

https://dspace.org/

An aftermarket parts framework for capital mining equipment in South Africa: An OEM Perspective

Ganasram, Amith

2021

University of the Witwatersrand, Johannesburg

https://hdl.handle.net/10539/41491

Ganasram, Amith . (2021). An aftermarket parts framework for capital mining equipment in South Africa: An OEM Perspective [Master's dissertation, University of the Witwatersrand, Johannesburg]. WireDSpace.

Downloaded from a DSpace repository. https://dspace.org/

An aftermarket parts framework for capital mining equipment in South Africa: An OEM Perspective

Amith Ganasram

WITS Business School

Applied Research Proposal is presented in partial fulfilment for the research component for degree of Master of Business Administration to the Faculty of Commerce, Law, and Management, University of the Witwatersrand

31st October 2021

DECLARATION

I Amith Ganasram declare that this research proposal entitled 'An aftermarket parts framework for capital mining equipment in South Africa: An OEM Perspective' is my own unaided work. I have acknowledged, attributed, and referenced all ideas that are not my own. I am hereby submitting this applied research proposal in partial fulfilment of the requirements of the degree of Master of Business Administration at the University of the Witwatersrand, Johannesburg. I have not submitted this report before for any other degree or examination to any other institution.

Amith Ganasram
Signed at Johannesburg on 31st October 2020

Name of candidate	**Amith Ganasram**
Student number	**1968613**
Telephone numbers	**076 411 22 63**
Email address	**amith.ganasram@gmail.com**
First year of registration	**2020**
Date of proposal submission	**31st October 2020**
Date of report submission	**N/A**
Name of supervisor	**Dr. Robert Venter**

ABSTRACT

Author: Amith Ganasram **Supervisor:** Dr. Robert Venter

Thesis title: An aftermarket parts framework for capital mining equipment in South Africa: An OEM Perspective

The purpose of this research study is to create an aftermarket framework for capital mining equipment in South Africa, which can be applied in organizations that currently are OEM Manufacturers for mining equipment.

The background literature that was reviewed for this study focused on aspects of SPM, SCM, inventory management, parts pricing methodologies, processes, purchasing, CRM and maintenance management. These topics were reviewed in detail, the definitions of these concepts and their respective components were identified and acknowledged during the learning journey. Models were touched on in this research study followed by a theoretical framework which was defined making use of the sourced academic literature.

To achieve the objectives set out in this study, there was a case study research conducted on an OEM, which was utilised for the full duration of the research. The case company used in the research is a Global OEM that manufactures mining equipment for the various stages of mining. It is projected that there will be a combination of 12 semi-structured and 10 structured interviews that will be conducted where the semi structured will focus on the customer and the structured will focus on the internal employees of the case company. All interviews will be conducted personally by the researcher to ensure that all information is treated in the strictest of confidence. The data collected from the interviews will be transcribed from their recordings and will be qualitatively analysed.

Research aims and objectives of this research study is:

- To systematically review previous work on aftermarket parts supply and aftermarket support.

- To identify aftermarket parts issues that are not supported by sourced literature which relates to my research topic, and which my research will be able to reveal or provide additional insight from a mining OEM perspective.
- To study aspects with respect to CRM, aftermarket strategy, pricing and aspects related logistics.
- To identify an appropriate aftermarket framework for aftermarket parts of aging and new capital mining equipment

Key results or arguments - To be completed in the Empirical Research
Conclusion – To be completed at the end of the research

Johannesburg, October 2020

TABLE OF CONTENTS

DECLARATION ii

Abstract iii

Table of contents v

List of acronyms viii

List of tables ix

List of figures x

List of tables and figures in the appendices xi

ACKNOWLEDGEMENTS xii

Definition of key terms and concepts in a mining context xiii

Case Study company xiv

1 Introduction to the research 15

1.1 Background and context 15

1.1.1 An introduction 15

1.1.2 South African Mining Industry 16

1.1.3 OEM's ability to support mining customers with aftermarket parts. 16

1.2 Research conceptualisation 16

1.2.1 The research problem statement 16

1.2.2 The research purpose (aim and objectives) statement 17

1.2.3 The purpose and research questions 18

1.3 Delimitations and assumptions of the research study 19

1.4 Significance of the research study 20

1.5 Preface to the research report 21

2 Literature review 22

2.1 Research problem analysis 22

2.1.1 Systems Thinking Approach 22

2.1.2 Trend Analysis 26

2.1.3 Problem tree and theory of constraints 27

2.1.4 Source, Summary and Synthesis of literature 27

2.2 Research knowledge gap analysis 28

2.2.1 Selecting, Summarising, Synthesising, Academic Literature 28

2.3 Qualitative attributes key to the research 33
2.3.1 Customer relationship management 33
2.3.2 Supply Chain Management, ... 33
2.3.3 Spare Parts Management 34
2.3.4 OEM Systems and Processes 34
2.3.5 Aftermarket KPIs 35
2.3.6 Local Parts Sourcing 35
2.3.7 Parts Pricing 35
2.3.8 Maintenance Management 36
2.4 Framework for interpreting research findings 36
2.4.1 What are systematic reviews? 36
2.4.2 Brief history of systematic reviews 36
2.4.3 The realisation of systematic reviews 37
2.4.4 Advantages and use of systematic reviews 37
2.4.5 Disadvantages and or limitations of systematic reviews 37
2.5 Summary and conclusion 38
2.5.1 Summary of literature reviewed 38
2.5.2 Proposed research strategy, design, procedure and methods arising from the literature reviewed 39
3 Research strategy, design, procedure and methods 40
3.1 Research strategy 40
3.2 Research design 42
3.3 Research procedure and methods 44
3.3.1 Research data and information collection instrument(s) 44
3.3.2 Research target population and selection of respondents 45
References 46
Appendices 53
Appendix 1.1: Data collection instrument(s) 54
Appendix 2.1: Ethics Documentation – Participant form 57
Appendix 2.2: Ethic documentation – Consent form 58
Appendix 2.2: Ethic documentation 59
Plagiarism Declaration 60
Honour Pledge 61

Permission Letter.....62

LIST OF ACRONYMS

In progress

OEM	Original Equipment Manufacturer
SPM	Spare Parts Management
CME	Capital Mining Equipment
SCM	Supply Chain Management
CRM	Customer Relationship Management
ERP	Enterprise resource planning
NWC	Networking Capital
LRU	Line Replacement level (spare parts at 1st level maintenance)
MTTR	Mean time to repair
KPI	Key performance indicator
et al	and others

LIST OF TABLES

In progress

LIST OF FIGURES

In progress

LIST OF TABLES AND FIGURES IN THE APPENDICES

In progress

ACKNOWLEDGEMENTS

In progress

DEFINITION OF KEY TERMS AND CONCEPTS IN A MINING CONTEXT

In Progress

Aftermarket: This is the market for spare parts, services, new and repairable components of capital mining equipment (*Aftermarket Definition and Meaning | Collins English Dictionary*, n.d.).

Product Support: a service provided by many Mining OEMs of various parts, primarily mining spare parts, that provides the end-user with a technical resource for information regarding the specific parts (*PRODUCT SUPPORT | Meaning in the Cambridge English Dictionary*, n.d.) that are found on the capital equipment, and offer support should the machine fail to operate, resulting in downtime.

CASE STUDY COMPANY

This research study follows a case study approach, what this means is that this approach will allow for some multi-faceted explorations of the case study company in terms of complex issues from an aftermarket perspective that is currently taking place, using data based on their real-life settings.

The case study company is a Global Mining OEM, hereafter referred to as The OEM. The OEM has been focused on multiple areas of business and innovation, however, their local branch in South Africa, focuses on the mining industry, specifically looking at the main stages of mining. This study provides an in-depth look at the aftermarket division specifically on aftermarket parts on the underground and surface equipment.

The OEM in located throughout Southern, Central and Western Africa but we are focusing only on South Africa, as we are in a middle of a global pandemic and international travel to other Southern Africa countries might not be feasible at this time to undertake the qualitative research element of the study. Currently the OEM has more than 1000 active machines (based on internal reports), that are spread across South Africa, what this means is that these machines are currently in operation at various mine sites across the various limbs of this country (central, northern, eastern and western).

With that number of machines currently in operation there is a requirement to ensure that the aftermarket is fully supported to reduce machine downtime, keep inventory costs low, stock the right parts in stock, ensure that the workshops have sufficient parts to ensure that the repairs of components, maintenance of onsite machines as well as workshop rebuild as well as administrative costs associated with the management of spare parts are all effectively managed through a framework for the aftermarket. Customer satisfaction is extremely important as well, due to the number of other OEM competitors in the market as well as other local competitors that have started up over the years to capture market share of the OEM.

1 INTRODUCTION TO THE RESEARCH

1.1 Background and context

The purpose of this research aims to develop an aftermarket parts framework for capital mining equipment in South Africa: An OEM Perspective. The supplier is also referred to as an Original Equipment Manufacturer (OEM). For the remainder of the study, for confidentiality purposes, the supplier is referred to as The OEM. This research study will investigate aftermarket parts in more detail based on the supply of parts by an OEM with specific focus on surface and underground capital equipment in three stages of mining namely; development, open-pit and underground.

(Driessen et al., 2014) highlighted that organisations depend on their capital assets to provide services or create products, similarly the mining industry aftermarket which is mainly a combination of parts and services (*Industrial Aftermarket Services: Growing the Core | McKinsey*, n.d.-a) that would offer capital mining equipment with product related support during the life cycle of the machine in its operation. Aftermarket offers outperforms capital equipment sales in numerous dimensions namely; faster growth rates, greater predictability; resilience through economic cycles, higher profitability (*Creating Value for Machinery Companies Through Services*, 2020). The management of spare parts and its logistics form part of product support which has an influence on life cycle cost (Ghodrati, n.d.). What (Ghodrati, n.d.) also alluded to was that parts availability on demand will reduce the products downtime and increase equipment utilisation which in turn ensure that the mine is more profitable.

