the organisation is compensating the employees for the increased volume of work?

Respondent

I don't think so, not at this stage, maybe in the future

Question 8

Is it possible that the introduction of any form of compensation will stimulate the commitment from the employees?

Respondent

Yes, I do think so. I think at the end of the day the whole full cycle is education for them for them to educate their families, their children, their grandchildren and in that, there are so many aspects that holds the future for them and also performance because a person who actually works hard, you feel rewarded for what you've done and when the rewards comes through, you actually make you work harder

Question 9

What is the general approach to sustainability in this organisation?

Respondent

Generally, in a very broad sense, we are trying to do the right thing for the environment in that what we are doing is besides the waste which is a big part which I can reflect on, what we also try to do is to educate the people and make people aware, so that in the greater aspect of things is good so with the less waste going to land fill, it improves the carbon emission and we report on this quarterly, I report to London every quarter which then goes into the sustainability report that Oldmutual does. But we are trying to get people to do things in a more sustainable way, getting things right. In the building fabric, it's a little bit more difficult because ultimately in the building fabric when you are making carpet out there for sustainability, you need a cradle

to grave kind of scenario and we are not at that stage yet. South Africa is very far behind in that. So, for instance, when we renovate a building, we pick up the carpet tiles that generally gets damaged, it doesn't go into any recycling format which is a bit sad. South Africa also, there is a lot of batteries in this building just for an example, we have a set of sensors in the bathrooms that have got batteries and South Africa is behind on recycling the batteries to get something out of it, to make something out of it. So, I think that's also a kind of a bit of a negative, but I think once we can get everybody to realise in the building industry that the fabric of a building and putting it together, sustainability will be better, we've got lightened enabled sensors in the building and that is better to sustainability because we've got people who reside across the road, and they always look out to the building and they comment on they've leave the lights on. Now as soon as there is no movement in the room, the lights go off. We only have emergency lighting on. So, there I think it's also doing good for sustainability and as people can see, Oldmutual is a green company, we've got green building status, that's our existing building status which also counts in our favour and it also makes people question things, people are aware of things and if you like Oldmutual brand, you can promote it, that in many ways help with sustainability.

Question 10

What is the organisation approach to social sustainability?

Respondent

I can't answer that question but what I will say is in the social aspect is educating people in the building and hopefully that gets carried outside the building. When we are working on projects sometimes, marketing, we do project to help old houses that sort of things, maybe we need to educate the people into building houses with recycled products rather than bricks and mortar. I think that will go as an option on the social side but I it's a bit difficult. Cuts in maybe I should help a little.

Question 11

Does this organisation receive feedbacks from employees concerning their use of technological innovations?

Respondent

It isn't out rightly, I wouldn't say specifically about that, but we do survey at least once in a year in the building to ask staff about the facilities that are offered. It is a very general and a bit broad so what we want to do is we want to measure if the staff are happy with the services that are offered in the building by suites and shops, our services as the maintenance and whatever and if there are people who complain, is there something bugging them about the ergonomics of their chair, they will put it in there. So, there is that feedback and that feedback is scored rated every year and we analyse it and we act on it. So that is currently starting today, and it runs for a week for this year.

Question 12

What are the adverse effects of technological innovations in this organisation?

Respondent

I personally don't but I know some people do. A lot of people have got laptops, they take them home, and if you are a dedicated worker and you've got deadlines or your work pressure are heavy, you gonna go home your family life is gonna suffer because you need to get the report that you need to do something, laptops come out. Also with telephones these days, everything is in smart phone, it can do a lot of things for you and I think that does on the technology side, it does interfere because you want to message colleagues about something you just remembered something or putting something up, a note on your phone, whatever, it is that you need to do tomorrow, your diary, your calendar, I think it does affects people's family lives on a negative side. On a positive side I think it does help people in getting work done and communication is a lot easier when you can do a call meeting to discuss issues now do it on a social media environment. So, things can get speeded up.

Question 13

How can this organisation help in improving the negative influences of technological innovations?

Respondent

There is always a risk, I can't come into that because am not an IT staff. Somebody that is an IT staff can better answer your question because there is always a risk. You know there are people that are trying to get into systems all the time, we've got this ransom software that are

going around, malwares and all these things, and I think that is just a huge risk at this point in time that with technology, its ... yeah I don't think we gonna get away from that.

Question 14

How does this organisation manage the issue of social isolation due to the adoption of technological innovations?

