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**Integrating physical asset management and
facilities management operation and its benefits
to the manufacturing industries**

A dissertation submitted in partial fulfilment of the degree of
Magister Ingenieriae / Magister Philosophiae in Engineering Management
Faculty of Engineering and the Built Environment
University of Johannesburg

Mamohlokwe Julia Phala

Supervisor: Professor Jan-Harm C. Pretorius (Pr. Eng.)

Co-supervisor: Dr E. Ogbeifun

2019

DECLARATION

I declare that this research report is my own work. It is being submitted for the degree of Master of Engineering to the University of Johannesburg, Johannesburg. It has not been submitted before for any degree or examination to any other university.

(Signature of Candidate)

-----day of-----2019



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To my best friend and cheerleader Paul, and our dearest children Pheladi and Modige– thank you for your encouragement, understanding and the space to pursue this study.

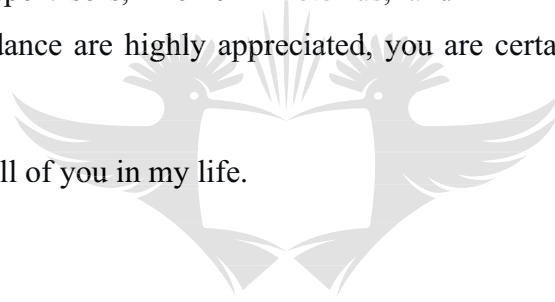
To my parents Lucas and Sophy Phala, who did not need education to understand the value of it - this is for you, for all your sacrifices, unconditional love and prayers to be the best we can.

To my siblings Gift, Isaac, John, Emmanuel and Thabo– thank you for always believing in me and challenging me to set the bar higher and to become better at everything I do.

To my village community at Dikgalaopeng in Limpopo, let this give you hope and be one of the many to come. You are a testimony to this saying “it takes a village to raise a child”.

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I thank God for having all of you in my life.



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ABSTRACT

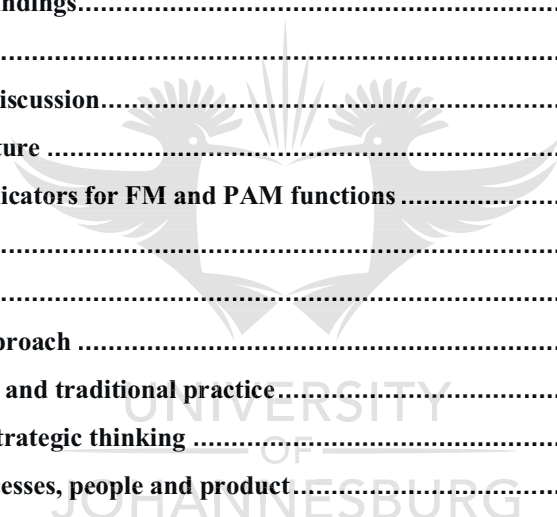
There is a thin line separating the functions of Physical Asset Management (PAM) from Facilities Management (FM). However, if these two functions are integrated at the strategic, tactical and operational levels, the critical assets and facilities necessary for effective business operations will be adequately looked after in a systematic approach. This will facilitate the efficient operation of production processes, improved product, which translate into achieving competitive advantages in the respective industry. The focus of this research is to explore the added value, to the manufacturing industry, if the functions of PAM and FM are integrated and the effects in achieving the strategic objectives of the industry. The research methodology adapted is the multiple sites case study of manufacturing industries, using the instruments of survey, interview and focus group sessions as tools for data collection. The sample encompasses the manufacturing industries, professional bodies and experts from academia. The findings revealed that the majority of the manufacturing industries operate parallel structures for PAM and FM resulting in duplication of functions and resources. These ultimately are negatively affecting the strategic objectives of the industries and the efficiency in the production system and product. Therefore, the progressive integration of both functions was observed as the panacea to achieving the strategic objectives of the industry, in the most cost-effective manner.

Keywords: Facilities management, Integrated functions, Production processes, Physical asset management, Strategic objectives

TABLE OF CONTENTS

DECLARATION.....	2
ACKNOWLEDGEMENTS.....	3
ABSTRACT.....	4
TABLE OF CONTENTS.....	5
LIST OF TABLES.....	7
LIST OF FIGURES.....	8
LIST OF ACRONYMS AND SYMBOLS.....	9
Chapter 1: Introduction.....	11
1.1 Background of the study.....	11
1.2 Problem statement.....	13
1.3 Research aim.....	13
1.4 Research objectives.....	13
1.5 Research questions.....	13
1.6 Scope of the research.....	14
1.7 Research limitations.....	14
1.8 Research method.....	14
1.9 Structure of dissertation.....	14
Chapter 2: Literature Review.....	16
2.1 Manufacturing industry overview.....	16
2.2 Facilities Management overview.....	17
2.2.1 Facilities Management definition.....	18
2.2.2 Facilities Management function in manufacturing industry.....	19
2.2.3 Drivers of Facilities Management outsourcing and insourcing in manufacturing.....	21
2.3 Physical Asset Management overview.....	24
2.3.1 Physical Asset Management definition.....	25
2.3.2 Physical Asset Management function in manufacturing industry.....	28
2.3.3 Drivers of Physical Asset Management outsourcing and insourcing in manufacturing.....	30
2.4 Integrated function of Facilities Management and Physical Asset Management.....	30
2.4.1 Similarities and differences of Facilities Management and Physical Asset Management.....	31
2.4.1.1 Similarities in terminologies and objectives.....	31
2.4.1.2 Similarities in work order process and key performance indicators.....	34
2.5 Research Gap.....	35
2.6 Summary.....	36
Chapter 3: Research methodology.....	37
3.1 Research method.....	37
3.2 Population and sample size.....	37
3.3 Data collection.....	38
3.4 Data analysis.....	42

3.4.1	Data analysis of preliminary survey	42
3.4.2	Data analysis of focus group	44
3.5	Validity and reliability	45
3.6	Research limitations.....	45
3.7	Summary	46
Chapter 4: Findings and analysis		47
4.1	Background.....	47
4.2	Research findings.....	47
4.2.1	Findings of preliminary survey	47
4.2.2	Findings and analysis of focus group	60
4.3	Test for validity and reliability.....	60
4.4	Summary	61
Chapter 5: Discussions on findings.....		62
5.1	Background.....	62
5.2	Preliminary survey discussion.....	62
5.2.1	Organisational structure	62
5.2.2	Key performance indicators for FM and PAM functions	63
5.2.3	Integration	64
5.3	Focus group session.....	66
5.3.1	Skill concern and approach	66
5.3.2	Historical perception and traditional practice.....	67
5.3.3	Integration require strategic thinking	67
5.3.4	Improvement in processes, people and product.....	67
5.3.5	Re-orientation and adopting industry best practices.....	68
5.4	Summary	69
Chapter 6: Conclusions and recommendations		70
6.1	Background.....	70
6.2	Summary	73
REFERENCES		74
Appendix A: Additional information on Survey Monkey.....		79
Appendix B: Table for reporting focus group session		80
Appendix C: Table for reporting survey responses.....		84



LIST OF TABLES

Table 2.1: FM Service Categories (Pragma, 2018)	20
Table 2.2: Example of insource-outsource comparison	22
Table 2.3: Common terminologies used in FM and PAM	31
Table 4.1: Summary of the analysis of focus group session	60
Table 5.1: Typical KPI for physical asset management department (Pragma, 2019)	64



LIST OF FIGURES

Figure 2.1: FM elements within manufacturing (IFMA, 2019)	19
Figure 2.2: Evolution of Facilities Management (Frost & Sullivan, 2015).....	18
Figure 2.3 Outsourcing Objectives (Executive Knowledge, 2017)	21
Figure 2.4: ISO 41012 Sourcing Workflow (SAFMA, 2018)	23
Figure 2.5: Tender evaluation factors (Executive Knowledge, 2017).....	23
Figure 2.6 Evolving client demands in FM (PwC,2014).....	24
Figure 2.7: Evolution of Asset Management (IBM, 2007).....	25
Figure 2.8: Summary of asset management (modified from IFMA,2019)	27
Figure 2.9: Asset Life Cycle (LCE,2019).....	27
Figure 2.10: Asset life cycle cost (Pragma Academy, 2019)	28
Figure 2.11: Manufacturing system strategy (Harrison & Petty, 2002)	28
Figure 2.12: Bathtub depicting failure patterns of assets (Pragma Academy, 2019)	29
Figure 2.13: Extract of a survey on outsourcing reasons in manufacturing in KSA (Al-Mutairi & Al-Hammad, 2015)	30
Figure 2.14: Work planning and control process for maintenance management (Pragma, 2019)	33
Figure 2.15: Facilities Management throughout the building lifecycle (FMA, 2018)	33
Figure 2.16: ISO 55000 and 41000 Framework (Leeuwen, 2018)	34
Figure 2.17: Reach for ISO 55000 on other ISO management systems (Leeuwen)	35
Figure 3.1: Survey invitation email sent to participants	39
Figure 3.2: Opening page for survey once participant has accepted the link	39
Figure 3.3: Survey questions.....	41
Figure 3.4 Preview of SAAMA Conference presentation	39
Figure 4.1: Set 1 questions.....	50
Figure 4.2: Set 2 questions.....	52
Figure 4.3: Set 3 questions.....	55
Figure 4.4: Set 4 questions.....	58
Figure 4.5: Set 5 questions.....	57
Figure 4.6: Set 6 questions (SAAMA conference)	59
Figure 6.1: Proposed integration model.....	71
Figure 6.2: Proposed Facilities and Assets Management Structure	72
Figure 6.3.: Types of integration for future work studies	73

LIST OF ACRONYMS AND SYMBOLS

Acronym	Full name
AI	Artificial Intelligence
BIFM	British Institute of Facility Management
BSI PAS	British Standards Institution's Publicly Available Specification
CAFMS	Computer Aided Facilities Management System
CEN	European Committee for Standardisation
CMMS	Computerized Maintenance Management System
CSR	Corporate Social Responsibilities
DMAIC	Define Measure Analyse Improve Control
EAMS	Enterprise Asset Management Software
FM	Facilities Management
GCI	Global Competitiveness Index
GDP	Gross Domestic Product
HVAC	Heating Ventilation Air Conditioning
IAM	The Institute for Asset Management
IFMA	International Facility Management Association
IoT	Internet of Things
ISO	International Organization for Standardization
KPA	Key Performance Areas
KPI	Key Performance Indicators
LCC	Life cycle costing
PAM	Physical Asset Management
RCA	Root Cause Analysis

RCM	Reliability Centred Maintenance
SAAMA	Southern African Asset Management Association
SABS	South African Bureau of Standards
SAFMA	South African Facilities Management Association
UN	United Nations
WTO	World Trade Organization



Chapter 1: Introduction

The manufacturing industry in South Africa is challenged with high cost of production, shrinking market share and ‘war’ for talent as critical skills are slowly diminishing, and at the same time, complexities from technology and regulations perspectives are increasing at a rapid rate (Standard Bank, 2020). Artificial Intelligence (AI) and Internet of Things (IoT) technologies are disrupting industries and have to be managed through proper infrastructure and skills in an integrated approach, however, as anything else in life – change is costly and sometimes uncomfortable.

In this chapter, the purpose of the research, which seek to challenge business leaders to evaluate their organisational structure pertaining to facilities management and physical asset management, and adopt the integration of the two functions into one because of the significant gains is outlined.

The research was executed through extensive literature from books, journals, and interaction with academics, professional experts and relevant bodies such as SAAMA, SAFMA and ISO. The chapter starts with a background to the study, highlighting global manufacturing industry statistics and challenges, followed by a lens view of the South African context. The research aim, objectives, methods and limitations are discussed in detail and the chapter is concluded with the structure of the entire paper.

1.1 Background of the study

Across the globe, organisations are under pressure to realise the value of their assets, and for the asset-intensive organisations whose primary objective is to produce products, the challenge is even greater. For these organisations, maximising the value of their assets means a continual improvement on the performance of their production assets while keeping up with the changing regulations for manufactured products, advancing technology and increased competition.

The shrinking market share currently dominated by United States, China, Japan, Germany, South Korea and India which collectively account for 60 percent of world’s manufacturing GDP (Global Manufacturing Competitiveness Index, 2016), makes it difficult for developing economies such as South Africa to open new foreign markets and grow the sector. According to Deloitte’s Global Competitiveness Index (2016), South Africa is ranked number 27, projected to move up to 25 in 2020. However, according to local studies, there are no signs of

improvement unless a major shift happens in the next two years. The sector continues to suffer job losses, currently employing 18% (384 000) fewer than it did in 2008 (IDC , 2017).

In terms of GDP contribution, the manufacturing sector declined by 20% since 2001 and this is attributed to the rising cost of production, lack of market protection policies due to South Africa's ties with World Trade Organization (WTO), skills shortage and lack of capital investments (Bhorat & Rooney, 2017). What is more concerning is that the decline is also experienced in agriculture and mining, accounting for 500 000 and 145 000 job losses respectively between 2001 and 2014. For a country with a high unemployment rate, inequality and poverty, focus must be devoted to the manufacturing sector to drive the much-needed economic growth. Fortunately, the government has recognised this need through the National Development Plan (NDP) and the Industrial Policy Action Plan (IPAP). Other sectors identified as critical to economic development are agriculture and mining.

The manufacturing industry is challenged with a high cost of production, shrinking market share and 'war' for talent as critical skills are slowly diminishing while manufacturing complexities from technology and regulations perspectives are increasing at a rapid rate. Optimisation in business processes and resources in terms of human, capital, machinery and leadership commitment to business improvement initiatives are crucial than ever before. Traditionally, facilities and plant equipment (production assets) are managed separately despite having a similar scope of assets to some extent, i.e. physical (engineering) assets and working towards the same objective, namely; high productivity through reliable and available assets by balancing cost, performance and risks. Although these two functions have been practised for more than three decades, Physical Asset Management (PAM) was embraced sooner than Facility Management (FM) and formalised at the international level. This milestone provides FM with an opportunity to leverage on the PAM best practices and advance the profession and its value-add into the bottom line.

Some of the observable deficiencies in operating PAM and FM separately are excessive manufacturing or factory overheads in staff salaries, supplies, use of contractors and counterproductive processes due to lack of alignment between departments or functions. E.g. In a mining scenario, the PAM may have scheduled a particular equipment for maintenance, 30ms underground in the mining shaft. At the same time and independently, the FM have scheduled the maintenance of the lift system in the shaft for the regulatory maintenance. In this regard, the PAM task scheduled for 3-hours may become a 3-days task with dire consequences

on production. Integration of the functions, therefore, maybe necessary option for increased operational efficiency.

1.2 Problem statement

It is known that the manufacturing industry is a multiplier sector and important for the economy in South Africa in terms of value addition, job creation and export earnings. However, the sector continues to underperform due to high costs of production, shortage of skills and complex regulations (Standard Bank, 2020). Facilities and assets are critical for the organisations in this industry to achieve their objectives, yet those managing the functions are challenged with doing more with less as capital is scarce. Added to this challenge is the misalignment of the functions resulting in duplications of tasks, wastages and counterproductive actions.

1.3 Research aim

Many organisations view PAM and FM differently with separate budgets and teams. Since the objective of both is to ensure that the critical assets and facilities of the business are looked after in a systematic approach, it is hoped that integrating the two functions will bring value and benefits to the manufacturing industry. Therefore, the purpose of this research is to explore ways in which Physical Asset Management (PAM) and Facilities Management (FM) can be integrated and applied to boost profitability for the manufacturing sector, and subsequently save jobs.

1.4 Research objectives

The objectives of this research are:

- To evaluate the reasons and impact of running PAM and FM as parallel units in the manufacturing industry;
- To evaluate the impact of integrating both functions on the productivity, efficiency and effectiveness of the production systems.

1.5 Research questions

In order to achieve the aim and objectives of this research, efforts will be made to provide answers to the following questions:

- What are the impacts of Facilities Management to manufacturing industries?

- How does the practice of Physical Asset Management help to improve the productivity of the manufacturing industry?
- What values can be derived by manufacturing organizations if the functions of FM and PAM are integrated?

1.6 Scope of the research

The scope of this research will be limited to the activities within automotive, fast-moving consumer goods (FMCG), packaging and money printing industries, in Gauteng Province. The research hope to explore the organisation that practice facilities management and physical asset management separately and those that have integrated the two functions into one, and their effects on the manufacturing industries.

1.7 Research limitations

The research has two limitations. The first limitation is the lack of literature in a similar study, weakening the point of reference for the study. The second limitation is in data collection, which had to be narrowed to selected manufacturing organisations and professionals for practicalities.

1.8 Research method

The research methodology adapted is a mixed approach, combining quantitative and qualitative methodologies. The quantitative method was used to collect preliminary information, which provided a generic overview of the industry perception to the research questions and objectives. The qualitative methodology was used to obtain salient information from respondents which provided detailed answers to the research questions and objectives. The instruments used for data collection include structured question survey, focus group and one-on-one discussion. Basic quantitative and qualitative approaches were used for the respective data analysis.

1.9 Structure of dissertation

This dissertation is divided into six chapters, briefly described as follows.

Chapter 1: Introduction: This chapter provides an overview of the research topic and its significance, scope and structure.