1.1.1 An introduction

This research study proposes to develop an aftermarket parts framework for capital mining equipment in South Africa: An OEM Perspective. This chapter 1 aims to introduce the research study by providing background and context by the research problem statement and a brief overview of the steps involved with the research. It highlights the research problem, an introduction to the aims and objectives of the research study and the research question. Finally, the chapter concludes with the delimitations and the significance of the research study.

1.1.2 South African Mining Industry

The mining value chain in South Africa contains is massive and it was reported that South Africa is the best resourced country in the world (*121107value.Pdf*, n.d.).2020 saw the rise of a global pandemic that has taken over all aspects of life including the mining industry, especially as lockdown restrictions had an impact on economic activity (Kotze, 2020), by inference it would mean that mines are less inclined to want to invest in capital equipment, but would rather focus on running their current equipment more efficiently which this research study aims to focus on the aftermarket parts supply of capital equipment found in the development, open-pit and underground stages of mining.

1.1.3 OEM's ability to support mining customers with aftermarket parts.

This research study will be looked at from the perspective of the OEM, which has a share of the aftermarket in South Africa. In order to be able to effectively support customers with parts that are required to maintain their equipment efficiently, repairable components and machine rebuilds, there needs to be the correct quantity of parts available in country based on the number of active installed fleet. This comes at a cost to the OEM to house the correct parts, which is characterised base on machine productivity and historical information derived from predicted operating costs. With new machines entering the market being more intelligent, there is a requirement for more accurate forecasting of the correct level of parts required between each 500-hour service maintenance interval and this problem persists with all new machines which places pressure on the OEM and direct impact on customer revenue.

1.2 Research conceptualisation

1.2.1 The research problem statement

According to a commodity report in August 2020, South Africa is the largest exporter of platinum globally (*South Africa Trade*, n.d.). Economic activity in South Africa has been centred around mining, their services and supply (*Mining in SA - Minerals Council South Africa*, n.d.) and there are a few OEMs that dominate the capital equipment market and therefore the aftermarket is extremely critical in supporting mining companies installed fleet (Fessehaie, n.d.). A preliminary investigation into aftermarket parts supply suggested that literature is limited, most research that was available was directed mainly to maintenance aspects within the mining context, a research study by (Toit et al., 2014)

on a case study for Anglo American on Inventory management, therefore there is a need for an aftermarket parts framework that specifically looks at capital mining equipment.

The same preliminary literature investigation suggested that there might be a gap between the way in which the ordering of aftermarket spare parts and the implementation of an effective parts system that measures various aspects in order to determine accurate parts usage on machines that could be done more effectively and based on operations in the mining industry of South Africa. To ensure that OEMs remain competitive they need to examine the aftermarket value which contributes significantly to their total revenue (*Industrial Aftermarket Services: Growing the Core | McKinsey*, n.d.-b). Allow an OEM to capture share of the parts aftermarket that they are not capturing currently or losing to local competitors.

This study aims to address the above-mentioned needs. The following section discusses the research objectives of the study.

1.2.2 The research purpose (aim and objectives) statement

The background, introduction and research problem statement has led to the research objectives to serve as a guide for the research. The research aims and objectives are required to:

1. Establish principles in existing frameworks in relation to aftermarket parts supply and aftermarket support.
    a. Review of existing SCM and SPM frameworks
    b. Review of aftermarket product support
    c. Reliability characteristics of spare parts
    d. Determine relationship between SCM, SPM Aftermarket Product Support and Reliability Characteristics of spare parts.
2. OEM perspective internal systems and processes review to address parts supply not addressed by the literature on mining customers
    a. review key concepts in CRM
    b. determine relationship between CRM and SPM
3. Customer Satisfaction
    a. Roles of CRM
    b. Customer challenges

    c. Parts Pricing and availability
4. Maintenance Practices
    a. review of customer forecasting and planning
    b. review of communication between customer and OEM
    c. review of customer maintenance practices
    d. distinguish a relationship between maintenance practices and parts consumption
5. Review of existing OEM SPM system on CME
    a. identification of existing spare parts classifications for CME
    b. methods used to classify fast moving spare parts
    c. identify demand planning techniques used to accurately forecast spare parts.
    d. overview of existing inventory management policies
    e. review of current SPM framework for ordering of spare parts
6. Develop an aftermarket parts framework for capital mining equipment
    a. Determine criteria to develop aftermarket parts framework that for enabling accurate parts forecasting.
    b. Create a framework from the criteria which has a defined structure.
7. Validation of aftermarket framework
    a. Validation of the framework as per research objectives.
    b. Provide outcomes of assessments based on validation.

Continuing from the background, introduction and problem statement the proposed framework would consist of a variation of aspects:

1. Application – the ease of use in applying the framework within an OEM.
2. Systems and Processes – The framework should reveal the multi-level systems and processes that need to be in place.
3. Structure – the framework should have a structure that services as a guide to the aftermarket parts model.

1.2.3 The purpose and research questions

The purpose of this research study is to formulate an aftermarket framework for the OEM case company's aftermarket parts in support of capital equipment. The research questions (RQ's) are as follows:

- RQ 1. How do we integrate aftermarket parts supply characteristics into a decision model that would allow for accurate forecasting of parts?
- RQ 2. How to manage inventory levels whilst strengthening core business in parts?
- RQ 3. How to improve customer satisfaction with aftermarket parts?
- RQ 4. What impact does effective maintenance practices have on spare parts consumption?
- RQ 5. How do lost parts sales relate to parts availability challenges?
- RQ 6. What should an aftermarket parts framework look like?

1.3 Delimitations and assumptions of the research study

It is imperative to characterise the delimitations to establish the boundaries this research study prior to commencement of the empirical research and to direct the that which it is purposefully intended. All root causes are identified as follows:

- Inappropriate inventory management practices
- SCM not effectively supporting aftermarket parts
- Inadequate local sourcing in alignment with localisation policies
- Broad variations of surface and underground machines in South Africa
- Lack of interconnectedness between internal company divisions systems and processes i.e. SCM, SPM, ERP and CRM.
- Poor customer maintenance practices.
- Classification of parts and reordering points misalignment
- Inaccurate spare parts stocking
- Inadequate critical spare part information available at the time of new machine introduction into the market.
- Current organisational structure in respect of having an appropriate aftersales network in place to support CME.

The two main root causes to this study are as follows:

- Lack of interconnectedness between internal company divisions systems and processes i.e. SCM, SPM and CRM: There seems to be complete misalignment in the overall systems and processes that are currently adopted and the silo way

of working is having a direct impact on the supply of aftermarket spare parts to the mining end users.

- Current organisational structure in respect of having an appropriate aftersales network in place to support CME: The aftermarket consists of a combination of the service and parts supply, which further consists of product support from a service and parts perspective utilising internal OEM resources in the form of technical support, field services staff and business unit that supports all capital equipment divisions as a result.

There are two main delimitations to this study are:

1. The study is focuses on aftermarket parts in CME in the three stages of mining only. There is no focus placed on aftermarket parts for other industries and this framework might not be adaptable as such.
2. The proposed framework is presented as a guide. It does not provide solutions to varied types of problems that could be encountered but focuses mainly on the framework to provide accurate aftermarket parts availability based on active machine install base and new machines entering a mine.

The following section discusses the significance of the research study.

1.4 Significance of the research study

The significance of this research study is to provide the main importance of the research.

- OEM risk losing the their aftermarket businesses the moment their CME goes out of warranty will eventually lose market share to other third party vendors (Cohen et al., 2006).
- Harvard Business Review conducted a survey that looked at the link between customer satisfaction and aftersales services and found that satisfaction levels were 10-15% lower than customer expectations (Cohen et al., 2006) which is critical to customers becoming dissatisfied with the service levels of the OEM because they are unable to supply parts as and when customers require them and might consider other options as part of their maintenance strategy.
- The disruption from the COVID-19 pandemic in 2020 new equipment orders have been affected, this means that OEMs need to consider opportunities in

aftermarket services in order to navigate through the crisis(*Aftermarket Services: The Digital Differentiator | Deloitte Insights*, n.d.), therefore neglecting to instil an appropriate aftermarket parts framework could have a ripple effect on capital equipment sales of new machines that will have a direct impact on customer relationships, future aftermarket revenue and FTE headcount if targets are not achieved for the OEM.

- In the eastern part of South Africa there are several mines that are closely located to each other, the purchase their CME from the same OEMs based on discussions they have based on performance of the CME when they are at trade shows such as the Annual Mining Indaba, or when employees move between mines and relationships are developed as a result, therefore bad reputational image based on inability to support their CME in the aftermarket would not be beneficial for business as it set precedence for future business growth (authors comments from work experience).

1.5 Preface to the research report

For this research proposal there are three chapters in this report. Chapter 2 provides a literature review following this introductory chapter, which covers the primary issue, the past studies that were reviewed, the explanatory framework as well as conceptual framework. The research strategy, architecture, procedures, measures of reliability and validity and limitations are addressed in Chapter 3.

2 LITERATURE REVIEW

This chapter covers three main objectives which are; to understand the study research problem, to state what the knowledge gap is based on existing literature and create a framework that enables an interpretation of the research findings.

2.1 Research problem analysis

This section looks at the research problem in a greater level of detail and it is broken down into four parts namely; systems thinking, trend analysis, problem tree & theory of constraints and the source, summary and synthesis of literature.
overview

2.1.1 Systems Thinking Approach

Based on the systems thinking approach by (Gharajedaghi, 1999), and in respect of the research study the structure has been modified to reflect the interpretation of available information that would support the Symptoms, Root-causes and consequences of the research problem.

2.1.1.1 Symptoms

Majority of the sourced literature focused on the areas below which is directly linked with the aftermarket parts aspect of this research study under analysis. From a perspective of symptoms, they are what drive many of the issues seen currently in the OEM under analysis.