Respondent

Yes, there are. We look at departments and the divisions within old mutual to have that sort of things depends on the budget available for, but I know there are various departments amongst themselves have a function just to boost staff morale, chat about things in more relaxed environment. We have a yearly function whatever manner it might be that people connect, we also have networking functions with other companies. So, we have instances I can tell that we have electronic expos here which we have in city of Cape Town and other people, eh there is a networking thing that can happen their way, you meet like-minded people swap ideas, swap business cards, brochures, question things which I think does also help with that sort of thing. So, yes while you are isolated to a point with technology, you can be bug down but I think also, it opens up other doors to be connected with other people. Experts in other fields maybe.

Question 15

How does this organisation manage the issue of corporate social responsibility?

Respondent

Well to staff, look, eeh the approaches to recycling waste is to reduce, reuse and,.. reuse, reduce and recycle. We have a lot of disadvantaged people here like our cleaning staff, waste staff that do things and often there is a lot of stuff that goes into the waste area that you will be surprised about which for me it might not just be worth it and I just dump it but for them it is a whole lot of stuff, so from a social aspect, my approach is rather than them see something like a mug in there, just a simple thing like a mug plate whatever and it's going to waste and they think ah, I could do with that, i would rather that they can get permission to take it out and give them a green slip for that so they can build up, this mini textile, fabric, whatever, we even have fabrics that go under the building. we renovate kitchen, if its beyond use, it's gets dumped but if it is re-useable, first come first serve and it can be re-used off, so we then have opportunity to

improve people's lives at home by giving them these things, so that is one aspect of the staff. They can't afford these things we understand it so rather that it goes to somebody that can use it than it be dumped and go to land fill. So on under social responsibility stuff, that is one area particularly in my field where we like to try and help.

Question 16

Have there been instances when this organisation has laid off employees because of technological innovations?

Respondent

I don't think so

Question 17

Is there training in this organisation that is not only targeted at efficient job performance?

Respondent

Ahh mm, there is training, oldmutual gives training, so I think there is something that oldmutual has. They will offer the training for the betterment of the staff, that's one way of retaining your staff and getting their expertise. So, I think from that aspect you know eemm anything without people who are clearness who have gone into courses easily become team leaders and they have been able to adopt and that's what mutual is about.

It's about helping people, training people, teaching people, bettering people's skill and with the object to retaining them but people move on once they've got skills people move on to the next phase of ehh, I think that also counts in Mutual's favour, you would always like to see that you educate somebody and doing something better for somebody on the social side so FM is benefit.

We have certain courses that you can do for your own benefit, in fact am nominated for course in next month that is called personal mastery and that is about looking at yourself and how you can overcome things and also that will help you give an understanding of you are not the only one with problems, so on a personal level, yes, there is also courses that people can learn very basic things about writing, business writing which at the end of the day its gonna benefit you whether you work for old mutual or whether you go and work from home or whatever, so there are certain courses that you can do, computer courses even, at the end of the day that benefits

you, well that is not oldmutual but it benefits you to be able to get a better job somewhere else. Mutual does do that we have exposure from time to time, through Nedbank, through the city council , we've got a programme for the staff, it's a wellness program, so anything to do with wellness, if you have issues, you need a psychologist or psychiatrist, somebody to talk to maybe you feel suicidal we've got that in place as well not as skill but there is a benefit for you, for an outlet just to speak, to get advice and also to aspect of your personal sphere so maybe conditions that sort of thing and mutual does try and focus on the wellbeing of the employee, that is part of the survey that we do. If you have a happy employee, you have a good output and mutual has been rated no 1 employer a few times. Cuts in... congratulations, laughs laugh...

Question 18

Are there any retirement development plans?

Respondent

Apparently there are, am not at that stage yet but I've got colleagues who has gone through it and I got a colleague who is going through it who is retiring next month and when you get to a certain age, I understand when you get to the age of 50, 55, they start preparing you for retirement, busying you with communications about your retirement status, what your fees are and where you need to up your fees because you might not have enough and then they also educate you as you are close to retirement about what to do with the money, there was a lady that I use to with a few years ago who retired early this year, she had to go through a process where they try to tell her, they teach her how to invest her money to get the best worth for it. So, they do help you with those programs because sometimes people think I will just go and buy myself a new car and buy myself a new house and they've got nothing to live on. So, from social aspect, mutual does try and offer their assistance, whether they are accepted is another story. So, they do try and educate you to your wellbeing.

Question 19

Is the remuneration in this organisation relative to use of technological innovations adequate?