Chapter 2: Literature review: This chapter provides the synthesis of information from previous research that has relevance to the current research

Chapter 3: Research methodology outlines research methodology applied, population and sample, data collection, data analysis and research limitation.

Chapter 4: Findings and analysis: This chapter presents findings and analysis of the research results

Chapter 5: Discussions on findings: This chapter discusses the key research findings in light of best practice gleaned from the literature.

Chapter 6: Conclusions and recommendations: This chapter provides the conclusion of the research exercise showing how the research aim and objectives were achieved. The chapter concludes with the recommendation of areas for further research.



Chapter 2: Literature Review

In order to achieve the objective of this research, relevant academic and industry literature were reviewed to provide generic information on the practice of facilities and asset management, with focus on how they are being applied in the manufacturing space. This chapter discusses an overview of the management of PAM and FM functions and industry trends in an effort to answer the research questions or problems.

2.1 Manufacturing industry overview

Modern manufacturing as we know it today, or the 'factory system' can be traced back to the 18th century during the Industrial Revolution birthed in Britain - due to its political powers and riches in mineral resources. The revolution set Britain for success and today it is regarded as a developed country holding 8th position in world's industrial nation, where manufacturing accounts for 10% of its economy and employing 2.6 million workforces (The Manufacturer, 2019). Globally, manufacturing contributes 16% of GDP and continues to be an important economic driver for both developing and developed markets at the same time (MGI, 2012).

In South Africa, the picture is grim as the sector continues to suffer job losses, currently employing 18% (384 000) fewer than it did in 2008 (IDC, 2017). In terms of GDP contribution, the manufacturing sector declined by 20% since 2001 and this is attributed to the rising cost of production, skills shortage and lack of capital investments (Bhorat & Rooney, 2017). Consequently, the manufacturing industry is operating in environments confronted by continuous changes, which in themselves, brings new challenges and opportunities (MGI, 2012). One of the highlighted challenges for developed economies is the increase in job loss due to automation of the production systems. However, for a developing economy such as South Africa, the industry has great potential and a significant role to play in accommodating the growing population in Africa estimated to reach 2.5 billion by 2050 according to a United Nations report published in 2017 (Allison, 2017).

The Business Dictionary explains manufacturing as "the process of converting raw materials, components, or parts into finished goods that meet a customer's expectations or specifications", and that process involves large scale machinery and labour at a facility, also referred to as a plant or factory. There are two stages during the manufacturing process, namely;

- 1) Primary stage in which raw material is transformed into industrial material through mechanical, thermal or chemical application.

2) Secondary stage in which industrial material is converted into a finished product to satisfy a customer's need by incorporating metal casting, plastic moulding, machining, forming and assembly – commonly referred to as manufacturing processes.

Each of the stages above takes place at a facility made up of buildings, equipment, technology and people in a safe and secure environment. Figure 2.1 shows main and common elements and relationship of FM in manufacturing industry.

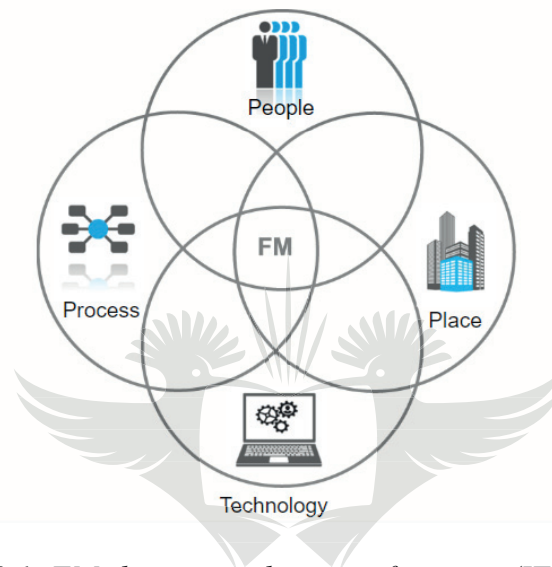


Figure 2.1: FM elements within manufacturing (IFMA, 2019)

2.2 Facilities Management overview

As with many management concepts, Facilities Management is categorised as an evolving concept with different views and definitions depending on geographical location and situation by a number of literatures. As a result, countries have created own definitions and scope of Facilities Management (Hendriks, 2013). In developed economies, FM is regarded as *mature* while in developing economies such as Africa, FM is regarded as in the stage of *low maturity*. According to the national convenor for the *FM Standard working group of the South African Bureau of Standards (SABS)*, South Africa is said to be at least a decade behind when it comes to facilities management practise according to David Khasebe (2018), the national convenor for the FM Standard working group of the South African Bureau of Standards (SABS) while US and UK are said to be advanced (Property Wheel, 2015). Figure 2.2 shows the evolution of FM. Although it is practised in different forms, there seems to be a consensus from different publications that its recognition started in the 1970s. Also, there are efforts to define the scope (Ogbeifun, 2011) and professionalise the function.

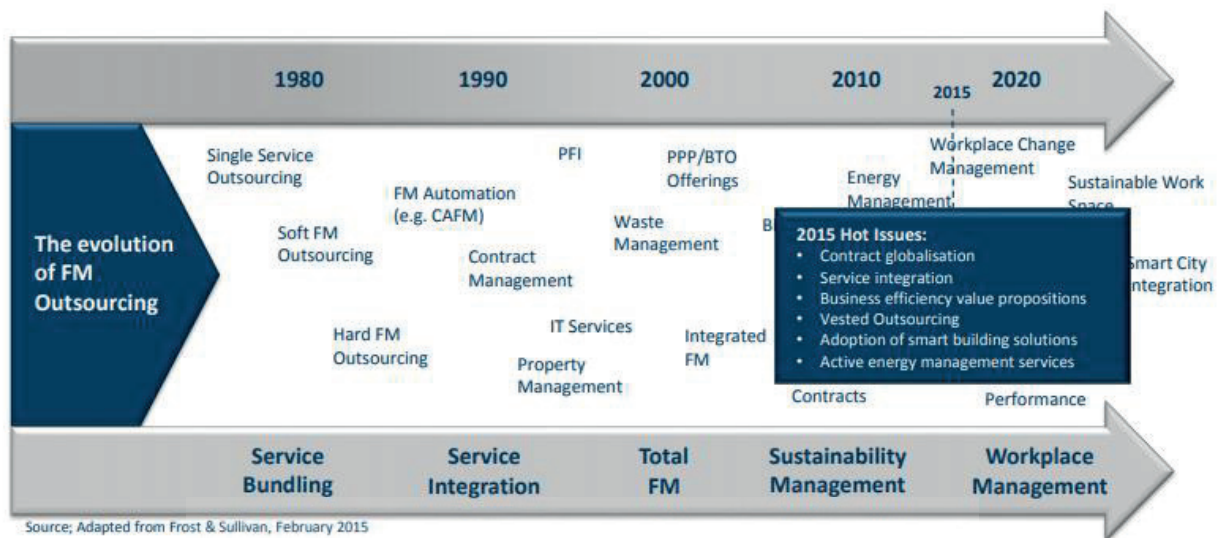


Figure 2.2 Evolution of Facilities Management (Frost & Sullivan, 2015)

To promote FM profession and achieve common understanding, a European Standard was developed and published in 2006 titled *Terms and Definitions*, followed by five other standards covering *Quality, Taxonomy, Processes, Space Measurements and Agreements Guidelines* within FM (Mitchell, 2010). Locally, a Standard (SANS 1752:2017 Strategic Facilities Management System- Requirements with guidelines, 2017) was developed and published in 2017 by South African Bureau of Standards (SABS), with a combination of focus areas from quality management (ISO/SANS 9001), environmental management (ISO/SANS 14001) and asset management (ISO 55000). The standard has been well received that there are companies that already comply with the standard such as Dijalo Property Group (Engineering News, 2018). Globally, FM industry celebrated the release of its first ISO standard on 15 April 2018, which is seen as an enhancement of the BS EN 15221 and hoped to raise the awareness of the FM and its benefits.

2.2.1 Facilities Management definition

There are two terms widely referred to, namely; Facilities Management and Facility Management which in essence mean the same thing. *Facilities Management* shall be used in this research paper as it is commonly used in South African literature. Since its emergence, there have been numerous professional bodies established to recognise and promote discipline. One such body is the International Facility Management Association (IFMA) as the long-standing body founded in the US in 1980. The equivalent body for South Africa, perhaps Africa at large is South African Facilities Management Association (SAFMA) founded in 1998 and

recognised as a professional body in 2013. Many of the country bodies are represented by Global FM at international level. However, they still hold diverse views suggesting that a lot still needs to be done to harmonise the FM definition and scope.

According to IFMA, Facilities Management “is a profession that encompasses multiple disciplines to ensure the functionality of the built environment by integrating people, place, process and technology” (IFMA, 2019). Expanding the scope, SAFMA defines Facilities Management as “an enabler of sustainable enterprise performance through the whole life management of productive workplaces and effective business support services” (SAFMA, 2019) however addressing FM as a support function. British Institute of Facilities Management (BIFM) defines it as “the integration of multi-disciplinary activities within the built environment and the management of their impact upon people and the workplace”.

European Committee for Standardisation (CEN), defines FM as “*Integration of processes within an organization to maintain and develop the agreed services which support and improve the effectiveness of its primary activities*” as adapted in EN15221-1: 2006 (CEN, 2006)– a definition accepted by all EU FM members including BIFM while ISO, in its new release defines FM as “the organizational function which integrates people, place and process within the built environment with the purpose of improving the quality of life of people and the productivity of the core business.”

Despite the different definitions, it is evident that FM is an integral part of any business aspiring sustainable success, elevating it to the strategic level to demonstrate its value through its multi-disciplinary focus. The scope of FM commonly covers space management, infrastructure, people and organisation; generally divided into hard and soft services (Tsebo Facilities Solutions, 2018).

2.2.2 Facilities Management function in manufacturing industry

All business exists to fulfil a certain need in the market, and although their strategies may differ, there is one thing in common and that is the need for facilities and management thereof to ensure business objectives are accomplished. For manufacturing businesses who rely heavily on their assets and facilities for production, keywords such as availability, accessibility, reliability, compliance and efficiency are critical in ensuring that business objectives are met. Furthermore, facilities (factories or plants) in manufacturing are different from corporate facilities and thus require certain skills and competencies of those managing the facility (Arminas, n.d.). Although the success of the business is a combination of *assets* and *facilities*,

or maintenance and facilities management, the two have not always enjoyed same attention by executives as other business elements such as production and finance.

As an industry, FM in South Africa is valued at R 39.12 billion and employs 42% in commercial, 44% in public and 15% in industrial (SAFMA, 2016). It is said to be the fastest-growing industry globally, with a prediction of \$1 trillion in 2025 (CBRE, 2019) and second-highest cost for organisations after the cost of salaries according to Shiem-Shin & Hee (2013) and Allan & Srinath (2010). Therefore, organisations can easily improve the bottom line if they approach FM strategically. Its core function is to support the organisation it serves, enabling it to concentrate and deliver its core functions safely and effectively. This support services can be provided through in-house or out-sourcing format for different services rendered to the parent organisation. These services are classified as hard or soft FM. Table 2.1 shows excerpts of a typical scope for each category, which can vary from service providers or the core functions of the organisation being served.

Table 2.1: FM Service Categories (Pragma, 2018)

Hard services	Soft services
Air-Conditioning Systems	Access Control
Building Information Technology	Car Wash
Building Maintenance & Repair	Catering
Building Management Systems	Cleaning Services
CCTV & Security Systems	Coffee Stations
Electrical & Lighting	Florist Services
Emergency control panels	Furniture Management
Energy & Utility Management	Recycling
External & Internal Signage	Relocation Management
Fire Detection	Security/Guarding Services
Fire Sprinkler systems	Waste Management

2.2.3 Drivers of Facilities Management outsourcing and insourcing in manufacturing

Outsourcing as a strategy can be traced back to 1980s as a result of the Industrial Revolution (Madikizela, 2014). According to Neil Usher (2003), the concept of outsourcing existed long before FM. During this period, organisations were faced with a number of challenges to stay relevant and competitive, this forced management to review their strategies and distinguish between core business and non-core business. Organisations that needed to continue business competitively during that period had to start focusing on their core functions and outsource non-core functions to other businesses, who have these non-cores as their core business. Some of the benefits attributed to outsourcing include cost reduction, access to superior quality and expert advice and flexibility in responding to the demands of the market (Kurdi *et al*, 2011)

The new ISO standard on Facilities Management describes outsourcing as a process of procuring an external service provider to deliver and/or manage a range of services (Eiselen, 2019). Due to the economic downturn, outsourcing is becoming a favourable option compared to insourcing as more organizations are striving to cut internal cost while improving efficiency (PwC, 2014). According to a 2017 Survey of South African Facilities Management Association, outsourcing continues to rise, with emphasis on cost savings and innovation from end-users (Servest, 2017). Figure 2.3 highlights the top four drivers of outsourcing locally.

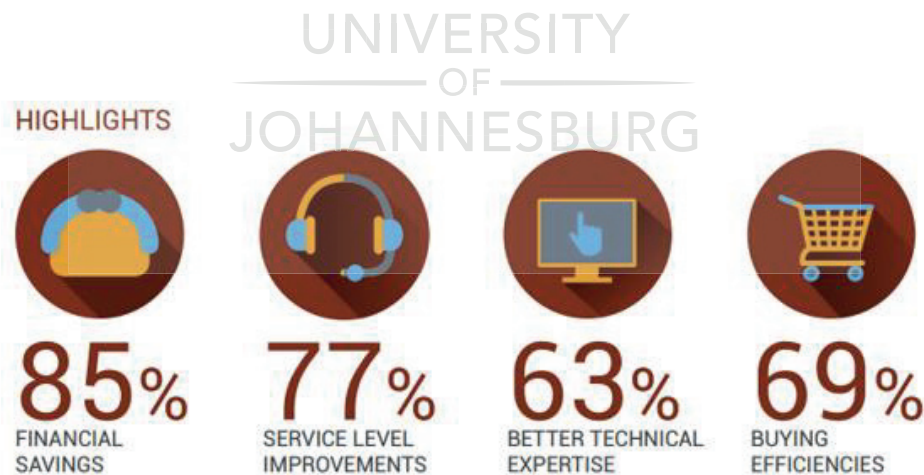


Figure 2.3: Outsourcing Objectives (Executive Knowledge, 2017)

Insourcing, a strategy in which an organisation uses in-house personnel to execute specific jobs (Kurian, 2013) remains an option. However, as the decision to outsource or insource is commonly based on cost, insourcing becomes less favourable in most scenarios and this could lead to a mismatch between FM service and organisation objectives. Table 2.2 shows an example of an insource versus outsource comparison from a local client, which focuses solely

on cost and not considering added value such as efficiencies, quality of service and access to expertise. When the executives of this client receive this information, they will only see Rand cost indicating the current inhouse FM service vs outsourced service cost. Options 1, 2, and 3 are outsourcing proposals and in this example, Option 1, in comparison with the existing cost is favoured as it brings 13% savings without a full understanding of the added value which cannot be quantified into Rand value at this stage or lack of thereof. However, Options 2 and 3 could be better options although they seem over budget by 5 % and 0.88 % respectively. Therefore, it is important that FM service providers and demand organisations spend enough time to align objectives and values to avoid poor decisions being made.

Table 2.2: Example of insource-outsourced comparison

CLIENT NAME -	Insource/Outsource Comparison - October 2018			
	Existing	Option 1	Option 2	Option 3
Once-off costs	400 000	724 900	624 900	624 900
Dev Fees - Once Off	400 000	300 000	200 000	200 000
Section 189 - Once Off	-	424 900	424 900	424 900
Fixed Costs	20 821 888	19 175 512	27 418 949	26 421 066
Management	-	-	-	5 786 498
Facilities Engineer	-	2 579 782	10 823 218	-
Additional Staff	-	-	-	-
Cost to Company	17 174 745	14 312 287	14 312 287	19 794 584
Annual bonus	951 281	792 734	792 734	-
Overtime	315 444	262 870	262 870	-
UIF	193 928	161 606	161 606	-
Workmans Comp	77 571	64 643	64 643	-
SDL	193 928	161 606	161 606	-
Training	161 606	-	-	-
Help Desk Administrator	338 226	574 983	574 983	574 983
Software Development & Support	-	-	-	-
AP Clerk	1 240 160	-	-	-
Uniform & PPE	175 000	265 000	265 000	265 000
<i>Fixed Cost Discount</i>	-	-	-	-
Variable Costs	1 722 515	-	-	-
Insurance	59 122	-	-	-
Fuel	687 725	-	-	-
Repairs	56 371	-	-	-
Tools and Equipment (Depreciation)	919 297	-	-	-
<i>Materials Pass-through</i>	-	-	-	-
Total Cost over 5 Years	22 944 404	19 900 412	28 043 849	27 045 966
		-13.27%	22.23%	17.88%
POTENTIAL SAVINGS				
Existing staff	-	-	3 900 000	3 900 000
Revised total cost over 5 years	22 944 404	19 900 412	24 143 849	23 145 966
		-13.27%	5.23%	0.88%

Although the studied literature supports outsourcing as an effective strategy, there is no adopted framework to work with during selection of service providers or decision-making between insourcing or outsourcing. To address this gap, the ISO 41012 published a workflow process as

shown in Figure 2.4 which highlights other aspects for consideration other than costs.