Maintenance Practices

(Du Toit, 2014) mentioned that the demand created for spare parts are caused by failures which are influenced by poor maintenance tactics being applied. (Du Toit, 2014) the maintenance aspect is depended on parts being made available in order to complete certain maintenance activities in order to reduce machine downtime. If there is poor reliability this might be as a result of inadequate maintenance on the product, (Ghodrati, 2005) said that products would require maintenance which includes spare parts at regular intervals to ensure that there is product reliability.

Decreased availability of an asset could be attributed to maintenance delays during which the asset is non-operational (Driessen et al., 2015). (Driessen et al., 2015)

distinguishes the three types of maintenance practices that should be followed i.e. preventative, corrective and modificative in order to prevent machine failures. System availability is warranted against effective preventative maintenance by being proactive and performing aged replacements before failure (Jin et al., 2015). Some losses from caused through downtime, speed or hidden losses and defects can be eliminated through effective maintenance practices (Al-Bawi, 2015). The correct maintenance practices are significant in combination with parts availability.

OEMs are in the best position to determine the maintenance requirements of their machines, based on the performance of the machines that accounts for the enivironment, the average run time and scheduled maintenance allowing an OEM to predict maintenance requirements that can optimise sales and inventory (*Selling in the Aftermarket: How to Win the Sales Street Fight | McKinsey*, n.d.).

Aftermarket Spare Parts Management

Costs of maintenance and spares parts for a fleet of trucks or loaders over their life usually exceeds the initial cost of the truck or loader, depending on machine operation, how they are maintained and relevant support (Ghodrati, 2005). In this section the aspects covered provide an overall view of the areas that impact the aftermarket spare parts of the OEM.

Availability: (Du Toit, 2014) spare parts are important and are required when there are failure or replacement of components. Parts availability has an impact on equipment utilisation and SPM is vital in order to manage expensive inventory costs. A Pareto Analysis on truck fleet on a mine had determined that availability of parts was the primary cause of increased levels of unproductive maintenance downtime on site (Hall et al., 2000). (Ghodrati, 2005) states that a lack support (spare parts) would lead to unexpected downtime, resulting in losses that cannot be compensated for; therefore, unavailability of critical spare parts could result in untimely machine stoppages. The forecasting spare parts based on reliability and maintainability characteristics of machine components is an effective strategy to prevent these unplanned stoppages (Ghodrati, 2005).

Criticality: decision-making is influenced by a few concepts such as geographical location of a machine, costs and criticality of the parts in knowing what to order and how much of it to order (Ghodrati, 2005). (Driessen et al., 2015) explains the

differences associated with the criticality of parts in terms of type of breakdown, where full system breakdown – critical parts required, partial system breakdown – partially parts required, parts that do not cause system breakdown are referred to as non-critical parts. The general information gathered on parts was of a technical nature where (Stamatis, 2014) mentions that the criticality of a part can be derived from a failure mode effect and criticality analysis.

Lead-time's: this works in conjunction with the operating location (mine), as distance influences lead times for service as well as delivery of spare parts (Ghodrati, 2005). (Gajpal et al., 1994) stated that spare parts are a substantial amount of the complete inventory in manufacturing organisations and that the uncertainty associated with SPM ranges from the different supplier lead times to unpredictability of demand. Supply lead-time for parts is a combination of repair lead time and procurement lead time (Driessen et al., 2015). Therefore, when there is downtime of a machine and parts need to be replaced, the unavailability of the parts required will cause a longer MTTR, which results in longer lead time.

Demand forecasting: two main techniques for spare parts, being reliability based and time series and the availability of data is determinant on which to choose (Du Toit, 2014). The demand for LRU's in many cases come up when there is equipment failure of sorts, therefore forecasting demand equates to forecasting failures (Driessen et al., 2015).

Reliability: (Costantino et al., 2018) states that critical performance decreases, may result in machine downtimes and irreparable economic losses. Which basically means that systems that have high-value assets, with low- frequency failures, is where spare parts management is critical.

Classification: The OEM in this study has a parts classification system in place that is in the form of the ABC Analysis (Al-Bawi, 2015). However, it seems that it is not efficient enough to manage critical spare parts required for new capital equipment.

Inventory Management: (Du Toit, 2014) states that the main challenge in managing inventory is the decision of what to purchase, when to do it and how many parts to purchase. Cost objectives influence the decision based on capital investments required

to house stock and unavailable stock items will lead to the OEM's service level being affected, therefore the middle the challenge is the balance between risk and cost.

2.1.1.2 Root causes

From section delimitations of the research study in chapter 1, the following two main root causes below were identified which are the main reasons for wanting to have an aftermarket framework for capital equipment in South Africa. A study in 2013, highlighted that 70 to 90 percent of the equipment lifetime cost lies with maintenance and repair, services (contain parts) that offer high margins and annual revenues that are predictable (*Study Shows Equipment Manufacturers Must Prepare for Change as the Aftermarket Is Set to Dominate | Infor*, n.d.) .

Supply Chain Management

The OEM in this Study undertakes business in the aftermarket with numerous mines within South Africa, predominantly Platinum mines, therefore a strong aftermarket framework would be required to approach these customers, specific to parts of capital equipment sold, the parts delivery process would be managed through the internal company supply chain. Currently increased customer dissatisfaction due to parts delivery has surfaced on numerous projects. (Du Toit, 2014) states that there is uncertainty present in all supply chains and therefore the impossibility in solving all SCM challenge if the effects of uncertainty are not considered. Some of the sources of the uncertainty will have a financial bearing on an organisation (Du Toit, 2014).

Spare Parts Management

Spare parts availability has an influence on the machine performance and in turn the parts stock levels will have an effect on the costs of inventory (Du Toit, 2014). Costly delays in repair work can be reduced by ensuring that there is adequate spare parts available instead of waiting (Ghodrati, 2005). Inventory maintenance to find the correct balance will come at an additional cost if there is lack of optimisation (Ghodrati, 2005). The multi-echelon system of spare parts can be split into two main types; repairable parts and non-repairable or consumables, which therefore means that the supply chain is divergent (Driessen et al., 2015). (Cavalieri et al., 2008) mentions that the correct spare parts in inventory by the correct quantities requires strong decision making as this will have an impact on the cost of inventory.

2.1.1.3 Consequences

(Driessen et al., 2015) states that parts criticality is the consequence of the failure of a part, and it directly related to the type of breakdown and the associated reaction time when it comes to parts availability.

Demand forecasting challenges pare a major determination of which parts will have a demand placed on them now and in the near future, therefore the quantities need to be identified. Future demand for spare parts is either (partially) planned or unplanned, therefore demand forecasts can be based on historical information, by the current future demand information or a mixture of both these forecasts (Driessen et al., 2015).
There are serious financial consequences parts are not in stock (Ghodrati, 2005), as evidenced through inventory holding cost as the unavailability of a spare part drop off into an extended unproductive downtime of the capital equipment, with impact on financial consequences on company profitability (Cavalieri et al., 2008).

(Ghodrati, 2005) states that the inventory of spare parts is very critical element as well as extremely challenging, as demand is difficult to foresee, therefore the effects of not having stock available can be catastrophic, as parts prices are higher. If the components are stored, the defective machines cannot be serviced, resulting in loss in production and consumer frustration as a result.

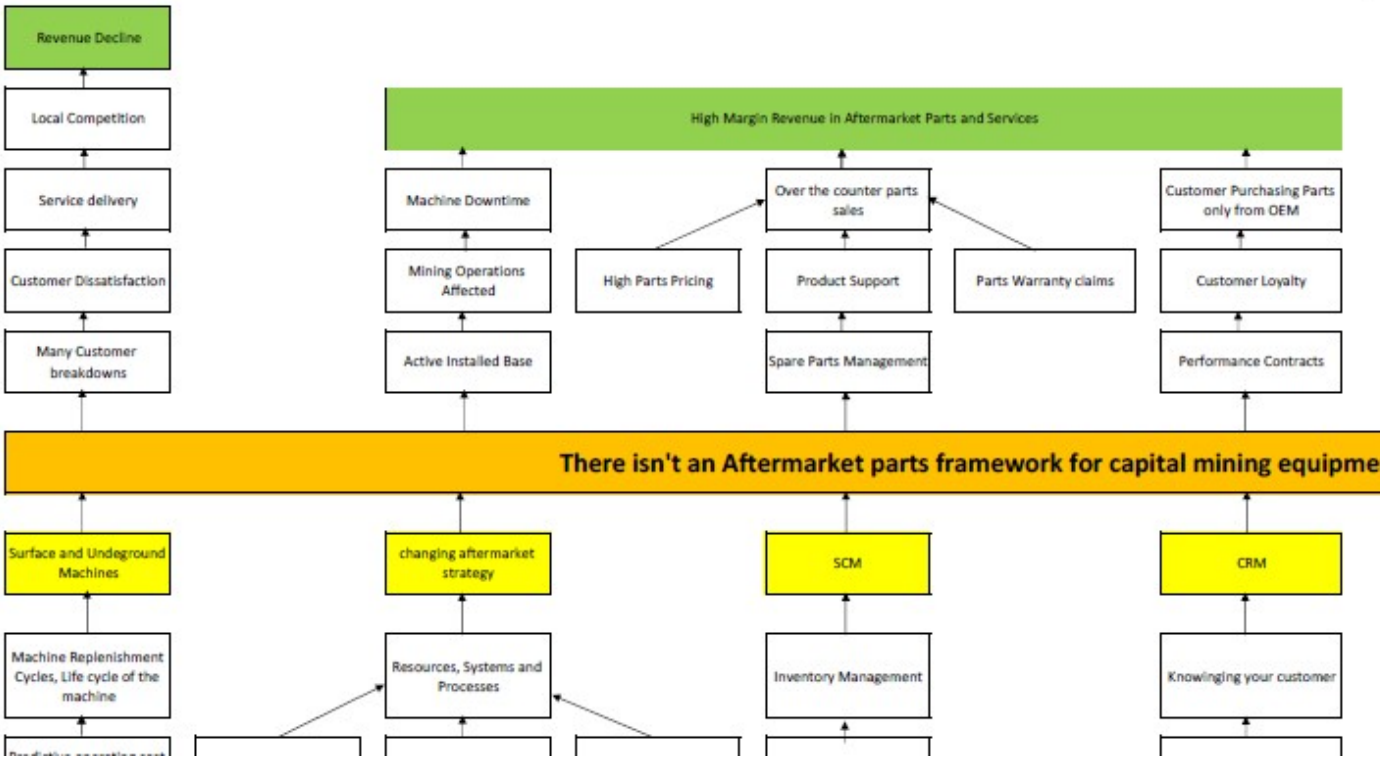
2.1.2 Trend Analysis

The trend analysis focuses on the symptoms of the research under analysis. The trend analysis is formulated based on the symptoms that have developed over a period of time and reflects how the research problem has been evident over the time period. From the analysis of literature, it can be seen that there has been a trend as follows that tracks aspects of the research problem over time as follows:

1. (Ghodrati, 2005): 2005, Behzad focuses on developing a decision model that integrates product reliability characteristics with product support.
2. (Cardona & Karlsson, n.d.): 2013, Their aim was to present solutions for ABB Operation centre in Sweden to better manage their inventory.
3. (Seitz, n.d.): 2013, to propose a purchasing strategy on spare parts to change current processes at the case company.