Respondent

eehhmmmm, eh yes and no. your money is never enough! However, I feel oldmutual salaries are benchmarked according to the market, so I have to start in fairness for oldmutual it is, but I

also have to say sometimes just your colleague, some colleague are working a little bit harder than others and they're getting more paid than what I am so it also depends on how smart you work. Just because am working harder does not mean am working smarter. So generally, I would say yes am paid adequately for my knowledge and for my job. So am carrying a lot of knowledge for having been here for thirty-three years

Question 20

Does the adoption of technological innovations threaten jobs in this organisation?

Respondent

I don't think it threatens my job but that of the people that are sorting because, I would still have to manage the contract whether it is robot that is doing it or not, I still have to manage that aspect of the contract. I still have to write a report on it to make sure that .. so, if the robot racks down those on truck, I have to get in and do it manually. And I have to fix the problem, so I don't think my job is threatened.

Question 21

Does the work in this organisation intrude into workers' home life?

Respondent

Work has got a positive effect on my home life more than a negative and that aspect is because of waste that am dealing with, that am learning, am teaching my children about recycling, reducing waste, how they affect the world and I have learnt to become greener at home, am using recycled water, am sorting my waste so from that aspect it has improved my life, hopefully my children lives and their future children. Negatively, I can say anything because I don't work for long hours, am on call 24/7 but I have good people that work with me, my site manager for the cleaning and the waste and he is a phone call away if there is a problem, so am happy to come in if necessary, I've got the right to choose if I need to and I've got a very good manager that I can approach for assistance, I have got good colleague. Yes, I think we are a good bunch of people where we are. if there is a problem for me, somebody else can help me along the way so I don't think it interferes negatively with my personal life. More on a positive note.

Interviewer: Thank you very much for your time.

Appendix G: Ethics Clearance

APPLICATION FORM

Please Note:

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

APPLICANT'S DETAILS		
Name of principal researcher, student or external applicant	Unekwu Jonathan Adama	
Department	Construction Economics and Management	
Preferred email address of applicant	admuns001@myuct.ac.za	
If a Student	You Degree e.g., MSc, PhD, etc.,	PhD
	Name of Supervisor (if supervised)	Associate Professor Kathy Michell
If this is a research contract, indicate the source of funding/sponsorship	Not Applicable	
Project Title	Influence of technological innovation on facilities management practice and the implications for social sustainability in South Africa	

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

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

SIGNED BY	Full name	Signature	Date
Principal Researcher/ Student/ External applicant	Adama Unekwu Jonathan	Signature Removed	09 Mar 2017

APPLICATION APPROVED BY	Full name	Signature	Date
Supervisor (where applicable)	A/Professor Kathy Michell	Signature Removed	09 Mar 2017
HOD (or delegated nominee) Final authority for all applicants who have answered NO to all questions in Section 1 and for all Undergraduate research (including Honours).	A/PROF MARYA Click here to enter text marya	Signature Removed	12/03/2017 Click here to enter a date.
Chair: Faculty EIR Committee For applicants other than undergraduate students who have answered YES to any of the above questions.	G. Sithole Click here to enter text.	Signature Removed	18/4/2017 Click here to enter a date.

Appendix H: Emergent Themes

Name	Sources	References
Auto coded node	9	185
Awareness of Potential technology Capabilities	5	6
Experience	9	9
Lack of knowledge about the full scope of FM	8	11
How the adoption of technological innovation will affect FM employees in the long run	1	1
Social Well-being	5	12
Issues of job losses due to technology adoption	3	6
Personal drive	1	1
Remuneration	4	5
Retirement development plan	4	4
Work and home life balance	5	7
Technology adoption and influences	5	6
Advantage of adopting technology	7	16
Efficient waste management	1	3
Cost effectiveness of technology	3	7
Feedback aimed at improving technology impact in the organisation	6	8
ICT enabled process	3	3
Influence of technology adoption on the operations of the organisation	7	15
FM contribution to the general sustainability	2	2
Influence of FM on social sustainability	2	2
Technology use in waste management	1	2
Nature of operational FM	2	2
Cleaning services	1	1
Operational challenge of adopting technological innovations	2	3
Threat to technology	1	1
Potential factor that can influence technology adoption	1	1
Technological flexibility	4	7
Technology adoption	7	8
Level of technology adoption	7	8
Technology type	8	15
Cloud	3	3
Sensor	6	7
Waste management technology	1	1
Training	7	11