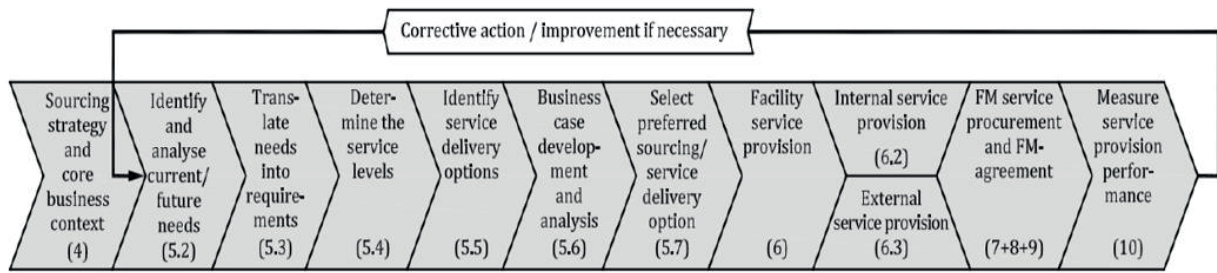


Figure 2.4: ISO 41012 Sourcing Workflow (SAFMA, 2018)

This workflow process is also supported by evidence from a local study, which showed cost, innovation and team capability among top priorities during the tender evaluation process for integrated FM service as shown in Figure 2.5. This shift is also confirmed by a recent study conducted by PwC (2014) which revealed the changing perception and expectation from clients, who are demanding value for money. The study focused on European FM markets and summarised value into eight elements shown in Figure 2.6, moving away from the “lowest bidder” approach.



Figure 2.5: Tender evaluation factors (Executive Knowledge, 2017)

In terms of manufacturing industry, the end-user will always be challenged with choosing the right strategy for the business as both strategies have pros and cons. The management of the

plants or factories is complex compared to corporate offices or public institutions. There are inherent risks and the FM service provider, whether insourced or outsourced need to understand the plant and product life cycle as well as the business strategy. This holistic view requires certain skills-sets and competencies of the team.

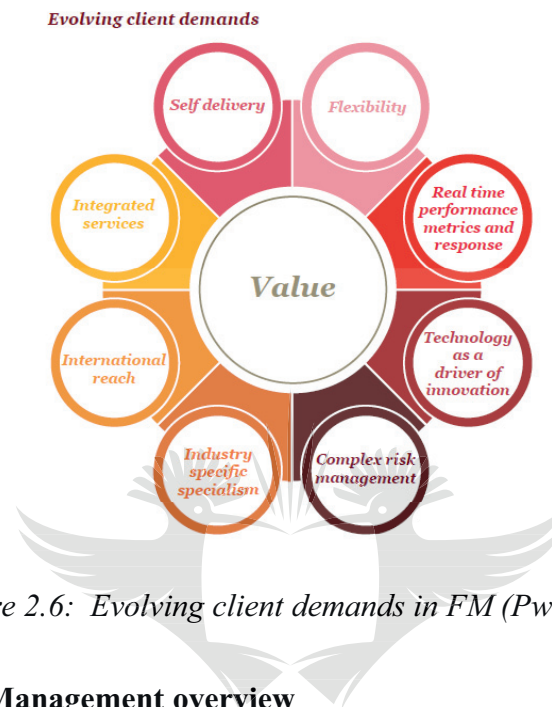


Figure 2.6: Evolving client demands in FM (PwC,2014)

2.3 Physical Asset Management overview

Every organisation relies on some physical assets to operate. For some, physical assets can be as few as land, building and furniture and for some as many and including machinery, vehicles, personnel, plant and tools. The complexity and nature of the assets depend on the business' objectives. Similar to Facilities Management, the term *asset management* has been around for five decades, and it is evolving. This constant change challenges asset owners, asset operators and asset managers to adapt quickly to the new best practices and technologies. The first challenge for the asset manager is to know when to use which best practice and its associated technology based on the uniqueness of their assets and business objectives - while remaining competitive. The second challenge is that clients both external and internal are evolving, demanding personalised service, quick turnaround and increased confidence levels - a trend that is also experienced in the FM environment.

Asset management recognition started in the 1970s as shown in Figure 2.7 from being a nuisance during the privatisation of water utilities by Great Britain to becoming part of the company's strategies (IBM, 2018). The North Sea Oil and Gas industry explored the concept further during the 1980s and 1990s by introducing an integrated approach following the oil

price crash and catastrophic incident, where 167 people were killed (Lloyd, 2010). From these lessons emerged core principles and best practices which are being used today in physical asset management.

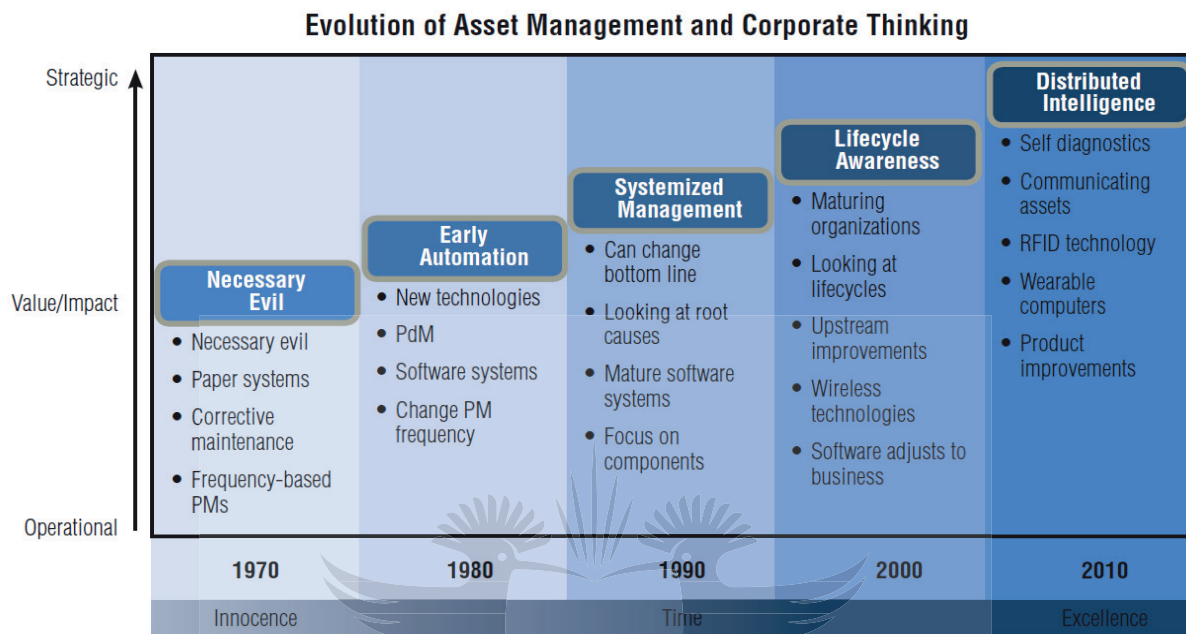


Figure 2.7 Evolution of Asset Management (IBM, 2007)

2.3.1 Physical Asset Management definition

Similar to Facilities Management, Physical Asset Management is an evolving field suffering from “terminology overload” (Davis, n.d) and competing interpretations (Woodhouse, 2006). A Google search on asset management definition brings the following answers, proving the different interpretations:

“Management of the financial assets of a company to maximize the return on investment.” (Kurian, 2013) - from the AMA Dictionary of Business and Management

“Asset management is a systematic process of developing, operating, maintaining, upgrading, and disposing of assets in the most cost-effective manner, including all costs, risks and performance attributes” (Wikipedia, 2019)

Hastings (2009) defines physical asset management as “the management of fixed or non-current assets such as equipment and plant” through their life-cycle i.e. concept to disposal. This definition is applicable to this paper. Typically, these are assets with a physical presence and depreciates in value over a period of time. These assets can be moveable such as chairs,

vehicles, laptops and tools or immovable (fixed) such as land, buildings, plant machinery and infrastructure (road or rail networks, dams etc).

The Institute for Asset Management (IAM), a professional body which has been at the forefront of the recognition of asset management and development of ISO 55000 series, defines asset management as "the coordinated activity of an organisation to realise value from assets." (ISO 55000, 2014) whereas the asset is described as "an item, thing or entity that has potential or actual value to an organisation" (ISO 55000, 2014). Prior to the release of the standard, industries across the globe adopted BSI PAS55 as the framework for good asset management, bringing organisations the following benefits:

- Enhanced customer satisfaction from improved performance and control of service delivery
- The ability to achieve and demonstrate the best value for money
- Improved risk management and corporate governance, with a clear audit trail
- Optimised return on investment and/or growth
- Improved health, safety and environmental performance
- Confidence from long-term planning, better sustainability and performance
- Improved corporate reputation, including enhanced shareholder value, greater staff satisfaction and more efficient procurement and supply chain

The success for the optimum life cycle asset management is depended on the coordination of activities between people, through robust processes, application of technology and at a defined place as summarised in Figure 2.8, with the objective of maximizing return on investment of the asset by balancing cost, risk and performance. Figure 2.9 depicts an asset life cycle which every physical asset undergoes according to ISO 55000.

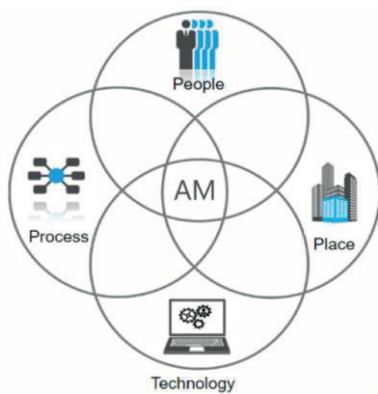


Figure 2.8: Summary of asset management (modified from IFMA,2019) (LCE,2019)



Figure 2.9: Asset Life Cycle



At **business case stage**, a need within the organisation is identified and formalised into a problem statement, followed by cost-benefit analysis linked to the organisational objectives.



At **create or acquire**, decisions made are detailed to ensure the intended benefits are realised. A cross-functional team is assembled to conceptualise, conduct feasibility study, design and implement the solution – which will bear a huge impact on the total cost of ownership. This is the stage at which 80% of the total cost is determined as shown in Figure 2. 10, therefore it is crucial that all key stakeholders are aligned.



During **operations and maintenance**, the performance of the asset is evaluated to create expected value. This is achieved through operations and maintenance management processes, where performance, cost and risk of assets are constantly evaluated. This stage accounts for 80% of the total cost of the asset in its life-cycle (Gulati, 2009) and can be reduced significantly if reliability and maintainability are incorporated during the acquisition stage.



During **disposal or replacement**, the asset is decommissioned, disposed or replaced as projected during the acquisition stage and when the asset can no longer fulfil its performance requirements.

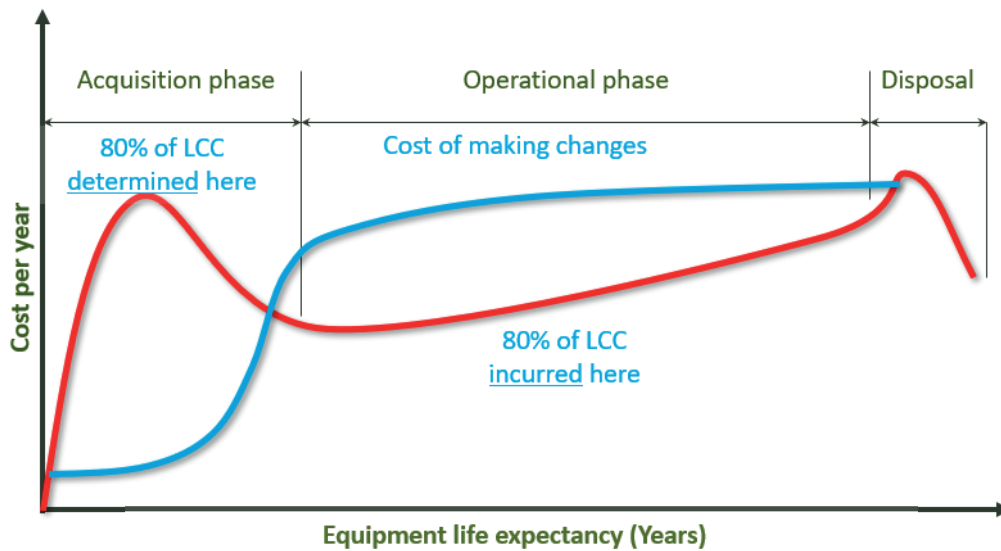


Figure 2.10: Asset life cycle cost (Pragma Academy, 2019)

2.3.2 Physical Asset Management function in manufacturing industry

Manufacturing organisations are dependent on engineering plant and facilities to produce products, this makes maintenance management and control critical in obtaining desired outcomes (Lloyd, 2010). This is achieved firstly, through a clearly defined strategy by ensuring alignment between organisation strategy and physical infrastructure as shown in Figure 2.11, secondly through the application of terotechnology, in which financial, engineering, building and business practices are combined to achieve optimum life-cycle cost (Harrison & Petty, 2002) as the asset undergoes failures as shown in Figure 2.12. In addition to the cost of failure repairs, there will be training cost, operating cost, information costs, special testing cost, standing and disposal costs, and legal or statutory conformance costs which asset owner should be aware of (Pragma Academy, 2019).

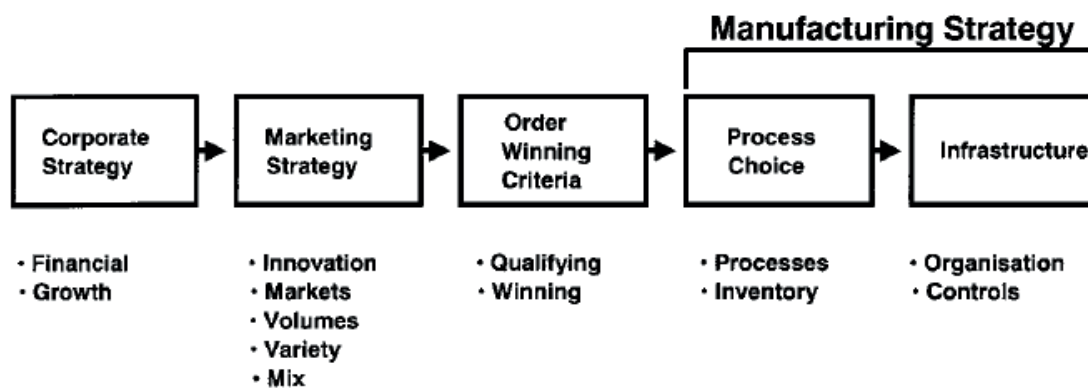


Figure 2.11: Manufacturing system strategy (Harrison & Petty, 2002)

Maintenance or asset care, a subset of asset management plays a significant role in ensuring that the economic objectives of an organisation are met during the whole life cycle of the asset. According to Goettsche (2005), a highly performing plant as a result of maintainability has a direct influence on the quality and competitive edge in the markets. Asset care is recognised as a key contributor to profit in manufacturing (Lloyd, 2010). From this recognition, different maintenance strategies have been developed and improved on to reduce costs, minimise risks, improve the reliability and availability of plant and equipment. Subsequently, according to Roberge (2007), poor execution of the strategies could result in the following

- Direct reduced production capacity due to downtime or lack of optimal performance during uptime
- Increased production costs and cost penalties for lack of optimal performance
- Lower-quality products and services with client dissatisfaction and possible lost sales
- Safety hazards and failures leading to loss of life, injuries, and possibly major liabilities

The most common strategies used are

- corrective maintenance; whereby an equipment is repaired after a failure has occurred,
- preventive maintenance; whereby equipment is repaired before failure occurs
- predictive or condition-based maintenance is when repairs take place when changes are noted in equipment

Although these strategies fall within maintenance management scope, coordination with other departments such as production, human resources, purchasing, information technology and finance is important and considered best practice approach by ISO 55000 guideline.

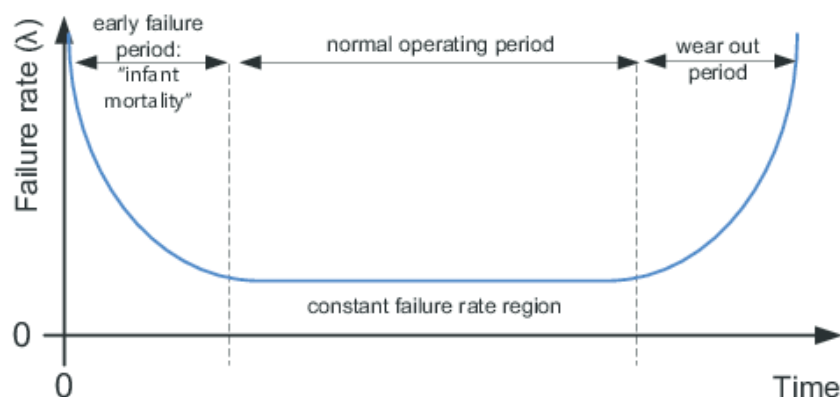


Figure 2.12: Bathtub depicting failure patterns of assets (Pragma Academy, 2019)

2.3.3 Drivers of Physical Asset Management outsourcing and insourcing in manufacturing

Expanding on Section 2.2.3 which highlights the literature studied regarding outsourcing and insourcing, there is indeed an appetite for the outsourcing of maintenance management for plant and equipment to specialists. This is due to the complexities of manufacturing technologies and equipment, which have driven maintenance costs high (Al-Mutairi & Al-Hammad, 2015). Cost reduction, efficiency and access to specialised skills are some of the key drivers in decision-making the process as is the case in FM. Figure 2.12 depicts an extract of results of a study conducted in Jubail Industrial City, to test the prevalence of outsourcing in manufacturing organisations, the motivations, advantages and disadvantages. The outcome proved outsourcing to offer more benefits, providing organisations with the flexibility needed to adapt to changing business environments (Hastings, 2010). However, as with any strategy – there are pros and cons to insourcing and outsourcing which vary from business to business, or industries. Therefore, organisations should spend time enough time evaluating the options.