4. (Du Toit, 2014): 2014, To create a decision making model on spare parts for capital intensive assets by reviewing existing literature, mastering the field of SPM, creating the model and testing the results.
5. (Al-Bawi, 2015): 2015, Looking at the management of spare parts within the production sector.
6. (Higab & Brückner, 2018b): 2018, centralised system for aftermarket spare parts inventory.

2.1.3 Problem tree and theory of constraints



2.1.4 Source, Summary and Synthesis of literature

*then use the constructed trend and problem tree to source, summarise, and synthesise literature to discuss the trend over time and the cause-effect of the research problem under study. The discussion should distinctively point out, with support from literature, the symptoms, the root-causes, and the consequences.

Based on the findings of the research problem analysis the it leads to the next section on the research knowledge gap.

2.2 Research knowledge gap analysis

This section concerns itself with the concept of Research knowledge gap Analysis, which by definition means, "disparity in levels of knowledge"(*Knowledge Gap | Definition of Knowledge Gap by Oxford Dictionary on Lexico.Com Also Meaning of Knowledge Gap*, n.d.) in the context of this study, it would mean in research. Damith Gangodawilage explains this as being able to recognise the gaps in current information by means of a literature review. This is why we do a research study is to address the selected gap that is identified and this can be in the form of theoretical gaps, empirical gaps in the study gap(*What Is a "Research Gap" or "Knowledge Gap" in Research and Literature?*, n.d.).

This section focuses on sourced information from academic literature where the authors have performed their studies through data collection and analysis, form part of this theoretical discussion. Each article is briefly discussed in the summary below.

2.2.1 Selecting, Summarising, Synthesising, Academic Literature

2.2.1.1 Article 1

This article by (Du Toit, 2014) focuses on a decision-making framework for inventory management of spare parts, with a focus on capital-intensive industries. The author aimed to review established principles in known fields of study, develop a deep understanding for spare parts management, formulate a decision-making framework for parts management with validation. Her theoretical framework covered SCM and SPM and she utilised a combination of qualitative and quantitative research strategies(Du Toit, 2014). She targeted one mine (Anglo American) from the perspective of a customer based on the data utilised in her study on a specific component only. She collected quantitative data from management reports and information systems and qualitative data from discussions with managers at the mine (Du Toit, 2014). Her empirical results revealed that the model acted in an expected manner and was a representation of a real-world system (Du Toit, 2014). Some of the key findings of the framework were that the asset under study should have more parts, information should be made available, the organisation should try to improve the management of their parts (Du Toit, 2014). Limitations of the study is where the case study selection was limited, insufficient data was made available, framework extent was not exhaustive, she lacked prior inventory management knowledge and the industry focus was concentrating on

mining (Du Toit, 2014). Author comment: This article was in alignment with this study based on the industry and the type of study, however she only focused on Anglo American (Du Toit, 2014) and this study will focus on several mining customers in South Africa for the OEM in this study.

2.2.1.2 Article 2

This article by (Ghodrati, 2005) focuses on the reliability and operating environment from a parts planning perspective. The author's main objective is to develop a decision model for integrating product reliability characteristics considering the operating environment. His theoretical framework covered product support, product support logistics and reliability characteristics using a quantitative research strategy (Ghodrati, 2005). He targeted two mines in Sweden and Iran respectively (KLAB Kiruna Mine and Choghart Mine) from the perspective of a customer based on the data utilised in his study on working time and down-time of systems or machines (Ghodrati, 2005). He collected quantitative data from reports from the crew and operators on the maintenance, repair and inventory of machines, the data focused on the mean time to failure as well as ordering and holding cost of components (Ghodrati, 2005). The operating environment was reviewed through observation, interviews and reviewing reports. His empirical results revealed that there was risk associated with environmental factors concerning the estimation of spare parts (Ghodrati, 2005). Some of the key findings were that suppliers were unaware of environmental factors on the mines and inventory management systems were modified to accurately present estimation for spare parts to reduce risks of shortages of parts. Limitations of the study is that only repairable parts were studied, operation and maintenance phases are included in the study and design and manufacturing were excluded (Ghodrati, 2005). Author comment: key learning from this article is that in South Africa the mines are spread out across the country from a geographical perspective (*Mines in South Africa | Africa Mining IQ*, n.d.) where distance from Gauteng to them would be a contentious factor and (Ghodrati, 2005) states that geographical location does impact the decision making in parts ordering evaluations.

2.2.1.3 Article 3

This article by (Al-Bawi, 2015) focuses on SPM in the production environment and the author's objectives focused on KPI's in relation to SPM and areas for improvement from a workshop perspective. His theoretical framework covered maintenance

management, SPM, spare parts classification and technique and supply management. He targeted six companies in various industries where he collected qualitative data through statistical interviews which he calls motivation research (Al-Bawi, 2015). His empirical results revealed that comparing policies with KPI's allows a company to find their strength or weakness and the size of resources or investment can be accomplished through SPM. Some of the key findings were that sub inventory techniques can reduce maintenance times and increasing contractor responsibility of parts will release the workload of a company but with increased cost (Al-Bawi, 2015). Limitations of the study is that it focuses on the manufacturing sector only. Author comments: The OEM has a workshop in Johannesburg that repairs certain major components for their customers, what (Al-Bawi, 2015) raised was that it would be imperative in SPM to ensure the right parts are in inventory when needed being cognisant of the cost of inventory (Cavalieri et al., 2008).

2.2.1.4 Article 4

This article by (Higab & Brückner, 2018a) focuses on aftermarket spare part inventory at a company from a centralisation perspective. The authors objectives focused on model and analyse a centralised inventory framework for their case study. Their theoretical framework was quite extensive covering aspects such as demand customisation, basic inventory and performance measures of inventory systems. They targeted one OEM case study to the mining industry, where they collected a combination of qualitative data through structured interviews with regards to lost demand and quantitative data through company records and data stored in software packages (Higab & Brückner, 2018a). Limitations of the study is that demand data is to be relied on customer sales orders only, the study considered a small quantity of components for the equipment, fillrate in the virtual warehouse is to be 95%. Author comments: In this OEM study and by virtue that this article along with others reviewed have not considered CRM, it is an area that needs to be investigated in this research study as (Higab & Brückner, 2018b) alludes to there being lost sales as the ERP system does not record customer requests that do not turn into orders.

2.2.1.5 Article 5

This article by (Cardona & Karlsson, n.d.) focuses on inventory management from an aftermarket perspective and the author's main aim is to present proposals for their case study company to manage their inventory. Their theoretical framework focuses on

logistics, the aftermarket and inventory management (Cardona & Karlsson, n.d.). They reviewed one company as a case study under analysis which supplies spare parts on a global level and the data collected was a combination of qualitative data and quantitative data through literature study, benchmarking, interviews and documentation reviews (Cardona & Karlsson, n.d.). Their empirical results revealed that further studies are to be conducted for the improvement of inventory management, the company is instituting the methods recommended in this article (Cardona & Karlsson, n.d.). Some of the key findings were that the company should develop their categorisation with customers and suppliers thereby leveraging on knowledge that is critical to their customers, there needs to be a global collaboration within the divisions of the company on a global level in the aftermarket in sharing problems and solutions (Cardona & Karlsson, n.d.). Limitations of the study is that it focuses only on the purchasing process within the company (Cardona & Karlsson, n.d.). Author comments: In our research study the OEM's machines are considered to be one of the best in the market, in order to be the leader in the mining industry they have to also be the leader in their aftermarket as (Cardona & Karlsson, n.d.) puts it.

2.2.1.6 Article 6

This article by (Seitz, n.d.) focuses on the improvement of spare parts supply chain management within their case study company with his aim to propose purchasing strategy that would lead to an improvement to the way spare parts are currently being procured. His theoretical framework focused on supply chain management, after sales management and spare parts supply management (Seitz, n.d.). He targeted fifteen different sites of the case study company's in their industry where he collected qualitative data through interviews conducted with key managers and employees most familiar with processes and business objectives (Seitz, n.d.). His empirical results revealed that with an increased level of pre-planned services, it would have a positive impact on the case company's uptime on their vehicles being presented in a cost-efficient manner (Seitz, n.d.). Some of the key findings were that their dealers can be informed of the impact of the pre-planning and its effects on cost reduction, in order for them to change their ordering behaviour (Seitz, n.d.). Limitations of the study is that it the concept of preplanning, this has different meanings in different industries, therefore its method was focusing on pre-planned service activities but not the aspects required for the concept to work also the detailed results were only on the case company so they cannot be directed to other industries. Author comments: The OEM

in this study has some similarities whereby not all parts are manufactured by the OEM themselves as the capital equipment consists of other OEM parts like Daimler or Volvo engines, the same way (Seitz, n.d.) mentioned that their case study company has parts sourced by their factory and purchase at higher transfer prices as opposed to buying directly from said suppliers themselves, by inference our OEM is potentially outpricing themselves in the aftermarket on certain areas where they are not the OEM and a pricing strategy should be considered.

2.2.1.7 Summary of Research Gap Analysis

Two authors (Du Toit, 2014) and (Al-Bawi, 2015) have discussed the aims concerning SPM. Vast majority of them were utilising SCM and SPM as their theoretical frameworks, except for (Higab & Brückner, 2018a) and (Cardona & Karlsson, n.d.) which highlights the importance of the two frameworks in the aftermarket, however also sheds some light on the knowledge gap concerning the aspect as customer relationship management where (Wang, n.d.) highlighted that manufacturers regarded CRM as a core business function. There was a 50/50 split when it came to the type of research strategy chosen for each set of authors, where 50% were focusing on combined (Du Toit, 2014), (Higab & Brückner, 2018b) and (Cardona & Karlsson, n.d.) and the other 50% had one author that focused on quantitative (Ghodrati, 2005) and two authors that focused on qualitative (Al-Bawi, 2015) and (Seitz, n.d.).

(Cardona & Karlsson, n.d.) data collection instrument consisted of benchmarking, where they benchmarked four other companies that focused on the aftermarket and the results from this exercise in combination with theoretical framework was used to suggest how the case company should structure their operations to effectively manage inventory. Finally from reading all the authors, other knowledge gaps that were quite apparent aside for the point above concerning CRM, Strategy did not come out too clearly and its of importance for there to be strong aftermarket strategy for the OEM in our study as strategy is used to identify long term goals for an organisation and goals influence the performance through various activities in an effort to motivating team participation (Rosal, 2018). Finally, parts pricing was also not evident in any of the articles in this review.

2.3 Qualitative attributes key to the research

This section focuses on four considerations namely; understanding and describing and attribute, providing a link between this studies research questions, creates the foundation for the structured and semi structured interview questions that will be formulated as part of the data and information collection instrument, and these attributes lead to the framework used to interpret the empirical results of this research study.

2.3.1 Customer relationship management

CRM refers to software that facilitates effective management of the company's associations and relationships with current and future customers (*What Is CRM - Salesforce India*, n.d.). (Hedlund & Ingman, 2008) states that CRM increases the economic value of an organisation, reduces cost of sales, focus on sales processes, makes use of cross-selling and up-selling initiatives and improves forecast capabilities.

Based on an analysis on the OEM's client based between 2019 to 2020 taken from an internal system called Qlikview, the system revealed that the OEM has 143 customers that purchase aftermarket parts that are currently active. Of the 143 customers, 13 of these customers contribute to 80% of the aftermarket sales generated. From a typical distribution perspective, 9% of the customers contribute to 80% of the OEM's total revenue for aftermarket parts over the period. The OEM does utilise Salesforce as their CRM tool currently but it is not effectively managed to its full potential in order to drive the product offerings in a manner that could further strengthen the relationships with the thirteen strategic customers above as well as grow the other 93% into the next level of strategic customers, (Hedlund & Ingman, 2008) stated in their research findings that increased internal efficiency with customer focus is necessary as employees that that do not embrace customer focus would result in these customers not staying with the company. This attribute will be internally focused.

2.3.2 Supply Chain Management,

This concept is associated with the supply chain activities related to a company or supply chains between other companies and focuses on the participants within the chain, i.e. customers, manufacturers, suppliers, distributors and retailers (Du Toit, 2014). (Abuhilal et al., 2006) stated that when it comes to the importance of SCM and the current market landscape is, that the competition lies between the supply chains and not

between individual companies and goes further to highlight that since inventory management is a cornerstone of SCM, effective management of inventory is a critical function of management as it is a cost contributor in a supply chain.

The OEM has to effectively manage the inventory of spare parts to ensure that the right parts are available at the right time (Cavalieri et al., 2008) for customers that would require them for their machines and to ensure that there is no downtime that could be caused by parts unavailability. Due to the number of active capital equipment found on the various customer mine sites, it is imperative that stocking of parts is a priority for the OEM. This attribute will be internally focused.

2.3.3 Spare Parts Management

(Du Toit, 2014) Spare parts are required when there is component failure, they need replacement or need to be repaired. The terminology of spare parts is associated with aftermarket service parts or component repair parts and spares.

(Cavalieri et al., 2008) stated that managing the maintenance, repair and materials in operations are important aspects of capital-intensive organisations. SPM that is managed well ensures that the productivity levels within an organisation causes idle time to reduce and elevation in resource utilization (Ghodrati, 2005). Parts availability has an influence over the performance of capital equipment, which in turn has an effect on the levels of stock, resulting in costs of inventory being influenced as well, therefore the primary aim is to strive for a balance in appropriate service levels whilst ensuring that inventory investment and administration costs are kept to a minimum (Huiskonen, 2001).

For the purpose of this research study, a spare part are considered to be those required by customer mine sites for the maintenance, service and repairs of their active installed fleet as well as duplicate or replacement parts and components used by the OEM workshop to during the repair, rebuild and field service technicians breakdowns on site. This attribute will be internally and externally focused.

2.3.4 OEM Systems and Processes

This attribute refers to the internal business processes of the OEM in this study. These systems and processes are in place to ensure that their value is created for both the inter-company departments between the aftermarket team and all the other capital equipment divisions that focus on the underground and surface equipment.

The main processes would be focused on in this study would be on the operational (day-to-day), customer management (CRM), regulatory (mining charter, BBBEE) and corporate social investment (Community focused). This attribute will be internally and externally focused.

2.3.5 Aftermarket KPIs

KPIs are important for an organisation as it is indicative on the progression of the organisation in terms of business goals and objectives. KPIs assist the organisation in identifying if their trajectory is moving in the right direction, ensure attention is paid to where it's needed and improve the health of the organisation in terms of its operational and strategic goals. In the context of this study, the aftermarket KPIs would be SPM KPIs, Financial, Sales Teams and Customer satisfaction. This attribute will be internally focused.

2.3.6 Local Parts Sourcing

This attribute refers to the sourcing of parts from local manufacture and supply of parts in South Africa. In the context of the study, the OEM currently sources parts from global hubs which has an impact on aspects such as elevated transfer pricing, fill rates, delivery lead times and logistics costs in having to airfreight items when there are customer emergencies. As part of sustainability initiatives are concerned and in keeping with industrial local development from a localisation perspective, the OEM in keeping with guidelines included in Mining Charter III, needs to review their localisations strategy, and direct this focus to the top customers to ensure that parts availability through local sourcing meets the quality and service standards from globally sourced parts. This attribute will be internally focused.

2.3.7 Parts Pricing

In the context of this study, this attribute refers to the pricing of the spare parts for capital equipment. (Cullbrand & Levén, n.d.) states that spare parts are minor in sales but major when it comes to the profitability of an organisation which is substantial, also ensuring that the pricing logic remains consistent can decrease the number of customer complaints and improve customer satisfaction and loyalty. This attribute will be internally and externally focused.

2.3.8 Maintenance Management

This attribute refers to the actions concerning technical, administrative supervisory which intends to retain and asset or restore it to a point where it can perform a specific function and to provide the correct reliability, availability capability and efficiency of a system, in this context capital equipment (Ghodrati, 2005). Maintenance management in this study can review the maintenance aspects from the OEM on their capital equipment in terms of condition-based, corrective, planned, proactive, preventative, reliability centred, capital-type rehabilitation (machine rebuilds) and from the customer perspective in terms of customer machine maintenance practices, service intervals. This attribute will be internally and externally focused.

2.4 Framework for interpreting research findings

This research study has used a methodology that has adopted a systematic review approach by evaluating available literature on aftermarket parts and to amalgamate findings in the literature into solving a coherent research problem statement.

2.4.1 What are systematic reviews?

Systematic review also known as systematic literature review is basically a type of literature review that makes use of a systematic / structured approach to the collection of information, reviewing of other research studies, synthesizing the findings either qualitatively or quantitatively ("Systematic Review," 2020). The scope of the research questions that are formulated can be either broad or narrow and provide evidence based on the synthesis of other studies that would relate to the review questions ("Systematic Review," 2020).

2.4.2 Brief history of systematic reviews

Stemming from the science of research that we know of today, it begins back in the 20th century, and as far back as 1959 Isabella Leitch an advocate of science had made her contributions to the science of research reviews in medicine (Farquhar & Marjoribanks, 2019). In 2009 (Hytten, 2010) paid tribute to Leitch's contribution where she had explained that research review focuses on the facts and the findings and rarely with the opinions taken from the research literature of others and that "it is a review of research and an inquiry into the deductions that may be drawn from an accumulation of results treated as a new whole"(Hytten, 2010).

2.4.3 The realisation of systematic reviews

The first known example for a systematic review was realised in 1753 by James Lind when he had published a research paper on scurvy (Elsevier, n.d.). Then in 1959 systematic reviews were adapted by Leitch in her pursuit if science in the field of nutrition where she founded the journal on Nutrition and Abstract Reviews. However over the years it has become highly recommended for use with professionals in the areas of health care, public policy and public health ("Systematic Review," 2020). In 1974 Archie Cochrane and his team had run an analysis on using aspirin in the prevention of heart attacks and became the most well known randomised controlled trial systematic review of its time and now, systematic reviews are being adapted to other fields of study such social sciences, business and economics ("Systematic Review," 2020).

2.4.4 Advantages and use of systematic reviews

Systematic reviews ensure that there is a comprehensive review on available literature on the subject matter and they are able to assist in finding research gaps within the current field under study (Elsevier, n.d.). They provide a very structure methodological approach that will help to improve future working aspects related to the topic under study and also provide the answers through available literature evidence on the research questions (Elsevier, n.d.). Because systematic reviews involves the steps of identifying, synthesizing, and reviewing available literature evidence for either qualitative or quantitative research, in order to create a comprehensive empirically derived answer to a research question (Mallett et al., 2012), it make the adaptation quite relevant for this research study.