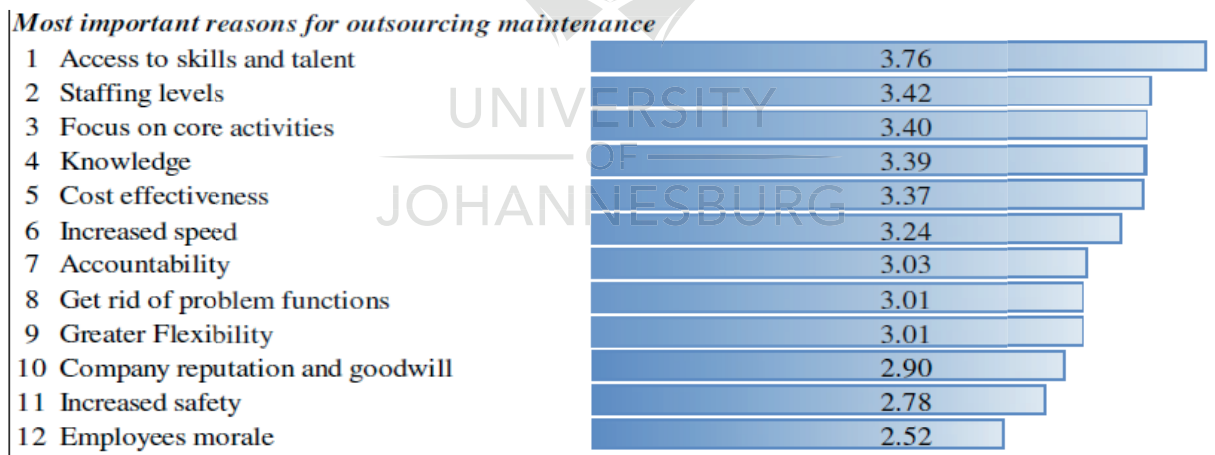


Figure 2.13: Extract of a survey on outsourcing reasons in manufacturing in KSA (Al-Mutairi & Al-Hammad, 2015)

2.4 Integrated function of Facilities Management and Physical Asset Management

Integration is one of the business words with different meanings, depending on the context. It is claimed to be used commonly in discussions where enterprise systems are the topic and is understood to be a process in which applications can exchange information (Gulledge, 2006). The Cambridge English Dictionary defines the word as “to combine two or more things in order to become more effective”; this definition is applicable to the context of this research, as it

explores the opportunities of combining functions of FM and PAM to make businesses more effective. However, there are limited literature about integrating these functions. The common use of the word integration, in business, refers to the concept of business to business in acquisition and mergers, technology integration (application to application) and integration of systems in engineering systems development.

2.4.1 Similarities and differences of Facilities Management and Physical Asset Management

2.4.1.1 Similarities in terminologies and objectives

Table 2.3 lists words presenting similarities of these functions from studied literature, which confirms the opportunities for integration. In other words, these words are used commonly in both FM and PAM, where for FM, *optimal work environment* is the primary objective and for PAM, *maximum return on asset investment* is the primary objective (Kavrakov, 2018). In overall, both functions are concerned with balancing cost, risk and performance over the lifecycle of the asset. The difference lies in the asset type and strategy of the organisation according to Kavrakov (2018).

Table 2.3: Common terminologies used in FM and PAM

Terminology	Context
Efficiency	Commonly used in physical asset management referring to doing the right maintenance, on the right equipment and at the right time.
Productivity	Commonly used in facilities management referring to the rate at which output is achieved by ensuring the availability of facilities or required support functions
Effectiveness	Refers to how well the effort results into reliability and availability
Consistency	Refers to achieving the same quality of output by focusing on processes
Compliance	Provide assurance on legal, statutory and regulatory requirements
Customer/stakeholder satisfaction	Meeting client or stakeholder demands without compromising the quality of service and safety are key to both functions.

Return on investment	Maximizing value on capital invested through improved asset performance and output
Enterprise Asset Management System (EAMS) also known as Computerised Asset Management System (CMMS)	A computerised system used to manage production equipment through their life cycle
Computer-Aided Facilities Management System (CAFMS) also known as Computerised Asset Management System (CMMS)	A computerised system used to manage facilities through their life cycle

From a similarity perspective, FM and PAM have a role to play at

- strategic level, ensuring alignment of assets and workplace productivity to organisation objectives,
- tactical level, defining plans and methods to achieve organisation objectives and
- operational level, managing the day to day activities in order to improve end-user productivity and customer's satisfaction (in FM) and asset performance (in PAM) safely and cost-effectively in both functions.

Furthermore, their involvement in organisations extend beyond the operation and maintenance boundaries as elaborated in section 2.3.1 and demonstrated in Figure 2.14 for their respective asset lifecycle. Figure 2.15 shows the ISO framework for both disciplines (FM and PAM) indicating their reach within different elements of organisations. Figure 2.16

shows the reach for ISO 55000 to other ISO management systems.

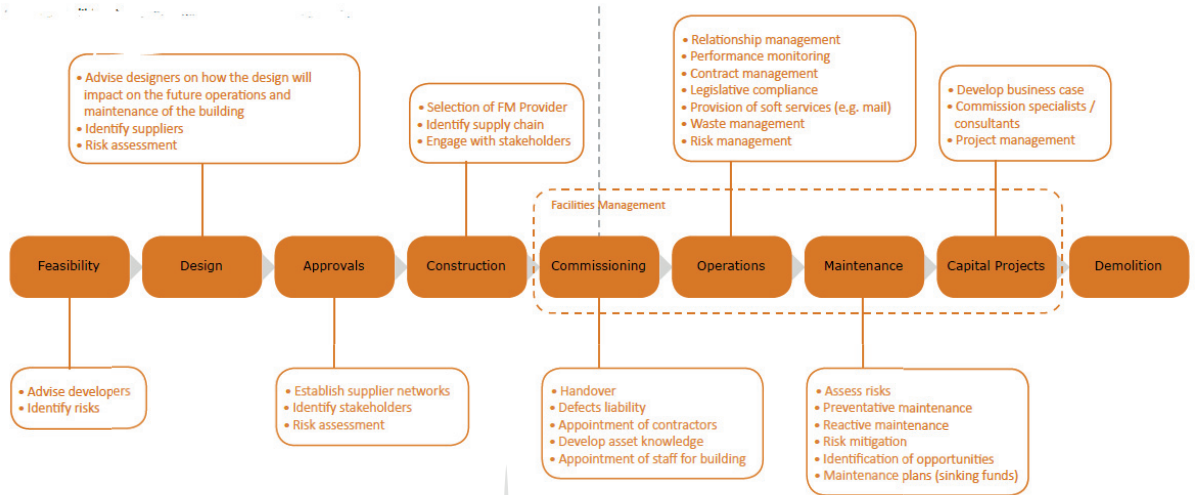


Figure 2.14: Facilities Management throughout the building lifecycle (FMA, 2018)



Figure 2.15: ISO 55000 and 41000 Framework (Leeuwen, 2018)



Figure 2.16: Reach for ISO 55000 to other ISO management systems (Leeuwen, 2018)

2.4.1.2 Similarities in work order process and key performance indicators

Facilities management, as established in Section 2.2 is a support function aimed at increasing productivity of end-users, whilst physical asset management is concerned with the performance of the equipment as highlighted in Section 2.3. Both functions rely on people, process and technology to function optimally. A best practice typical work order process for executing tasks follows the Work Planning and Control steps in Figure 2.17, extracted from Pragma (2019), a service provider in FM and AM. The process starts at work identification (step 1) where a user or operator logs a request, the work request is then validated (step 2) and planned for execution – which can be within a day or weeks depending on the urgency (step 3, 4, 5). Once the task is completed, feedback is provided and the work order is analysed (steps 8, 9) before the work order is closed (step 9). This process works for assets such as production equipment (scope of PAM), facility lifts (scope of FM), overhanging cranes (scope of FM/PAM) and HVAC (scope of FM), etc. A typical maintenance management KPI reporting resulting from the work planning and control will include (Pragma Africa, 2019)

1. planned maintenance schedule attainment, to measure the effectiveness of the execution for planned work orders within the set time period
2. backlog, to measure resource capacity for the management of maintenance workload
3. labour utilisation, to measure time spent by tradespeople on technical tasks as opposed to administrative tasks.

4. meantime to repair, measuring the time it takes to restore the function of an asset after failure by repairing or replacing the asset
5. meantime between failures measuring the interval of time during which an asset or component is performing its required function.
6. downtime vs available production time
7. incomplete schedules due to unavailability of machinery during planned maintenance

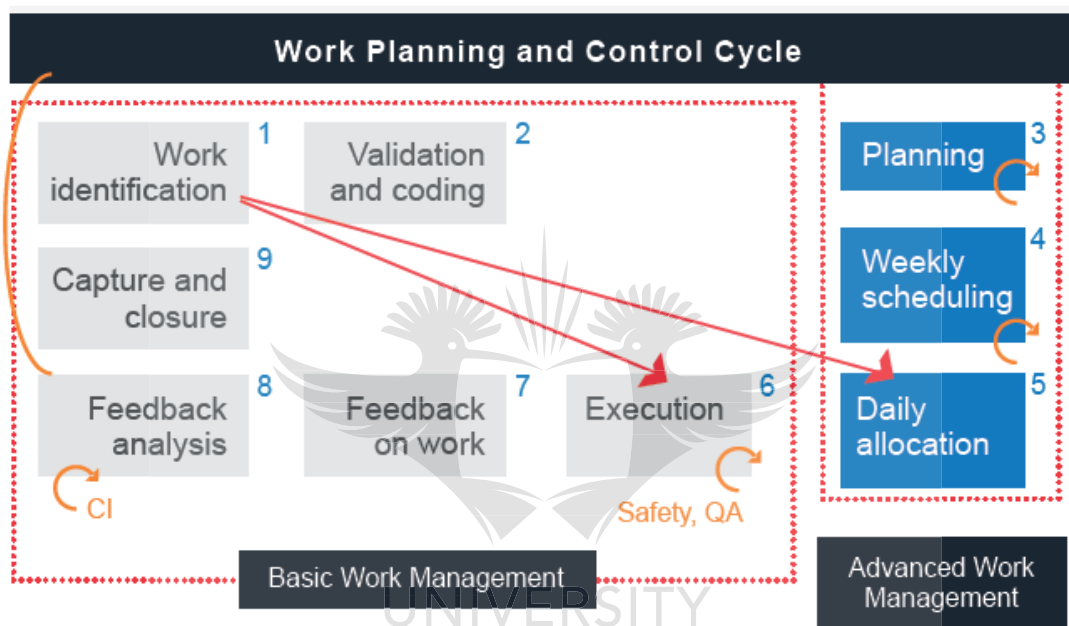


Figure 2.17: Work planning and control process for maintenance management (Pragma Africa, 2019)

2.5 Research Gap

Manufacturing organisations are dependent on engineering plant and facilities to produce products, and both fall within physical assets. Efficiency, productivity, effectiveness and compliance are key in achieving desired results from both functions. Because of the same type of assets managed and skills used it, therefore, makes sense to re-organise the functions for maximum value.

In the reviewed literature, there is no sufficient information on the integration of FM and AM functions. However, information on the use of the concept and principles of integration of related functions, in other industries, suggests that there is a high potential for improved productivity. This is why this research seeks to explore the relative advantages of integrating FM and PAM functions in the manufacturing industries.

2.6 Summary

Manufacturing organisations across the globe are faced with a number of challenges requiring flexibility and adaptability on how these organisations are run. The industry in South Africa is continuing to decline, due to high costs of operation and skills shortage. Facilities management and physical asset management are important in the success of the organisations in this industry and have both evolved as value-adding services. Similarities exist in that both functions rely on people, process and technology to function optimally and follow similar work planning and control processes with PAM leading in best practices and standardisation. However, there is a gap in the concept of integration for these functions in literature.



Chapter 3: Research methodology

This chapter provides an overview of the research method adopted, the population and method of selecting the sample used for the research. The data were collected using multiple instruments and analysed accordingly as well as highlighting observed limitations and how they were mitigated.

3.1 Research method

The research methodology adapted is a mixed approach, combining quantitative and qualitative methodologies. This approach was considered most appropriate to address the subject of the research. The quantitative method was used to collect preliminary information, which provided a generic overview of the industry perception to the research questions and objectives. Through the preliminary information, it was easy to observe that the majority of manufacturing industries practice the existence of FM and PAM as an independent organisation. Very few industries have embraced the concept of integrating the two functions. The qualitative methodology was used to obtain salient information from respondents which provided detailed answers to the research questions and objectives. Respondents provided ideas on the benefits of integrating the FM and PAM functions, identifying some constraints and how to mitigate them. The instruments used for data collection include structured question survey, focus group and one-on-one discussion. Basic quantitative and qualitative approaches were used for the respective data analysis.

3.2 Population and sample size

The manufacturing industry in South Africa is very broad. Therefore, careful consideration was made to ensure wider coverage of the different manufacturing types. Sample representatives were drawn from two clusters of the industry; first, the manufacturing sector, and secondly, the industry practitioners and the academics. The chosen sample from the first cluster were the organisations involved in the production of bulk products for consumption by consumers (general public) or produce products that are used in other industry value chain. These industry types are those that are depended on facilities and plant equipment/machinery for the execution of their operations.

The selection span across 20 organisations, distributed as follows: automotive (4), fast-moving consumer goods (FMCG) (9), packaging (2), processed foods (4) and printing (1) within Gauteng Province in South Africa. The selection was based on easy accessibility to the organisations and only organisations with more than 150 employees were considered. Therefore, 50 professionals from this cluster of industries were invited to participate in an online survey, using Survey Monkey Audience platform (SurveyMonkey Inc, 2019) to answer ten (10) questions. The respondents include facilities and infrastructure engineers, middle and senior managers, and plant maintenance engineers. The selection from the second cluster were industry practitioners in both AM and FM, and academics the researcher met at the annual conference of the Southern African Asset Management Association (SAAMA), held in Stellenbosch. Here 19 participants were engaged in a focus group session for 45 minutes. The audience included head of facilities management, head of plant equipment, procurement manager, reliability engineers, maintenance managers, chief executive officer, infrastructure engineer and independent consultants within asset management.

3.3 Data collection

The data collection was conducted between November 2018 and May 2019, in two stages. The first stage was from the manufacturing industries where 50 professionals from the manufacturing industries were invited to participate in a preliminary online survey. Secondly, during the annual conference of South African Asset Management Association, held in Stellenbosch, May 2019, a group of 19 people from academic, government, oil and gas, manufacturing, power utility and mining sector were pulled together in a focus group session.

In the first phase of data collection, participants were invited to participate in the research exercise through email communication as shown in Figure 3.1. Those who accepted the invitation proceeded to the main page of the survey in Figure 3.2 and started interacting with the questions.

University of Johannesburg: Value creation through integration of Facilities Management and Asset Management Strategies

Good day

My name is Julia Phala, a Masters in Engineering Management student at the University of Johannesburg.

My research focus is to unlock value in organisations by integrating Facilities Management and Physical Asset Management strategies to improve efficiencies while reducing costs.

You are invited to participate on this topic as a professional who works in an organisation that depends on Facilities Management and Asset Management to function and meet output goals.

Please share your opinion by answering 10 questions which will take you approximately 2 mins to complete. Simply click on question #1 below.

Thanks for participating!

Julia Phala
Cell: +27 82 758 7538
Email: julia.phala@pragmaworld.net

Figure 3.1: Survey invitation email sent to participants

University of Johannesburg: Engineering Management Masters Research

Value creation by integrating Asset Management and Facilities Management

Facilities Management is defined as "an enabler of sustainable enterprise performance through the whole life management of productive workplaces and effective business support services" - SAFMA. Simply put, "it is the structuring of building plant and contents to enhance the creation of the end product" - Alan Park. It is categorized into hard services and soft services as shown in table below.

Hard Services	Soft Services
Electrical	Cleaning/Waste disposal
Mechanical	Reception
Plumbing	Catering
Building structure and fabric	Access controls/security

Asset Management, also referred to as physical asset management is defined as "the coordinated activity of an organisation to realize value from assets," where the asset is described as "an item, thing or entity that has potential or actual value to an organisation". - ISO55000

With these two definitions in mind, please answer the questions that follows. Thank you for your participation!