2.4.5 Disadvantages and or limitations of systematic reviews

Challenges associated with systematic reviews are that as a non-academic researcher, it can become quite taxing as it requires access to a wide variation of databases and peer-reviewed journals (Mallett et al., 2012). Resource time constraints means relying purely on the research of the authors and their self-proclaimed design and results, which can introduce their bias into the research (Mallett et al., 2012). Systematic reviews can become very resource intensive to manage as there is a large number of studies that would need to be reviewed at the beginning and can become very time-consuming (Mallett et al., 2012). Data-extraction and qualitative synthesis can become a challenge as

many reviews do not provide comprehensive summaries in their studies (Dahabreh et al., 2012).

2.5 Summary and conclusion

2.5.1 Summary of literature reviewed

The research literature that was reviewed were firstly based on several articles that focused on other industries and not all specifically on mining, the primary reason for this was to provide insights into how aftermarket parts were managed in those industries and to ensure there was a wider range of industries covered. There were qualitative, quantitative and combination of both these research methods. (Du Toit, 2014), (Al-Bawi, 2015), (Seitz, n.d.) and (Cardona & Karlsson, n.d.) had commonalities in respect of the areas of SCM, SC, SPM and Aftermarket Sales in terms of their theoretical approach. (Ghodrati, 2005) was centred around reliability and product support and (Higab & Brückner, 2018b) had a strong focus on a centralised inventory model from a logistics perspective.

All of the literature had mostly focused on analysis in order to derive at the results of the research problems contained in their studies. Most of the literature were based on case studies either on a specific company or stretched out across companies in varied industries, which indicated that the target population was very specific. Empirical results for most literature revealed that the desired outcomes were achieved, where others highlighted that there was information not accessed which did not completely validate the research problem and required further research with additional data requirements.

(Du Toit, 2014) summarised the shortcomings in terms of literature limitations quite astutely stating that limiting one's research to a specific type of part would not allow for the testing of all decision paths, the quality of the information directly translates to the outcome of the quality of the framework, tests conducted are only concluded on the basis of available data and might have other outcomes if the study is exhaustive, having prior knowledge on subject matter enforces the framework application much better and finally frameworks under study do not validate necessarily in all industries.

2.5.2 Proposed research strategy, design, procedure and methods arising from the literature reviewed

This section serves to provide background into the research study that will be conducted resulting from the literature review that was performed as part of the identifying, sourcing, synthesising and summarising process and will make use of a systematic review methodology. This research study will be qualitative in its approach in the form of interviews that would be focusing on employees within the OEM organisation (internal stakeholders) and from their top 13 customers (external stakeholders). The interviews will consist of a combination of structured and semi structured interviews in order to allow for consistency in feedback but also in order to have flexibility as discussions can reveal other aspects that were not originally thought of that can aid this research study.

The research study will focus on the aftermarket of spare parts from the OEM perspective which will provide valuable insight into challenges that the organisation faces which has a direct impact on the business performance as well as the organisation foot print and overall approach for existing and potential customers for capital mining equipment. Empirical results will be transcribed from the interviews and analysed to ensure that they are addressing the research problem as well as the research questions.

The next section provides a discussion into research strategy, design, procedure and methods.

3 RESEARCH STRATEGY, DESIGN, PROCEDURE AND METHODS

This chapter focuses on the research approach, design and includes the procedure and methods that will be looked at as part of this research study in order to collect, process, and analyse empirical evidence.

3.1 Research strategy

Research strategy refers to an action plan that reflects a step by step approach to the researchers effort and ideas towards a specific area of focus, which enables them to be able to conduct research systematically and within a specific time period, in order to solve a research problem, validate a proposed framework by producing quality results in a structured report. The type of research strategy can broken-down into three which is quantitative research strategy (through data instruments), qualitative research strategy (through an observed setting) and mixed research strategies (philosophical assumptions). Based on the literature that was reviewed the research strategy that will be undertaken into this research study will be that of a qualitative research strategy which focuses on the answers to structured and semi-structured interview questions based on the observations acquired.

The research strategy used in this study will be contained within the frame of qualitative research as the primary aim of this study is to develop an aftermarket parts framework for capital mining equipment and a qualitative strategy would be most equipped to test research theory and concepts related to the research. The reasoning behind choosing this strategy is that it would to take into consideration the differences between internal and external stakeholders and would be most appropriate method for this study since the goal is to develop a framework that focuses on the aftermarket parts that are the OEM supplies to the mining industry based on their active capital equipment install base and certain challenges that they have faced that the framework can address, which can be utilized from a real business sense for their future operations. It is also important to understand the people, systems, processes, gaps in the current environment which is the basis of the framework.

(Al-Bawi, 2015) had utilised this strategy in his master's thesis where his research focuses more specifically on spare parts management within the production environment. His study analysed the reasoning behind way spare parts are important to an organisation and effective management of this area could lead to an organisation being profitable, having increased productivity and reliability (Al-Bawi, 2015). The overall study had elements that were related to this research study as its main focus was on the spare parts which is a focal point for the aftermarket.

(Al-Bawi, 2015) aims and objectives identifies the KPI's that are critical to the quality of SPM, a general view of the KPIs that organisation has used in order to improve their current situation and which were not utilised, downtime of production which is associated with SPM and important areas where improvement would be beneficial as well as their repair workshops view. (Al-Bawi, 2015) chose this strategy was because it enabled them to analyse the quality in SPM within a manufacturing environment.

(Al-Bawi, 2015)'s research was an analytical study, where the primary objective was to analyse SPM from a manufacturing perspective. The researcher had established that personnel with the organisation held information that would be useful identifying how manage their parts inventories, orders, quantities, and systems they use to manage them. Qualitative strategy allowed for information to be collected and analysed to enable critical evaluation for their research problem. (Al-Bawi, 2015)'s research can be fundamental towards future research that evaluate the situation from an, time, polices, economic, administration and inventories perspective. The qualitative research type revealed the analysis on the quality in SPM within the manufacturing environment. It was also seen that their research is considered to be a motivation type of research, that is important to qualitative research studies as has a tendancy to uncover potential trends through the interview process (Al-Bawi, 2015). Due to there being no standard model to follow which can be used to manage spare parts, the organisations are able to evaluate their internal models in accordance to the experience of experts.

Qualitative research allows a researcher to explore and understand what people or organisations ascribe to within a research problem. This line of research involves emerging questions, system, procedures, and information that would be collected in the convenience setting of the participant. Data analysis thereafter inductively builds upon the aspects to the main themes of this research, enabling interpretations to be made

from the analysis process. The benefit of using this strategy will provide face to face interaction from the interview process to allow for constructive feedback to be used in the development of the aftermarket parts framework in this research study, which would directly benefit the OEM in the study in their business approach.

3.2 Research design

Research design is a procedural plan, structure and strategy which is adopted by a researcher in order to interrogate research in order to obtain answers to their research questions in terms of validity, accuracy and objectivity. Research design in a traditional sense is the template that stipulates how the research study will conclude. Research design allows the researcher to communicate in a formal report the decisions they have taken on the research under study and present a proposal as to method of collecting information from their participants, their selection, instrument of used for the collection and presentation of the findings. In (Bryman, 2012) book social research methods, he examines the five generic types of designs namely; experimental; cross-sectional; longitudinal; case study and comparative design which is explains the way in which a research will choose to collect data.

The research design that has been selected for this research study is that of a case study. The primary reason for this choice in design is because the research problem is related to that of a single organisation , the OEM in this sense where all data that is collected will be derived from interviews from employees and an the organisation's mining customers where they have previously sold capital equipment to and would directly relate to the research problem which is on the aftermarket parts for these machines.

The rationale for the case study approach will be based on a single case design. The critical case study under analysis will be the OEM who currently supplies capital equipment and aftermarket parts and services to mining customers in South Africa. The case study relates directly to the research questions in Chapter 1 as well as the research attributes in Chapter 2. The case study will then be used to determine the outcomes of the research questions. This case study is based on a common case rationale as the problem that relates to it is operational and transpires as a regular occurrence within the OEM.

In addition, the detail in this research design and the rationale and justification for the outcomes will ensure that they talk to the how and why research questions that are part of this study. From the literature that has been reviewed and in the articles that contained a case study analysis approach to the research design, the outcomes of these articles yielded results that were valid and reliable. This approach was more popular and was used across different fields. This research study will thus be focused on the single case whilst maintaining holistic and realistic perspectives on the various challenges facing the OEM from the aftermarket perspective.

(Du Toit, 2014) had utilised the case study research design method where she had conducted a case study in cooperation with Anglo American on one of their mines. The mine has capital equipment on site which could potentially be the same type of capital equipment whose parts are investigated in this research as Anglo American is a customer to the OEM. (Du Toit, 2014)'s aim is to establish principles in the relevant fields of study, excel in the filed of SPM, develop a decision-making framework for the management of spare parts and validate the framework that she has created. She chose this case study design as the research under study was specific to a mining customer and where SPM is of critical importance when it comes to the capital expenditure released on mining equipment, therefore her case study was suitable to validate the proposed solution. The benefit of following this research design was that it the mine has capital intensive assets and the investigation of the case study analysis was narrowed down to a specific type of equipment where data was available to analyse.

Case studies makes it possible for vast amounts of data to be collected which would not have been easily obtainable through other research designs methods. Due to the researcher for this study being part of the OEM organisation, it makes it much more convenient to be able to collect the data which contains live and accurate information that is extremely relevant to the study. What is a great part of this chosen research design is that the case study can allow for scientific experiments to be conducted which can further present as evidence towards the research questions in this study.

3.3 Research procedure and methods

3.3.1 Research data and information collection instrument(s)

A data collection instrument refers to the instruments that are used to collect data and can be in the form of an online or paper questionnaire, computer-based survey interviewing system, case studies, checklists, interviews and at times observations (Blog, n.d.). Data collection is part of the research process and the choice of data collection instrument will be dependent on the type of research (quantitative or qualitative). The two main types of data collection will be in the form of either and observation schedule or interview schedule. Based on the literature review process, it has been established that the collection instrument for this study will be in the form of an interview schedule.

The interview data collection instrument will entail a series of interviews that would be conducted either on the OEM and Customer sites or over Microsoft teams and will consist of a series of questions being asked in an interview format. There will be recording of the interviews for transcription later on as well as handwritten notes of the discussions as well.

The format of the interviews will be a combination of structured interviews as well as semi-structured interviews. The reason for structured is that the questions and order of questioning will already be set and if there is additional intervention required, it will allow for question clarification if needed as well as to ask participants to provide a greater level of explanation in the form of probing if the answers they provide are too vague. The semi-structured will also consist of planned questions, however the researcher conducting the interview will have the flexibility to modify the wording and order of the questions where necessary to do so. Both interview structures will be set up in an open-ended format. The types of qualitative research interview questions can either be structured, semi-structured or unstructured. The choice of a combination of structured and semi-structured interview question format in order to maintain consistency across all interviews conducted but with the freedom to change the wording of certain questions and to allow flexibility in order to explore a topic in the interview discussion.

(Seitz, n.d.) conducted a research study on improving spare parts SC management at his case company. The aims of this article were to create a purchasing strategy that would

lead to changes in the current procurement practices at the case company from a spare parts perspective. It was not discussed in detail the reasons they have chosen this form of interview format, however, it was mentioned that they wanted to interview senior managers and observe the processes at the facilities that they visited in order to see if there was some level of consistency. The benefit of using this type of interviewing structure ensured that they were able to determine whether there was consistency at the fifteen different offices, factories and warehouse which would come together quite nicely during the analysis phase. The interview questions for this research study on the OEM will be sourced based on the attributes contained in Chapter 2 and also common questions that are sourced through literature that might be applicable.

The research data collection instrument for this study can be found in appendix 1.1.

3.3.2 Research target population and selection of respondents

3.3.2.1 Research target population

The population will consist of 12 customers who are external and 10 employees that are internal who are associated with the OEM.

REFERENCES

121107value.pdf. (n.d.). Retrieved October 31, 2020, from https://static.pmg.org.za/docs/121107value.pdf

Abuhilal, L., Rabadi, G., & Sousa-Poza, A. (2006). Supply Chain Inventory Control: A Comparison Among JIT, MRP, and MRP With Information Sharing Using Simulation. *Engineering Management Journal*, *18*(2), 9.

Aftermarket definition and meaning | Collins English Dictionary. (n.d.). Retrieved October 31, 2020, from https://www.collinsdictionary.com/dictionary/english/aftermarket

Aftermarket services: The digital differentiator | Deloitte Insights. (n.d.). Retrieved October 25, 2020, from https://www2.deloitte.com/us/en/insights/industry/manufacturing/aftermarket-services-digital-differentiator-beyond-COVID-19.html#

Al-Bawi, A. (2015). *Spare parts management potential in production sector*. http://urn.kb.se/resolve?urn=urn:nbn:se:mdh:diva-28820

Blog, F. (n.d.). *7 Data Collection Methods & Tools For Research*. Retrieved October 31, 2020, from https//www.formpl.us/blog/data-collection-method

Bryman, A. (2012). *Social research methods* (4th ed). Oxford University Press.

Cardona, C., & Karlsson, L. (n.d.). *30 credits, Advanced level*. 95.

Cavalieri, S., Garetti, M., Macchi, M., & Pinto, R. (2008). A decision-making framework for managing maintenance spare parts. *Production Planning & Control*, *19*(4), 379–396. https://doi.org/10.1080/09537280802034471

Cohen, M. A., Agrawal, N., & Agrawal, V. (2006, May 1). Winning in the Aftermarket. *Harvard Business Review*, *May 2006*. https://hbr.org/2006/05/winning-in-the-aftermarket

Costantino, F., Di Gravio, G., Patriarca, R., & Petrella, L. (2018). Spare parts management for irregular demand items. *Omega*, *81*, 57–66. https://doi.org/10.1016/j.omega.2017.09.009

Creating Value for Machinery Companies Through Services. (2020, August 19). BCG Global. https://www.bcg.com/publications/2014/engineered-products-infrastructure-service-operations-creating-value-machinery-companies-through-services

Cullbrand, M., & Levén, L. (n.d.). *Spare Parts Pricing:* 141.

Dahabreh, I. J., Chung, M., Kitsios, G. D., Terasawa, T., Raman, G., Tatsioni, A., Tobar, A., Lau, J., Trikalinos, T. A., & Schmid, C. H. (2012, March). *Box 1, Common limitations of existing systematic reviews of test accuracy* [Text]. Agency for Healthcare Research and Quality (US). https://www.ncbi.nlm.nih.gov/books/NBK92424/

Driessen, M., Arts, J., Houtum, G.-J. van, Rustenburg, J. W., & Huisman, B. (2015). Maintenance spare parts planning and control: A framework for control and agenda for future research. *Production Planning & Control*, *26*(5), 407–426. https://doi.org/10.1080/09537287.2014.907586

Driessen, M., Arts, J., van Houtum, G.-J., Rustenburg, J. W., & Huisman, B. (2014). Maintenance spare parts planning and control: A framework for control and agenda for future research. *Production Planning & Control*, 1–20. https://doi.org/10.1080/09537287.2014.907586

Du Toit, D. (2014). *Decision-making framework for inventory management of spare parts in capital-intensive industries* [Thesis, Stellenbosch : Stellenbosch University]. https://scholar.sun.ac.za:443/handle/10019.1/96111

Elsevier. (n.d.). *Why systematic reviews matter*. Elsevier Connect. Retrieved October 31, 2020, from https://www.elsevier.com/connect/authors-update/why-systematic-reviews-matter

Farquhar, C., & Marjoribanks, J. (2019). A short history of systematic reviews. *BJOG: An International Journal of Obstetrics & Gynaecology*, *126*(8), 961–962. https://doi.org/10.1111/1471-0528.15214

Fessehaie, J. (n.d.). *The Regional Value Chain for Mining Capital Equipment: Linkages and Firm Upgrading in South Africa and Zambia*. 29.

Gajpal, P. P., Ganesh, L. S., & Rajendran, C. (1994). Criticality analysis of spare parts using the analytic hierarchy process. *International Journal of Production Economics*, *35*(1–3), 293–297. https://doi.org/10.1016/0925-5273(94)90095-7

Gharajedaghi, J. (1999). *Systems thinking: Managing chaos and complexity: a platform for designing business architecture*. Butterworth-Heinemann.

Ghodrati, B. (n.d.). *Reliability and Operating Environment Based Spare Parts Planning*. 201.

Ghodrati, B. (2005). *Reliability and operating environment based spare parts planning*. http://urn.kb.se/resolve?urn=urn:nbn:se:ltu:diva-17787

Hall, R. A., Knights, P. F., & Daneshmend, L. K. (2000). Pareto analysis and condition-based maintenance of underground mining equipment. *Mining Technology*, *109*(1), 14–22. https://doi.org/10.1179/mnt.2000.109.1.14

Hedlund, J., & Ingman, A. (2008). *Unlocking the value of CRM: From the perspective of a global IT-company*. http://urn.kb.se/resolve?urn=urn:nbn:se:ltu:diva-43374

Higab, J., & Brückner, R. (2018a). *After-market spare parts inventory centralization at Sandvik Mining and Rock Technology*.

Higab, J., & Brückner, R. (2018b). *After-market spare parts inventory centralization at Sandvik Mining and Rock Technology*.

Huiskonen, J. (2001). *Maintenance spare parts logistics: Special characteristics and strategic choices*. 9.

Hytten, F. (2010). Isabella Leitch's contributions to the development of systematic reviews of research evidence. *Journal of the Royal Society of Medicine*, *103*(3), 114–117. https://doi.org/10.1258/jrsm.2009.09k065

Industrial aftermarket services: Growing the core | McKinsey. (n.d.-a). Retrieved October 26, 2020, from https://www.mckinsey.com/industries/advanced-electronics/our-insights/industrial-aftermarket-services-growing-the-core

Industrial aftermarket services: Growing the core | McKinsey. (n.d.-b). Retrieved October 24, 2020, from https://www.mckinsey.com/industries/advanced-electronics/our-insights/industrial-aftermarket-services-growing-the-core#

Jin, T., Tian, Z., & Xie, M. (2015). A game-theoretical approach for optimizing maintenance, spares and service capacity in performance contracting. *International Journal of Production Economics*, *161*, 31–43. https://doi.org/10.1016/j.ijpe.2014.11.010

Knowledge Gap | Definition of Knowledge Gap by Oxford Dictionary on Lexico.com also meaning of Knowledge Gap. (n.d.). Lexico Dictionaries | English. Retrieved October 29, 2020, from https://www.lexico.com/definition/knowledge_gap

Kotze, C. (2020, August 13). South Africa's mining production down 28.2% in June. *Miningreview.Com*. https://www.miningreview.com/health-and-safety/sa-mining-production-down-28-2-in-june/

Mallett, R., Hagen-Zanker, J., Slater, R., & Duvendack, M. (2012). The benefits and challenges of using systematic reviews in international development research. *Journal of Development Effectiveness*, *4*(3), 445–455. https://doi.org/10.1080/19439342.2012.711342

Mines in South Africa | Africa Mining IQ. (n.d.). Retrieved October 29, 2020, from https://www.projectsiq.co.za/mines-in-south-africa.htm

Mining in SA - Minerals Council South Africa. (n.d.). Retrieved October 22, 2020, from https://www.mineralscouncil.org.za/sa-mining

PRODUCT SUPPORT | meaning in the Cambridge English Dictionary. (n.d.). Retrieved October 31, 2020, from https://dictionary.cambridge.org/dictionary/english/product-support

Rosal, J. (2018). *Aftermarket strategy and business networks: Case study of a hydraulic motor firm*. https://jyx.jyu.fi/handle/123456789/57894

Seitz, B. I. (n.d.). *Improving Spare Parts Supply Chain Management at Kverneland Group*. 191.