Figure 3.2: Opening page for survey once participant has accepted the link

1. Do you have a Facilities Management department/division in your organisation?

Yes

No

2. If you answered yes, what is the size of the department/division? Please choose correct answer below.

1 - 10 employees

10 - 30 employees

40+ employees

3. Do you have Facilities Management key performance indicators (KPI's) clearly defined?

Yes

No

4. Do you have an Asset Management department/division in your organisation?

Yes

No

5. If you answered yes, what is the size of the department/division? Please choose correct answer below.

1 - 10 employees

10 - 30 employees

40+ employees

6. Do you have Asset Management key performance indicators (KPI's) clearly defined?

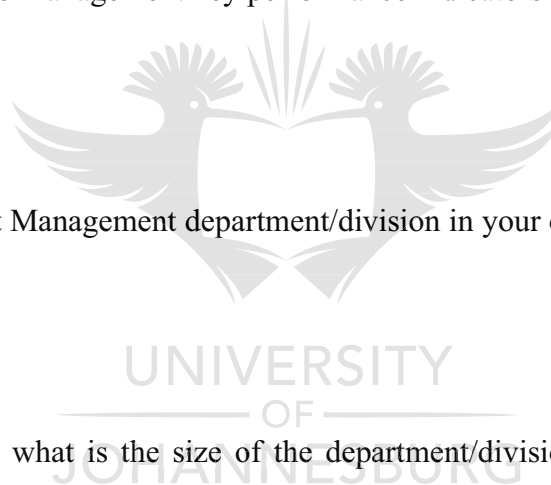
Yes

No

7. Are you aware that there is a Facilities Management ISO standard?

Yes

No



8. Are you aware that there is an Asset Management ISO standard?

Yes

No

9. Do you believe Facilities Management and Asset Management business processes are similar?

Yes

No

Maybe

10. Do you believe there is value in integrating Facilities Management and Asset Management?

Yes

No

Figure 3.3: Survey questions

During the focus group session, first, the research aim, objectives and the result from the preliminary survey was presented to the group, as summarised in Figure 3.4. After the presentation, participants were led in a systematic discussion of the following questions:

1. Are there major similarities or differences in the functions of FM and PAM in the manufacturing industry?
2. What is the common rationale for operating FM and PAM separately in organisations?
3. What are the possible advantages or disadvantages of integrating the two functions into one in the manufacturing industry?
4. Where are the cost savings potential if functions of FM and PAM in the manufacturing industry are integrated?
5. If integration is of value, what would it take for the industry to accept it as an operation strategy?



Figure 3.4: Preview of SAAMA Conference presentation

3.4 Data analysis

Data means nothing until it is analysed for human interpretation as information and knowledge. Within the research space, the main objective of the data analysis is to derive insights which will contribute to knowledge or theory. This is achieved by combining perspectives from data collected and literature sources to form the outcome of the research. Albers (2017, p 215) explains the goal of data analysis as “to reveal the underlying patterns, trends, and relationships of a study’s contextual situation”. Two methods of data collection were applied, namely;

1. qualitative data collection in a form of focus group and conversations and its typical analysis involves the development of concepts and generalisation of statements through comparison of text, materials and cases (Flick, 2014). The analysis can take two forms of focus, where the description of a phenomenon is the focus or comparison on similarities and/or differences is the focus according to Flick (2014). The latter is applicable to this research.
2. quantitative data collection in a form of the preliminary survey, and it’s typically used to find evidence in support of a hypothesis or to reject the hypothesis (Dudovskiy, 2019). The analysis is commonly presented in numerical data that is then generalised (Research Guides, 2019) from either a descriptive or experimental data collection.

3.4.1 Data analysis of preliminary survey

A popular internet tool called Survey Monkey (Marra & Bogue, 2006) was used to collect the data for a quantitative portion of the study, i.e. the preliminary survey. The tool was selected on the basis of

- flexibility during set-up, in that one is able to design logic and test it

- accessibility as it only requires email addresses and internet for target population
- user-friendliness and
- cost-effectiveness and time-saving (Symonds, 2011). The free basic plan was used for the purpose of this research.

Information on how the survey platform works is available on the link provided in Appendix A.

Once the tool has been set up and participants were added as recipients, a bulk email was sent as shown in section 3.3. When the recipient received the email and clicked on the provided link, the clock (timer) started counting to show an individual average time of completion of the survey as shown in Figure 3.5.

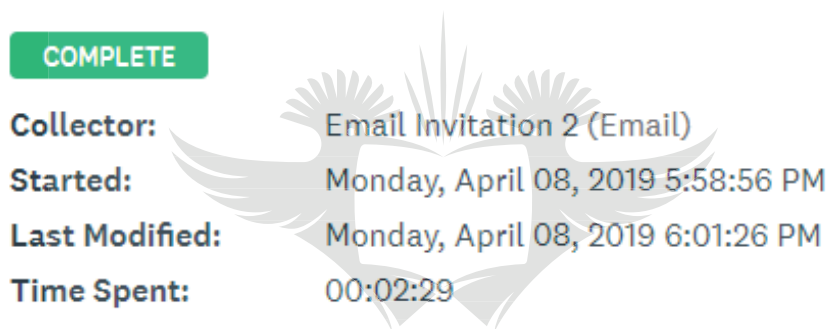


Figure 3.5: Individual response dashboard of Survey Monkey

For each response completed, the Survey Monkey tool sent a notification to the survey creator for analysis and automatically grouped and analysed the responses per question. Figure 3.6 shows the available information tabs of the survey. The yellow highlighted tab is where data is analysed – this is pre-programmed at the back-end of the tool. The Survey Monkey software provides real time analysis of input from each and group of respondents within a regulated time interval. The display of the analysis of each respondent’s input continues until the end of the stipulated time allocated for participants’ response. The result is displayed as shown in Figure 3.7. This is how the response to the ten questions in the preliminary survey where analysed. In this tab, the results are presented in a visual chart and a table as shown in Figure 3.7.

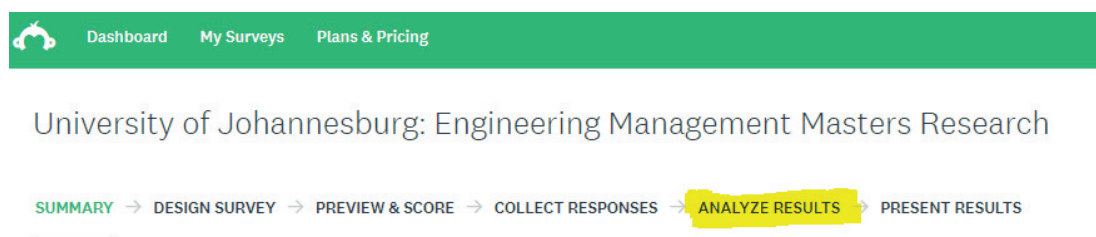
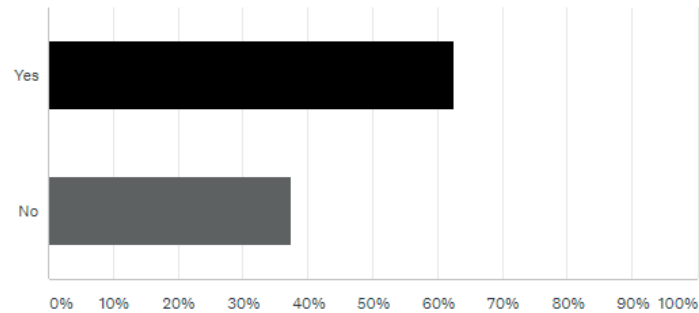


Figure 3.6: Available information tabs of a survey in Survey Monkey

Do you have a Facilities Management department/division in your organisation?

Answered: 16 Skipped: 0



ANSWER CHOICES	RESPONSES	
Yes	62.50%	10
No	37.50%	6
TOTAL		16

Figure 3.7: Response analysis dashboard of Survey Monkey

3.4.2 Data analysis of focus group

Following the preliminary survey which sought to understand target group's organisational structure, awareness of facilities management and asset management and views about integration, a focus group data collection was used to further understand the relationships between FM and PAM by asking the following key questions:

1. Are there major similarities or differences in the functions of FM and PAM in the manufacturing industry?
2. What is the common rationale for operating FM and PAM separately in organisations?
3. What are the possible advantages or disadvantages of integrating the two functions into one in the manufacturing industry?
4. Where are the cost savings potential if functions of FM and PAM in the manufacturing industry are integrated?
5. If integration is of value, what would it take for the industry to accept it as an operation strategy?

The analysis of the qualitative data collected during the focus group session followed the principle of content analysis (Methods Map, 2019) where the ideas generated from each

participant were first collated, then compared with the information from other participants through which themes were developed, as answers to the research questions.

3.5 Validity and reliability

The issue of the validity of data and reliability of procedure are central in any research exercise (Ihantola & Kihn, 2011; Yin, 2014). Therefore, the source of data, method(s) of collection and instruments used for the collection of data are influenced, significantly by the selected population and sample for the research. In this regard, the population and sample for this research were drawn from manufacturing industries which adequately cut across the different clusters of manufacturing industries in South Africa. The participants in the process of data collection were active hands in the industries, professional bodies and the academia. The quality of participants provides the guarantee that the information collected is reliable.

The mixed-method (combining qualitative and quantitative approach) was used for both data collection and in the execution of the research exercise. The synthesis of the information collected through the preliminary survey (quantitative approach) was correlated with the qualitative information collected through the focus group session, in a type of triangulation of information (Flick, 2018). This approach assists in validating the data collected, ensure the reliability of the process and enables other researchers to replicate the process (Golafshani 2003 & Flick 2004).

3.6 Research limitations

The findings of this study should be interpreted in light of the following limitations:

Lack of previous studies within this area:

- although there is enough literature about FM and PAM, there is limited literature and industry examples within South Africa, on the practice of the integration of the functions of FM and PAM and this presented challenges in terms of reference.

Data limitation:

- data collection was limited to five types of manufacturing, which were chosen on the basis of practicality and accessibility.
- sample participants were basically engineers, professionals (consultants, industry and academia) who can be classified as tactical leaders and factory floor supervisors

(operational leaders) with very few senior management and middle management level, with very few senior management

- against the background of the limitations of data set, any attempt to generalise the results from this research, for industry application requires effective contextualisation.

3.7 Summary

Mixed methods technique was applied, whereby quantitative method was used to collect preliminary information and focus group used for the qualitative data. To ensure wider coverage of the manufacturing industry, a sample profile of manufacturing categories such as FMCG, printing, packaging and automotive was part of the population. A total of 20 companies with a headcount of 150+ and 50 professionals were selected for the preliminary survey. In addition, a wider audience from different industries as part of the focus group session as SAAMA conference where the topic sparked robust discussions during and after the session, suggesting it to be a contentious issue from both FM and AM communities. The analysis of the data started with quantitative data from which further questionnaires were drafted for further probing at a focus group session. The research has limitations, the first being the limited literature on the subject and second, being the fact that data collection was limited to a few manufacturing disciplines and roles due to practicalities and time constraints.

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Chapter 4: Findings and analysis

In this chapter, an overview of the research purpose, data collection, analysis and findings of the results are presented. The findings and analysis are split into the respective methods of data collection and a summary provided at the end.

4.1 Background

Many organisations view PAM and FM differently with separate budgets and teams even though they are both critical in ensuring that assets and facilities of the business are looked after in a systematic approach to enable the organisation to reach its objectives.

The purpose of this research is to explore ways in which Physical Asset Management (PAM) and Facilities Management (FM) can be integrated to bring value and benefits to the manufacturing industry, which is currently struggling in South Africa. The efforts are hoped to boost profitability for the manufacturing sector, and subsequently save jobs. The following key questions were formulated as the research guideline:

- What are the impacts of Facilities Management to manufacturing industries?
- How does the practice of Physical Asset Management help to improve the productivity of the manufacturing industry?
- What values can be derived by manufacturing organizations if the functions of FM and PAM are integrated?

These main questions were further explored, in efforts to gain insights on the management of facilities and asset management within the manufacturing industry, such as the structure and staff, key performance indicators, awareness on international standards and opinions on integration. The results are presented in Section 4.2.

4.2 Research findings

This findings section is split into quantitative, where preliminary survey results are presented and qualitative, where focus group results are presented – using content analysis.

4.2.1 Findings of preliminary survey

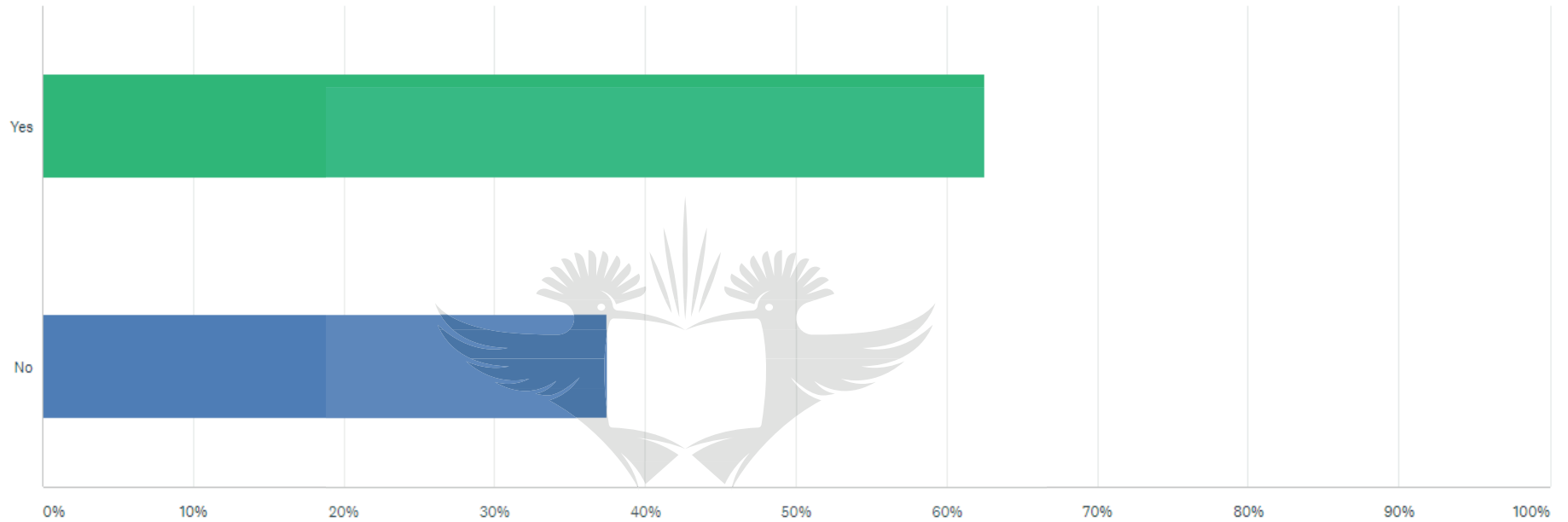
The purpose of the preliminary survey was to explore the understanding and practice of PAM and FM in the manufacturing industries in South Africa. An online, real-time instrument, the

‘Survey Monkey’ was used to collect the quantitative data. On average, Survey Monkey respondents spent an average time of 2 minutes, 8 seconds to answer the questions. 16 of 50 participants, [about 32%] completed the survey in full by answering all ten questions. Responses to the questions were then grouped into sets and the findings are presented here. Each set of question and answer is displayed in bar chart [as shown in figure 4.1] and followed by a description of findings. A table of results is also provided Appendix C.



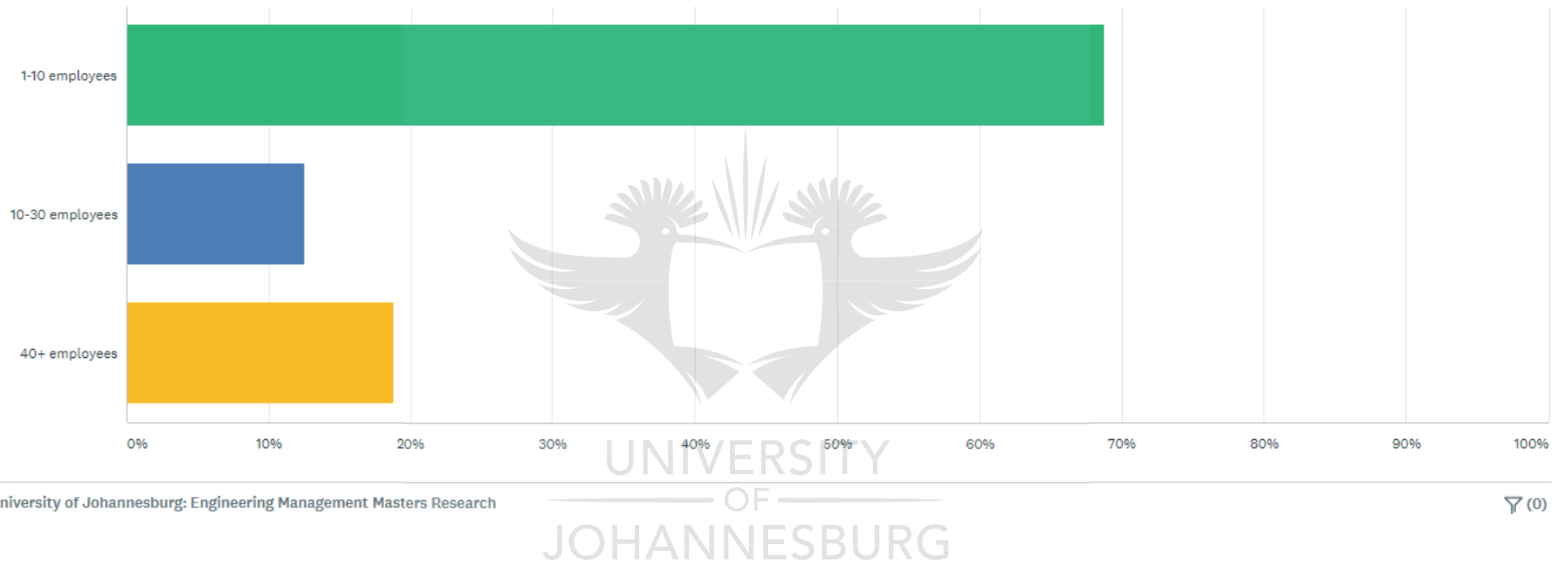
Do you have a Facilities Management department/division in your organisation?

Answered: 16 Skipped: 0



If you answered yes, what is the size of the department/division? Please choose correct answer below.

Answered: 16 Skipped: 0



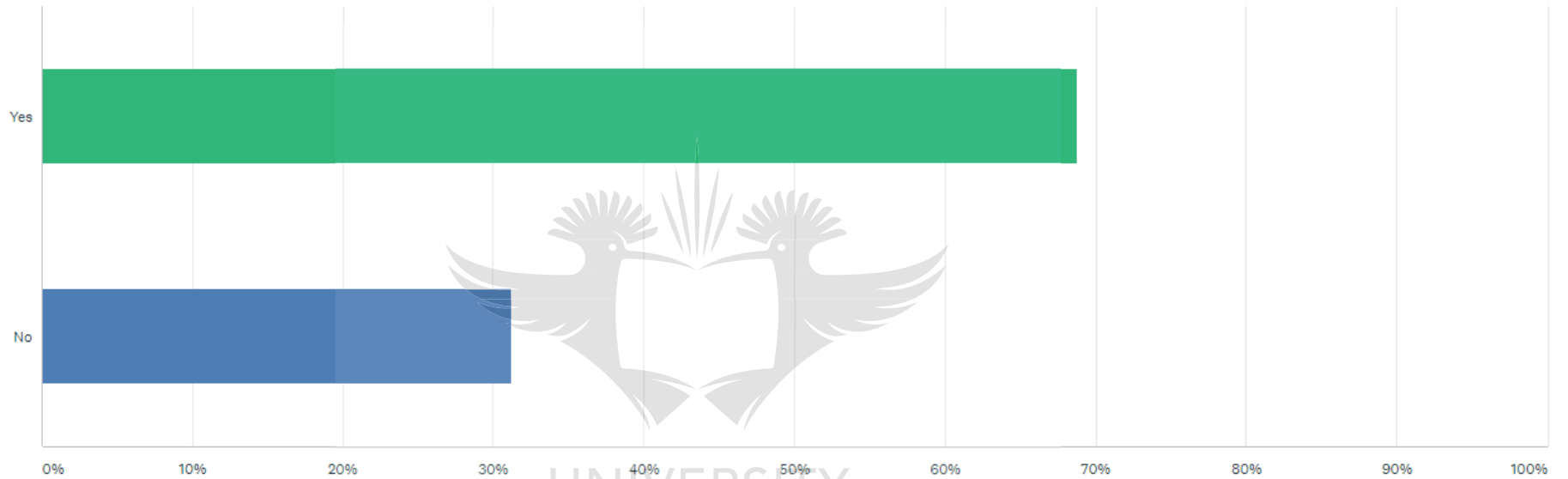
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Figure 4.1: Set 1 questions

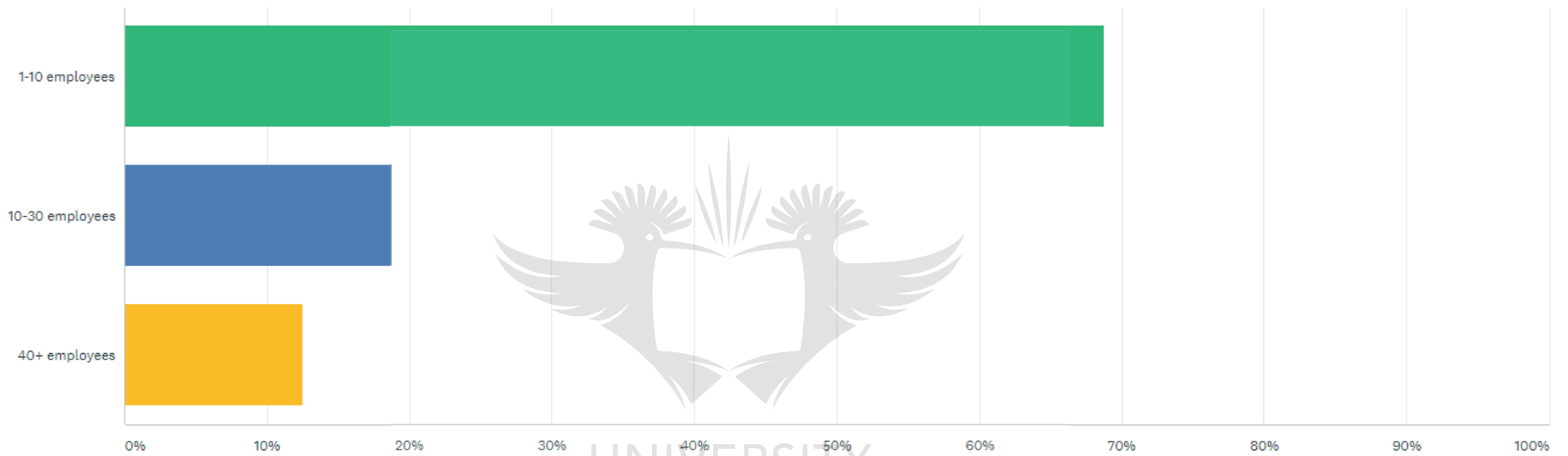
Do you have an Asset Management department/division in your organisation?

Answered: 16 Skipped: 0



If you answered yes, what is the size of the department/division? Please choose correct answer below.

Answered: 16 Skipped: 0



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Figure 4.2: Set 2 questions

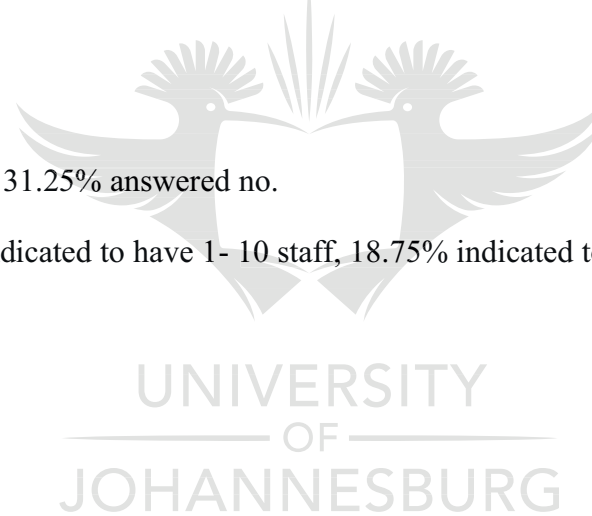
Questions one to four were mainly about understanding organisational structure for FM and AM and the sizes of the departments within the same organisation.

Responses for FM

- 62.50% said they have FM department while 37.50% answered no.
- 68.75% of those who have FM department indicated to have 1- 10 staff, 12.50% indicated to have a 10-30 staff and 18.75% indicated to have a staff of more than 40.

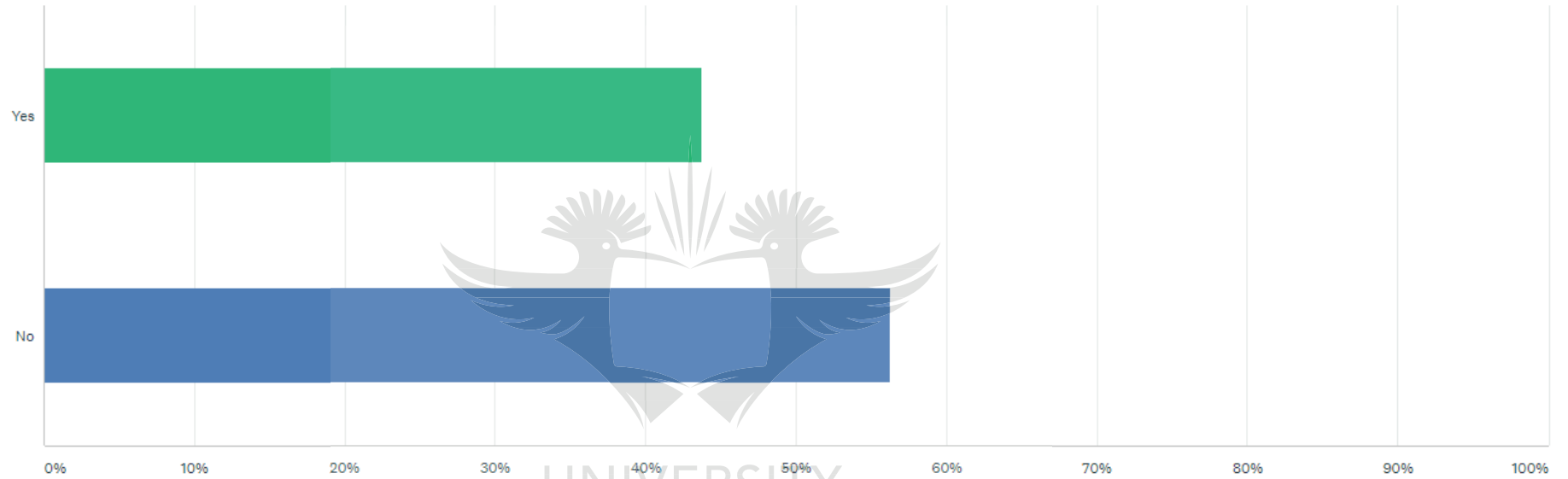
Responses for PAM

- 68.75% said they have AM department while 31.25% answered no.
- 68.75% of those who have AM department indicated to have 1- 10 staff, 18.75% indicated to have a 10-30 staff and 12.50% indicated to have a staff of more than 40.



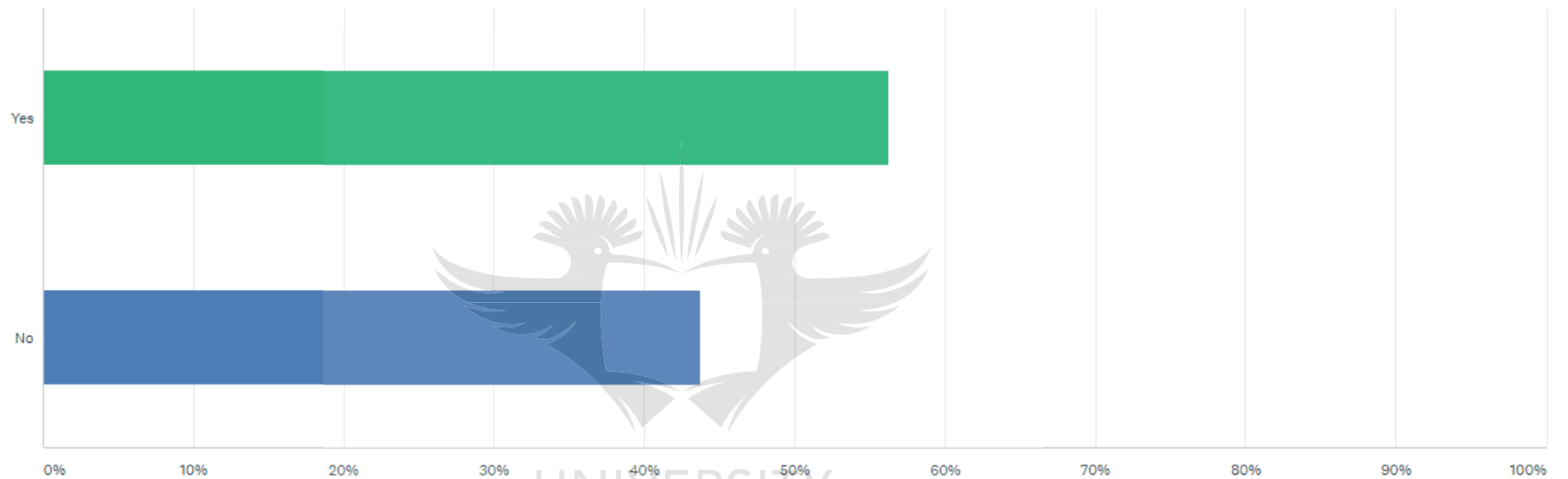
Do you have Facilities Management key performance indicators (KPIs) clearly defined?

Answered: 16 Skipped: 0



Do you have Asset Management key performance indicators (KPIs) clearly defined?

Answered: 16 Skipped: 0



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Figure 4.3: Set 3 questions

On clearly defined KPIs questions for FM and AM departments, more than 50% answered 'No' for FM and 'Yes' for AM

Responses for FM

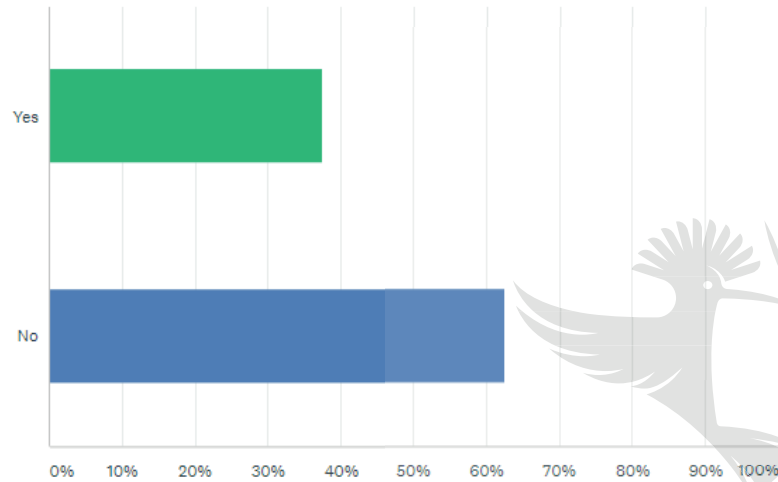
- 56.25% said they do not have clearly defined KPI while 43.75% answered Yes.

Responses for PAM

- 56.25% said they have clearly defined KPI while 43.75% answered No

Are you aware that there is a Facilities Management ISO standard?

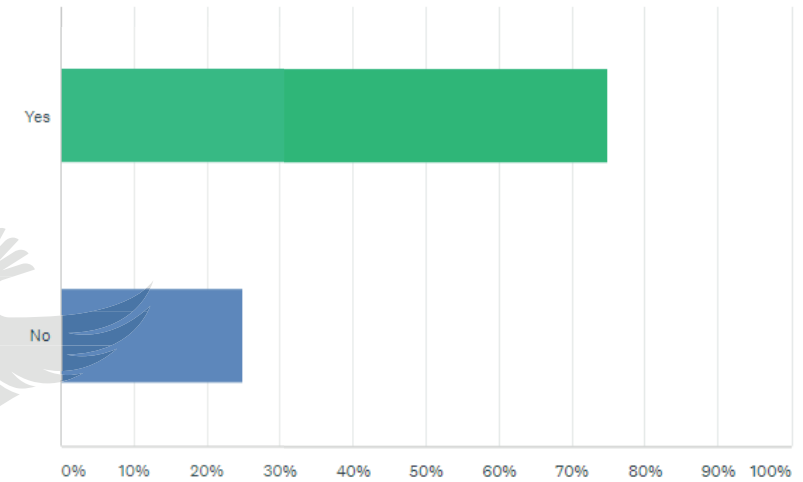
Answered: 16 Skipped: 0



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Are you aware that there is an Asset Management ISO standard?

Answered: 16 Skipped: 0



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Figure 4.4: Set 4 questions

On awareness questions, respondents' awareness of ISO standard for FM is low at 38%, compared to the overwhelming awareness for AM at over 70%.

Responses for FM

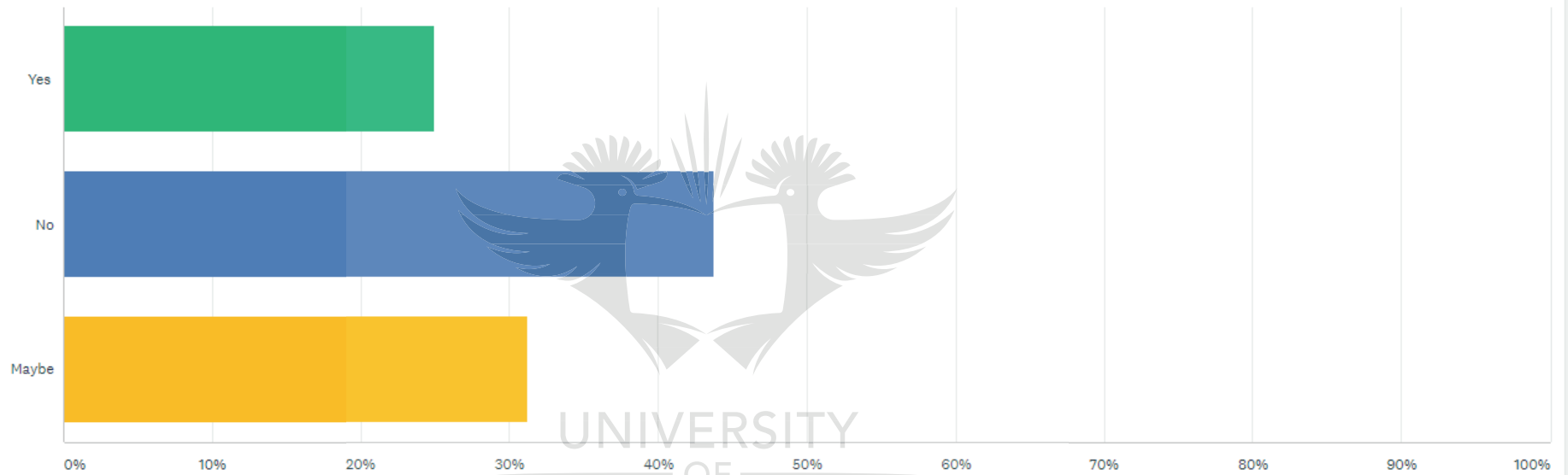
- 62.50% said they are not aware of ISO standard while 37.50% answered Yes.

Responses for PAM

- 75% said they are aware of ISO standard while 25% answered No.

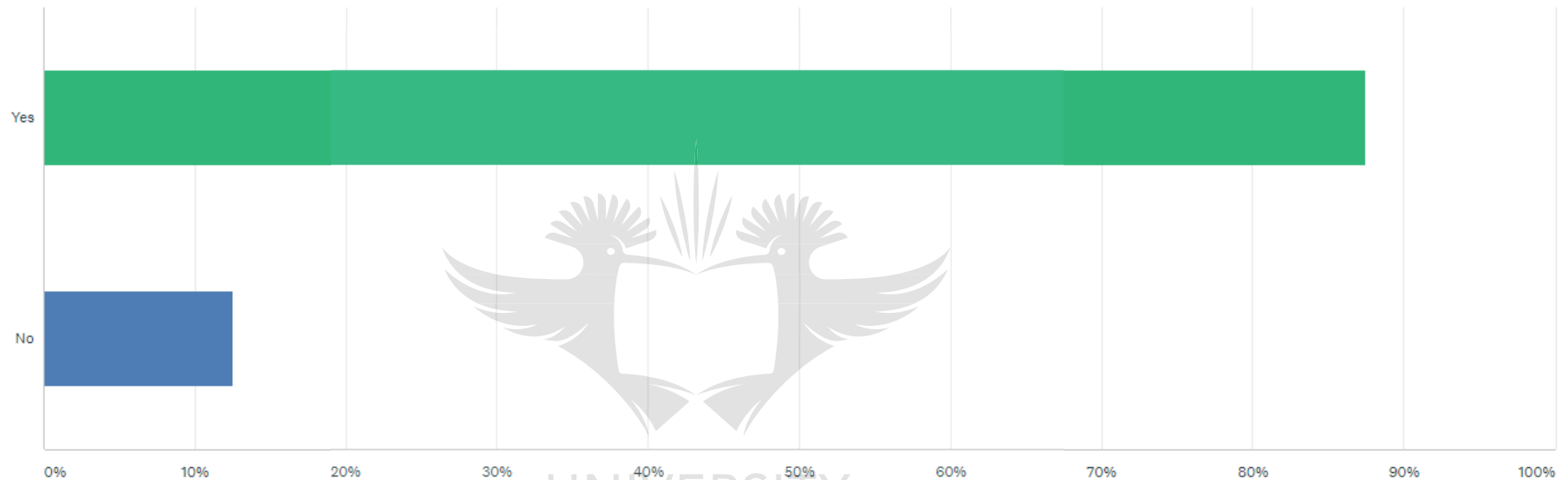
Do you believe Facilities Management and Asset Management business processes are similar?

Answered: 16 Skipped: 0



Do you believe there is value in integrating Facilities Management and Asset Management?

Answered: 16 Skipped: 0



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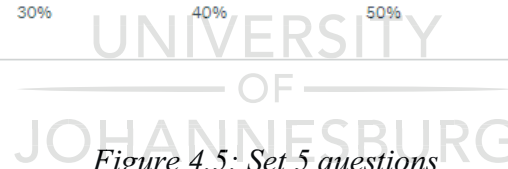


Figure 4.5: Set 5 questions

On similarity question about FM and PAM business processes, i.e. how tasks are generally carried out for FM and AM, the majority answered ‘No’ followed by ‘Maybe’ and ‘Yes’ [25% answered Yes, 43.75% answered No and 31.25% answered Maybe]. The same question was posed to delegates at the SAAMA conference which took place in May 2019 at Stellenbosch via a live Mentimeter platform and 72% answered ‘Yes’ while 17% answered ‘No’ and 11% answered ‘Maybe’ as shown in Figure 4.6 below. Regarding integration, 87.50% answered Yes while 12.50% answered No from Survey Monkey. 63% of focus group answered ‘Yes’, followed by 21% who answered ‘Maybe’ and 16% with a definite ‘No’ as shown in Figure 4.6.

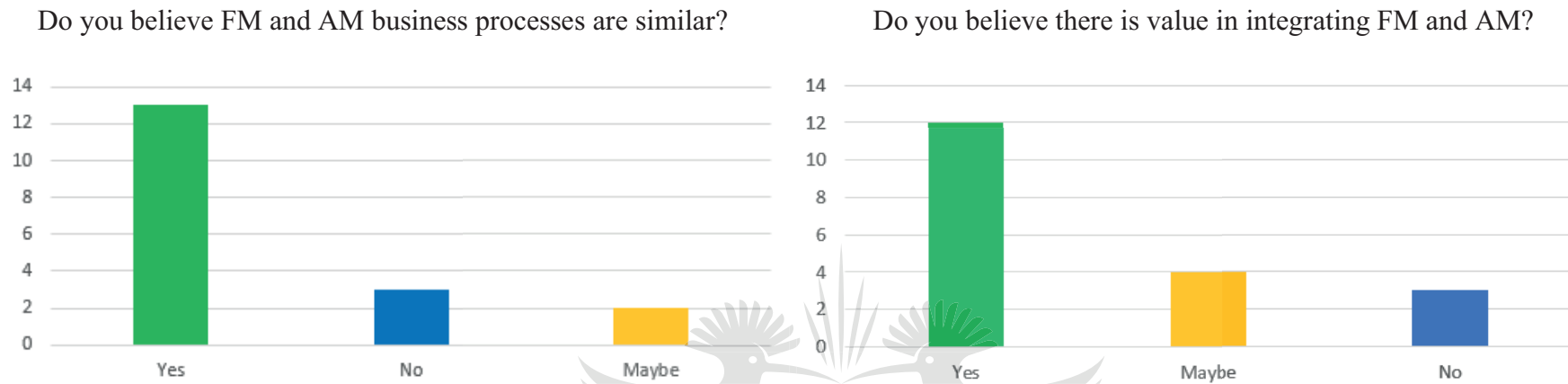


Figure 4.6: Set 6 questions (SAAMA conference)

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4.2.2 Findings and analysis of focus group

Since the majority of the participants in the preliminary survey, as well as participants from the SAAMA conference, were in the affirmative that there were benefits in integrating the functions of FM and PAM, a focus group (FG) session was conducted for five participants, selected from the SAAMA respondents. The FG session was set up to address the encapsulating questions developed from the outcome of the quantitative stages of data collection. The analysis of the outcome of the FG session followed the principles of content analysis, as shown in appendix A. The discussions and summary of responses captured were analysed in order to identify themes suitable for each question, as shown in the table below 4.1.

Table 4.1: Summary of the analysis of the focus group session

S/No	Question	Theme
1	What are the major similarities or differences in the functions of FM and PAM in the manufacturing industry?	Skill concern and approach
2	What is the common rationale for operating FM and PAM separately in organisations?	Historical perception and traditional practice
3	What are the possible advantages or disadvantages of integrating the two functions into one in the manufacturing industry?	Integration requires strategic thinking
4	Where are the cost savings potential if functions of FM and PAM in the manufacturing industry are integrated?	Improvement in processes, people and product
5	If integration is of value, what would it take for the industry to accept it as an operation strategy?	Re-orientation and adopting industry best practices

4.3 Test for validity and reliability

The data for this research was collected from three different sources of the credible participant, at the industry level, professional practitioners and academia, in a sort of triangulation of information. The analysis of response showed a correlation of opinion in support of the research aim that there are benefits in the integration of the functions of FM and PAM in the manufacturing industry.

4.4 Summary

PAM and FM are often separated with different budgets and teams even though they are both critical in ensuring that assets and facilities of the business are looked after. The purpose of this research is to explore ways in which Physical Asset Management (PAM) and Facilities Management (FM) can be integrated to bring value and benefits to the manufacturing industry. Three main research questions were formulated, and preliminary survey and focus group were utilised to gain insights on the management of facilities and asset management within the manufacturing industry and also to seek integration opportunities. 16 responses to the online survey were received, and 5 responses for the focus group analysed using content analysis method. The summary of the outcome of the FG session was presented in a table with appropriate themes.



Chapter 5: Discussions on findings

This chapter discusses the findings summarised in Chapter 4. The background of the study is provided, followed by preliminary survey findings and focus group findings discussion in a mixed approach. The summary is provided at the end highlighting the main points of the discussion compared to best practices gleaned from the literature.

5.1 Background

The manufacturing industry is challenged with a high cost of production, shrinking market share and 'war' for talent as critical skills are slowly diminishing while manufacturing complexities from technology and regulations perspectives are increasing at a rapid rate. Flexibility and adaptability are key ingredients for the industry while operational efficiencies are crucial in sustaining business as capital is scarce.

Proper management of facilities and plant equipment (production assets) is important, however, these two functions are treated differently and managed separately despite having a similar scope of operations, to some extent. Some of the observable deficiencies in operating PAM and FM separately are excessive manufacturing or factory overheads in staff salaries, supplies, use of contractors and counterproductive processes due to lack of alignment between departments or functions.

The purpose of this research is to explore ways in which Physical Asset Management (PAM) and Facilities Management (FM) can be integrated to bring value and benefits to the manufacturing industry, which is currently struggling in South Africa.

5.2 Preliminary survey discussion

The purpose of the preliminary survey was to explore the understanding and practice of PAM and FM in the manufacturing industries in South Africa while the focus group provided ideas on the benefits of integrating the FM and PAM functions, identifying some constraints and how to mitigate them. Key findings from the data are discussed below.

5.2.1 Organisational structure

On questions related to the structure and sizes of FM and PAM departments, majority of the participants (63% and 69%) indicated that they have either the FM or PAM department and in many of the manufacturing industries, they have both departments. The FM and PAM

departments have as small as ten personnel and as large 40 and more. This question of the size of employees within the departments was asked in order to understand to what extent the organisations insource or outsource full or part of the operations. 68.75% of the respondents indicated up to 10 staff headcounts for FM and AM, and this could mean that most part of the scope is outsourced to contractors.

Interestingly, between 33% and 39 % of the respondents suggest that they do not have FM or AM department, this is odd for manufacturing organisations with the size of 150+ employees. It is possible that the departments exist, except that they operate or are known by different names. In the studied literature and companies, (physical) asset management is also referred to as equipment or plant maintenance (Cooke, 2003) or just maintenance, and facilities management, referred to as utilities management, real estate or property management, or building maintenance (Allen, 1993; Chanter & Swallow, 2007). Despite the existence or practice of the two functions for decades, it is only recently (2014 and 2018) that PAM and FM are elevated at international level through ISO 55000 and ISO 41000 when the standards were published (ISO 55000:2014, 2014; ISO 41001:2018, 2018). The different priority levels between FM and PAM are also confirmed by focus group discussion, whereby the historical perception of associating FM function with cost rather than value has led to the functions being operated separately. While the majority of respondents has indicated to be in favour of integration, 12.50% does differ. This finding could be attributed to the lack of understanding or exposure between the two functions. Education, through classroom training or on the job training through rotation can add value in removing the barriers between these functions.

5.2.2 Key performance indicators for FM and PAM functions

The studied literature (Frost & Sullivan, 2015; IBM, 2007) indicates that FM and PAM concepts started during the same period, as demonstrated by Figures 2.2 and 2.7 in Chapter 2. However, from the results, PAM proves to be at the forefront with clearly defined objectives in comparison to FM. The preliminary survey results revealed that more than 50% of respondent have well defined KPIs, suggesting that PAM is prioritised and probably a discussion at senior management. This is expected because firstly, the successful production output of any manufacturing facility or plant depends on the availability and reliability of plant or production equipment, which are achieved through proper maintenance (Al-Mutairi *et al*; 2015). Secondly, a body of knowledge on Physical Asset Management has been in existence for more than three decades and formalised through ISO from which best practices and key performance areas were

developed (ISO 55000, 2014). Some of the typical KPIs measured to improve availability and reliability of machines through preventive maintenance are shown in Table 5.1, measured month by month against a set target and supporting the findings, where PAM's is observed being at an advanced stage on KPIs within the studied organisation.

However, plant equipment alone cannot meet business objectives, it is important that the two functions (FM and PAM) are elevated to the same level, as one cannot do without the other. The existence of PAM's developed KPAs and methodologies provides FM with an opportunity to re-organise itself, as there are found to be overlaps on work planning and control and the typical measures as discussed in section 2.4.1.2.

Table 5.1: Typical KPI for physical asset management department (Pragma, 2019)

Key Performance Indicator	Dec-16	Jan-17	Feb-17	YTD Average	Target
%PM Schedule Attainment	99%	86%	88%	92%	95%
PM Backlog per Artisan for the month	1.38	2.71	2.05	1.32	1.00
%Labour Utilisation - Artisans	93%	86%	88%	90%	65%
Tactical vs Non Tactical Work	100%	96%	99%	98%	60%
%Downtime vs. Total Available Production Time	1%	1%	0.9%	1.6%	1.00%
%Schedules Incomplete due to plant not stopping	30.52%	24.54%	13.91%	14.30%	0.00%

5.2.3 Integration

Integration is one of the business words with different meanings, depending on the context. For the purpose of this research, the definition is confined to *combining two or more functions in order to be more productive*. During the study of meanings for facilities management and physical asset management, whereby FM is defined as "an enabler of sustainable enterprise performance through the whole life management of productive workplaces and effective business support services" (SAFMA, 2019) and PAM as "the coordinated activity of an organisation to realize value from assets." (ISO 55000, 2014) and also as

"the management of fixed or non-current assets such as equipment and plant" (Hastings, 2010). Similarities and the topic of integration became apparent because of the nature of assets and facilities used in the manufacturing industry. At a component level, ISO 55000 (2014) defines an asset as "an item, thing or entity that has potential or actual value to an organisation" while facility is defined as "something that is built, installed, or established to serve a particular purpose"; according to Meriam Webster Dictionary (2019) or "an equipment provided for a particular purpose" (Oxford Learner's Dictionary, 2019). From these definitions, it can be concluded that an asset or a facility in the manufacturing context is a physical item of value to

the organisations with a life cycle to be managed. To understand the management and value of these 'items' to organisations, a literature study was conducted, from which similarities between FM and AM emerged as:

- terminologies and objectives; where productivity, compliance and return on investment are the main objectives for manufacturing companies
- work order processes; in the manner in which technical work orders are planned and carried out
- type of technology used; in that both FM and AM depend on computerised programs to function effectively
- key performance areas measured such as availability, health and safety, reliability and efficiency (productivity) and last but not least
- stakeholder satisfaction to meet internal and external customer needs.

What also became evident is that both functions have a significant role to play at three different levels within organisations; namely; (Chanter & Swallow, 2007; Woodhouse, 2006; Leeuwen, 2018)

- strategic level; ensuring alignment of assets and workplace productivity to organisation objectives,
- tactical level; defining plans and methods to achieve organisation objectives and
- operational level; managing the day to day activities in order to improve end-user productivity and customer's satisfaction (in FM) and asset performance (in PAM) safely and cost-effectively in both functions.

The preliminary survey results supported the idea of integration for FM and AM functions by an overwhelming majority of 88%. However, 43.75% and 31.25% answered *no* and *maybe* respectively to the question on business process similarity, that is nearly 73% of uncertainty. This uncertainty prompted the focus group discussion to seek clarity. It is likely that the acceptance to integration could also be attributed to the general value perceived by any integration process within organisations, where integration translates to efficiency and effectiveness.

5.3 Focus group session

Following the preliminary survey which was sought to understand target group's organisational structure, awareness of facilities management and asset management and views about integration, a focus group data collection was used to further understand the relationships between FM and PAM, and seek clarity on some of the conflicting answers. The analysis followed the principle of content analysis where ideas generated from each participant were first collated, then suitable themes were developed. Five themes emerged from the analysis (as shown in Table 4.1) and are discussed below.

5.3.1 Skill concern and approach

The preliminary survey results indicated mixed opinions regarding similarities on business process question, where 43.75% and 31.25% answered no and maybe respectively and 25% answered yes. To understand this further, in the focus group session, the subject of the similarities and differences between FM and PAM, was one of the questions discussed. This question is important because, until the differences and similarities in function between FM and PAM are understood, discussion on the subject of integration may not achieve its desired objectives.

The key differences observed by members of the FG session were in terms of:

- Scope: In practice, FM is broader than the management of technical assets, which is the focus of PAM, to include buildings and ground, which can be classified as hard or soft FM. FM is also responsible for services that ensure a warm and positive feeling of employees and guests (Kok, Mobach, & Omta, 2011)
- Focus and approach of work: Generally, rudimentary practices of FM, is reactive while PAM is proactive through its LCC and engineering methodology

The areas of similarities centred on the type of assets or facilities being managed and skills set required. Technically, in the manufacturing industry, asset refers to the machines of production, while facilities refer to the envelope housing the machines (building fabrics), compartments (offices and other ancillary fixtures necessary for the comfort of employees for the execution of the core functions of the industry). The objectives of these two organs of the industry are to execute their functions in the most cost-effective manner in order to achieve the strategic objectives of the industry; meeting production targets and profitability. No doubt, managing these diverse functions requires appropriate skill sets at the strategic, tactical and operational

levels of leadership. Therefore, the difference and similarities of FM and PAM have been aptly described by the theme skill, concern and approach.

5.3.2 Historical perception and traditional practice

The historical perception of the practice of FM and PAM influences the recognition accorded to the two functions in any organisation, including manufacturing industries. Initially, maintenance department, which is progressively expanding and upgrading its performance to be known and called FM unit/department, were seen as units of an organisation that provides reactive services, which is expensive (Cooke, 2003; Alsyouf, 2006; IBM, 2018). Generally, facilities and facilities management are the second largest cost component, after staff salaries in any organisation (Booty, 2006 as cited by Kok, *et al.*, 2011). However, FM is gradually becoming a value-added service unit by adopting modern management techniques and performance measurement tools (Kulatunga *et al.*, 2005).

Industry practitioners within these two sides of the divide would like to maintain their traditional domain. Those who have risen to the strategic levels of leadership will not encourage the idea of integrating the two functions, because no one would like to be subordinate to the other. However, the arguments for operating the two functions begins to lose credibility when the net effects of the wastes due to the duplication of resources (Men, Materials and Money), are analysed and tabled before senior management.

5.3.3 Integration require strategic thinking

The outcome of the preliminary data collection revealed that there are significant similarities between FM and PAM. The key objective of FM is to provide suitable support services which will enable the organisation to carry out its core functions. Similarly, the objective of PAM is to ensure machine reliability and availability in order to maintain steady productions. Therefore, integrating these two functions require strategic thinking, long-term planning, re-orientation of the personnel of the two functions and creating the atmosphere of collaborations. The benefits of integrating the two functions are whatever investment in the process and practice of integration.

5.3.4 Improvement in processes, people and product

The focus group session opined that a well thought out integration of FM and PAM, will eliminate waste, reduce overhead cost, improve operational efficiencies, production output and

profit. It encourages innovation which is the hallmark of the new revolution in modern manufacturing industries; shifting emphases from being labour-intensive to technology-intensive where the use of mechanisation and automation is increasing (Alsyouf, 2006). Due to the scarcity of capital, organisations are challenged with restructuring to meet their market demands for cheap but quality products with quick turnaround time. Therefore, any improvements in processes or people in terms of re-skilling to achieve more will contribute to profitability, and allow organisations to invest in innovations through research and development for better products.

Some of the benefits observed during analysis include cost-saving opportunities in people, processes, technology as demonstrated by Figure 2.1 and Figure 2.8. The opportunities for savings are in:

- human resourcing by cutting overheads expenses and upskilling of personnel
- business process streamlining through the centralised approach to work planning and control, leveraging on industry best practices
- software optimisation (EAMS/CMMS) through the use of a single system, as opposed to multiple software

Therefore, effective integration reduces the risk and length of downtime, improve productivity and profitability.

5.3.5 Re-orientation and adopting industry best practices

Re-orientation of FM and AM operatives is important, and should start with an understating that “a failure in equipment or facilities not only results in loss of productivity, but also in a loss of timely services to customers, and may even lead to safety and environmental problems which destroy the company image” (Alsyouf, 2006). A well thought out integration strategy could reward the manufacturing industry with benefits such as

- access to the right skills through a shared services model
- improved customer experiences internally and externally through improved reliability of machines and better products
- better profits, enabling investment in research and development
- improved revenue base allowing the organisation to invest in corporate social responsibilities (CSR) and respond to government initiatives

All of which will ultimately help the industry to survive its challenges, improve the bottom line, raise enough capital to rebuild the industry and subsequently reduce unemployment, inequality and poverty in South Africa.

5.4 Summary

The rising costs of production for manufacturing industry have dire consequences for the South African economy. More cost-cutting initiatives to achieve operational efficiencies need to be done for the survival of the industry. The research seeks to find ways in which Physical Asset Management (PAM) and Facilities Management (FM) can be integrated to bring value and benefits to the manufacturing industry. Five themes emerged which provide organisations with opportunities to integrate their FM and AM functions. The primary and immediate cost savings benefits lie in human resources, business processes, and software optimisation while secondary benefits include skilled personnel, improved customer experience through better and quality products, and funding for industry and government initiatives to improve the economy and livelihood of the majority of people living in South Africa.



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Chapter 6: Conclusions and recommendations

This chapter brings together the collection of efforts of the research to advocate for the integration of the function of FM and PAM in the manufacturing industries, because of the perceived benefits.

6.1 Background

Organisations across the globe are under pressure to realise the value of their assets, and for the asset-intensive organisations whose primary objective is to produce products, the challenge is even greater. For these organisations, maximising the value of their assets means a continual improvement on the performance of their production assets while keeping up with the changing regulations for manufactured products, advancing technology and increased competition. In South Africa, the manufacturing industry is faced with three main challenges; high cost of production, shrinking market share and 'war' for talent as critical skills are slowly diminishing. At the same time, complexities from technology such as Artificial Intelligence (AI) and Internet of Things (IoT) are disrupting the industry and regulations are increasing at a rapid rate.

All of these changes must be managed through proper infrastructure and skills in a coordinated approach, adding on as costs. However, if areas of optimisation are identified and implemented, capital can be one of the benefits realised from the initiatives. One of the optimisation opportunities exists in Facilities Management and Physical Asset Management, which are critical within manufacturing organisations, without them organisations would not be able to reach their objectives. Sadly, the functions do not receive the same appreciation and attention as enjoyed by other functions such as production, supply chain, quality, and finance - all of which make it to the boardroom agenda items.

The research methodology adapted is a mixed approach, combining quantitative and qualitative methodologies. Quantitative method was used to find evidence in support of the hypothesis (or to reject it) through structured questionnaires via an online survey. The results supported the hypothesis and allowed for the second round of qualitative data collection, through focus group to proceed. The analysis of the qualitative method followed the principle of content analysis where themes were developed for discussion.

- **Conclusions from the findings**

The literature study and findings have substantiated the important role of Facilities Management and Physical Asset Management functions within manufacturing organisations, where availability and reliability of assets and facilities have a direct impact on the productivity of the plant and success of the organisation. Proactive planning on maintenance and coordination with clear KPIs from both functions is critical to achieve desired assets or facilities performance. The findings and analysis also revealed the existence of FM and PAM as parallel functions, with PAM leading in terms of KPIs, asset management best practices, standardisation and methodologies such as DMAIC, LCC, RCM and RCA. Historical perception is identified as the reason these functions are operated in parallel despite their undisputable similar scope of assets and skills requirements, subsequently creating a knowledge gap and counterproductive processes between the functions. The industry needs to re-organise its approach to FM and PAM.

- **Recommendations**

The consolidated results indicate a consensus towards an integration of FM and AM, with careful consideration - recognising the differences, similarities and their uniqueness. The integration will provide manufacturing industries with bottom-line value add, mainly through streamlining of processes, optimisation of computerised systems, upskilling and sharing of human resources. Therefore, a collaborative integration type is proposed as represented in Figure 6.1.

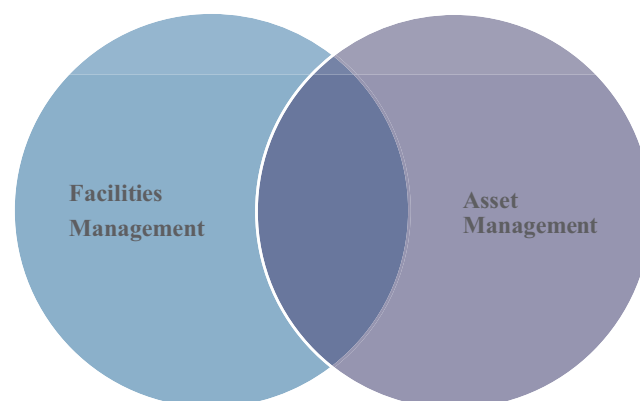


Figure 6.1: Proposed integration model

For example: FM's soft service forms part of day-to-day operations of an organisation by ensuring the work environment is safe and clean. This task requires a certain set of personality traits (friendly and customer-centric) with no formal education, which can remain on the left

side of the circle. On the other hand, there are also hard services comprising of technical assets within FM such as HVAC, requiring certain skills set and level of education which are also prerequisites for maintenance management team within AM. The work management process for this can then be in the shadow area of the circles, which is where the opportunity for efficiency exist. This can be achieved by combining the functions as shown in Figure 6.2 to facilitate better planning and skills sharing from the cross-functional teams.

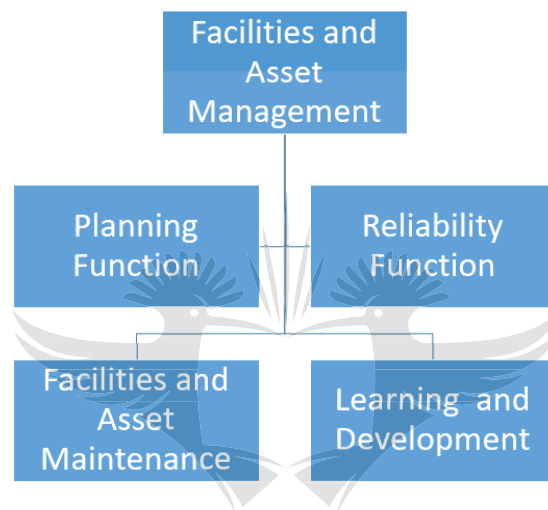


Figure 6.2: Proposed Facilities and Assets Management Structure

Awareness of core functions and objectives of FM and PAM is strongly recommended as a start to gain buy-in from stakeholders.

- **Future research**

Although integration of functions or departments is a common practice in public and private organisations, there is no evidence of integrated FM and PAM or the appetite of this concept from the studied literature to date. Positive feedback of participants should be the foundation for future research, which will contribute immensely to the literature gap on the topic.

More work should be done needed to determine the financial links (quantifying the initiatives to Rands and cents) of FM and PAM to the organisation's performance in efforts to attract the attention and support of executives. The research should also focus on the type of integration, i.e. if it is AM integrated into FM or FM integrated into AM as depicted in Figure 6.3 and guidelines on what a strategic integration should look like.

The longitudinal study is also proposed for those who participated in the study to assess the impact of this study in their workplaces. Example, would they continue working the way they have been, in silos? Or are they truly open to the idea of integration and see value in it? Lastly, studies on organisations that have tried integration of FM and PAM should also be conducted, focusing on their successes and failures to develop a robust FM and PAM integration models.

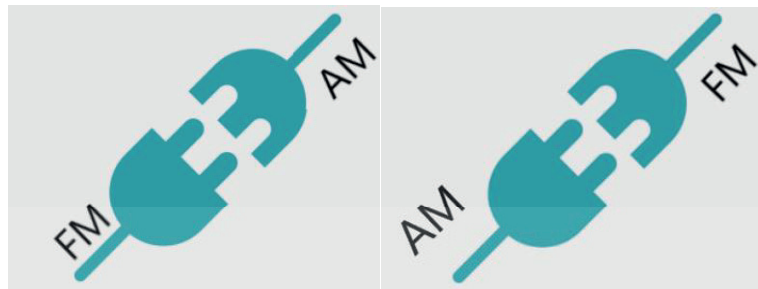


Figure 6.3.: Types of integration for future work studies

6.2 Summary

The literature study and findings have substantiated the important role of Facilities Management and Physical Asset Management functions within manufacturing organisations, where availability and reliability of assets and facilities have a direct impact on the productivity of the plant and success of the organisation. Due to uniqueness of scope to some extent, a collaborative type of integration is proposed, with clear boundaries and proposed for future studies.

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Appendix A: Additional information on Survey Monkey

Home page of Survey Monkey: <https://www.surveymonkey.com>

Video on how to create a survey: <https://www.youtube.com/watch?v=7xdCDJxxoRk>

Overview of Survey Monkey: https://www.surveymonkey.com/mp/take-a-tour-2/?utm_expId=.tSzOnORwTpSzOdV38DlebA.1&utm_referrer=https%3A%2F%2Fwww.google.com%2F



Appendix B: Table for reporting focus group session

A. Question	B. Vertical analysis (summary of each respondent to each question)					C. Horizontal analysis (Summary of all respondents to each question)	D. Theme
	Respond't 1	Respond't 2	Respond't 3	Respond't 4	Respond't 5		
1.What are the major similarities or differences in the functions of FM and PAM in the manufacturing industry?	Similarity in skills set for type of assets managed and maintenance work	Difference in scope of work, e.g FM has large scope of soft services which require different type of personnel	Both are concerned with triple p (3P) – people, planet and profit	Facilities management is less concerned about life-cycle costing while PAM incorporates LCC in planning	FM is a support function; PAM is a critical function of which production of products is depended on availability of equipment	Similarities are in: the same skill set, assets, and impact of 3Ps to business. Differences are: FM a concern with maintenance and AM focuses on LCC	Skill concern and approach
2.What is the common rationale for operating FM and PAM	Traditional set up of businesses where FM was regarded a	FM seen as a cost rather than value-adding	Machine complexity fast-tracked development of PAM			FM confined to soft services, seen as a cost and non-value add function; while PAM is seen	Historical perception and traditional practice

separately in organisations?	support soft service	service and hence it reports to finance				to focus on machine reliability	
3.What are the possible advantages or disadvantages of integrating the two functions into one in a manufacturing industry?	Disadvantage is scope of FM which is larger than PAM, where FM is soft and hard services/technical and integration should be well thought to ensure a sound balance	FM is the brand and image of the business, right skills set and attitude should be centre of the integration	Improvement in control of statutory and regulatory requirements such as Health, Safety, Security and Environmental (HSSE),	Better business decisions making on investments and support required			Integration require strategic thinking

4. Where are the cost savings potential if functions of FM and PAM in the manufacturing industry are integrated?	Savings can be gained from contractor appointments and personnel recruitment and training	Use of single software to carry out functions and central office to coordinate work	Leverage of PAM best practices through the Do-Check-Act (PDCA) can be the culture ultimately saving on operational and capital costs.			Improved processes in contractor selections, Recruitment of single set of personnel, Use of single software, and Application of industry best practices	Improvement in processes, people and product
5. If integration is of value, what would it take for industry to accept it as an operation strategy?	FM cannot be seen as a subset of PAM; therefore, it should take the lead. Without a facility there is no manufacturing plant	PAM concepts are broader and have been tested over time, value is in PAM	ISO should be the lead for the integration for better alignment	Re-orientation of FM and PAM personnel; Cost benefit analysis	Identification of duplication of personnel; Use of standard software that integrates FM&PAM (CMMS)	Re-orientation of FM&PAM operatives Do cost-benefit analysis Adopt suitable industry best practice software	Re-orientation and adopting industry best practices

		taking the lead				and standard (CMMS, ISO)	
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Appendix C: Table for reporting survey responses

S/No	Research question	N	Response					
			Yes %	No %	Maybe %	1-9 employees	10-39 employees	40+ employees
1	Do you have a Facilities Management department/division in your organisation?	16	62.50	37.50				
2	If you answered yes, what is the size of the department/division?	16				68.75	12.50	18.75
3	Do you have an Asset Management department/division in your organisation?	16	68.75	31.25				
4	If you answered yes, what is the size of the department/division?	16				68.75	18.75	12.50
5	Do you have Facilities Management key performance indicators (KPI's) clearly defined?	16	43.75	56.25				
6	Do you have Asset Management key performance indicators (KPI's) clearly defined?	16	56.25	43.75				

7	Are you aware that there is a Facilities Management ISO standard?		37.50	62.50				
8	Are you aware that there is an Asset Management ISO standard?		75	25				
9	Do you believe Facilities Management and Asset Management business processes are similar?		25	43.75	31.25			
10	Do you believe there is value in integrating Facilities Management and Asset Management?		87.50	12.50				



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