Selling in the aftermarket: How to win the sales street fight | McKinsey. (n.d.). Retrieved October 28, 2020, from https://www.mckinsey.com/business-functions/operations/our-insights/selling-in-the-aftermarket-how-to-win-the-sales-street-fight#

South Africa Trade: Still The Largest Platinum Exporter In The World. But For How Long? (n.d.). Commodity.Com. Retrieved October 22, 2020, from https://commodity.com/data/south-africa/

Stamatis, D. H. (2014). *The ASQ pocket guide to failure mode and effect analysis (FMEA)*. ASQ Quality Press.

Study Shows Equipment Manufacturers Must Prepare for Change as the Aftermarket is Set to Dominate | Infor. (n.d.). Retrieved October 28, 2020, from https://www.infor.com/news/study-shows-equipment-manufacturers-must-prepare-for-change-as-the-aftermarket-is-set-to-dominate

Systematic review. (2020). In *Wikipedia*. https://en.wikipedia.org/w/index.php?title=Systematic_review&oldid=985832837

Toit, D. D., Prof, S., Vlok, P. J., & Toit, D. D. (2014). *Abstract Decision-Making Framework for Inventory Management of Spare Parts in Capital-Intensive Industries*.

Wang, N. (n.d.). *A comparative study of customer relationship management (CRM): How strategies and applications vary across industries*. 72.

What is a "research gap" or "knowledge gap" in research and literature? Is gap explored or constructed ? How can gap in research be identified? (n.d.). ResearchGate. Retrieved October 29, 2020, from https://www.researchgate.net/post/What_is_a_research_gap_or_knowledge_gap_in_research_and_literature_Is_gap_explored_or_constructed_How_can_gap_in_research_be_identified

What is CRM - Salesforce India. (n.d.). Retrieved October 30, 2020, from https://www.salesforce.com/in/crm/what-is-crm/#definition

APPENDICES

Appendix 1.1: Data collection instrument(s)

Interview Template – OEM Internal Employees

The purpose of these interviews is to increase the knowledge about the OEM, to also gain employee's opinion on aftermarket parts systems and processes as they are currently as well as their expectations of what they would like to see in the future. These interviews will be conducted with employees that are part of the Parts and Services Department at the OEM.

1. Tell us about your role within the company.
    a. What are your main roles and responsibilities in your current position?
    b. Which other departments are you working closely with/have been employed at?
    c. How long have you been employed at this organisation?

2. What is your view on the factors below in terms of their influence your customers when it comes to them making a choice of their supplier for spare parts?; arranged in order of importance:
    a. Reputation
    b. Quality of parts
    c. Lead time of parts
    d. Technical product support
    e. Customer service
    f. Parts Pricing

3. Describe the current parts supply channel for aftermarket spare parts.
    a. Global Hubs
    b. Local Sourcing
    c. Equipment Factory Divisions
    d. Issues and challenges associated with either of the above options.

4. Which are your largest competitors? Where are your biggest threats? What products?

5. What is your understanding of customer relationship management? Who should be involved in this process end to end?

6. What is the current stocking level of parts within the various locations currently?

7. How do we calculate what level of parts should be kept in stock based on the number of active machines on customer sites?

8. What are the benefits to having parts in a kit format?

9. How many customers currently have parts availability challenges and which customers are these?

10. Would local sourcing of parts have any tangible benefits to this organisation?

11. What are the current KPIs for the measurement of the people, processes and systems for better management of the aftermarket?

12. Is the current parts pricing at the correct level in terms of business sustainability for the long term?

13. What could we do differently instead of lowering our prices and providing additional discounts in order to retain business with our strategic customers?

14. What impact is parts availability and pricing having on the maintenance through the workshops and on customer sites? Is there something that can be done that is different to the current processes?

15. Can you tell me what your understanding is the internal process challenges currently being experienced?

16. Are there any other concerns that you would like to raise with in order for there to be some improvements from this study that can be mutually beneficial?

Thank you for taking the time to answer my questions, I really appreciate it. I look forward to speaking with you again.

Regards,

Interview Template – External Companies

The purpose of these external interviews understands the impact of the OEMs aftermarket on customer businesses and operations. The companies that are interviewed are all key customers of the OEM.

1. Tell us about your role within [Company Name Here].
    a. What are your main roles and responsibilities?
    b. Which departments are you working closely with?
    c. In what way have you worked with aftermarket parts?

2. Tell us about [Company] and the department you work for?
    a. Number of employees
    b. Do you have a VMI or consignment store on site?
    c. Do you have a preference as to where you would like parts to be sourced from?

3. How many active machines do you currently have?:
    a. How many spare parts ado you consume in a month?
    b. How many of these parts do keep in stock? (Approximation)
    c. What is the volume of parts sold per annum?

d. Are there orders cancelled often, if so, please comment?

4. How would you perceive that the following factors in terms of our parts and services as a supplier?
   a. Reputation
   b. Quality of parts
   c. Lead time of parts
   d. Technical product support
   e. Customer service
   f. Parts Pricing

5. What would you consider to be an order qualifier which gets converted into an order?

6. Would you consider yourself to be a loyal customer to our organisation?

7. Do you work with parts that are in a kit format? Would this be something that you would be interested in? If not, why?

8. Are you receiving adequate support from the sales team currently?

9. Are there any challenges that you would like to raise that can be shared with the sales team?

10. Are you currently sending components to our workshop for repairs?

11. Are there any other concerns that you would like to raise with in order for there to be some improvements from this study that can be mutually beneficial?

Thank you for taking the time to answer my questions, I really appreciate it. I look forward to speaking with you again.

Regards,

Appendix 2.1: Ethics Documentation – Participant form

Dear Participant,

My name is Amith Ganasram, a Master's student at the University of the Witwatersrand. As part of my studies, I am requested to complete an applied research project.

The purpose of this research is to "An aftermarket parts framework for capital mining equipment in South Africa: An OEM Perspective".

The research is purely for academic purposes and it will take the participant approximately 30-45 minutes to complete an interview schedule with structured and semi-structured questions.

Your participation is voluntary:

- No identifiable information such as names or personal details will be requested;
- Responses will be strictly confidential and anonymous;
- The information you provide will be held securely and not disclosed to anyone else;

Thank you for your participation.

Yours Sincerely;
Amith Ganasram
Student: Master's in Business Administration
University of Witwatersrand

Appendix 2.2: Ethic documentation – Consent form

MBA THESIS CONSENT FORM

Title of research project: An aftermarket parts framework for capital mining equipment in South Africa: An OEM Perspective

Name of Researcher: Amith Ganasram, Person No 1968613

I, ……., agree to participate in this research project. The research has been explained to me and I understand what my participation will involve. I agree to the following:

(Please circle the relevant options below):

I agree that my participation will remain anonymous	YES	NO
I agree that the researcher may use anonymous quotes in her report	YES	NO
I agree that the interview may be audio recorded	YES	NO
I agree that the information I provide may be used anonymously		
After this project has ended, for academic purposes by other researchers		
Subject to their own ethics clearance being obtained	YES	NO

Please sign below

Signed: ……

Name of participant: ……..

Date: ……

Appendix 2.2: Ethic documentation

Plagiarism Declaration

Wits Business School
Sculpting global leaders

THIS DECLARATION IS TO BE ATTACHED TO ALL ASSIGNMENTS

Student details	
Student Number: 1968613	Student name: Amith Ganasram
Email address: amith.ganasram@gmail.com	

Assignment details	
Course Code: ??	Course Name: ARP
Assignment no. 1	Due date: 31 October 2020
Assignment topic *(as given in the coursepack)*: ARP Proposal	

Student Declaration

I am aware that plagiarism (the use of someone else's work without their permission and/or without adequately acknowledging the original source) is wrong and is a violation of both the General Rules for Student Conduct and the Plagiarism Policy of the University of the Witwatersrand.

I am aware that it is wrong and is a violation of both the General Rules for Student Conduct and the rules of the Wits Business School for a student to submit for a course, unit, or programme of study, without the written approval of the course instructor or the programme director, all or a substantial portion of any work for which credit has previously been obtained by the student or which has been or is being submitted by the student in another course, unit, or programme of study in the University or elsewhere.

I confirm that this assignment my own unaided work except where I have explicitly indicated otherwise.

I confirm that this assignment has not been nor will be submitted in whole or in substantial part in another course, unit, or programme of study in the University or elsewhere without the written approval of the course or unit instructor or the programme coordinator.

I confirm that I have followed the required conventions in referencing the words and ideas of others in this assignment.

I confirm that I understand that this assignment may at any time be submitted to an electronic plagiarism detection system, and may be stored electronically for that purpose.

I confirm that I have received a copy of the University's Plagiarism Policy S2003/351B and a copy of the General Rules for Student Conduct and Code of Conduct C2010/27.

I confirm that I understand that any and all applicable policies, procedures, and rules of the University and of the School may be applied if there is a belief that this assignment is not my own new and unaided work, or that have failed to follow the required conventions in referencing the words and ideas of others, and I understand that application of the policies, procedures, and rules may lead to the University taking disciplinary action against me.

Note: The attachment of this statement on any electronically submitted assignments will be deemed to have the same authority as a signed statement.

Student Signature: Amith Ganasram Digitally signed by Amith Ganasram DN: cn=Amith Ganasram, o=Sandvik, ou=Parts and Services, email=amith.ganasram@sandvik.com, c=ZA Date: 2020.10.31 23:09:10 +0200'	Date: 31.10.2020

Honour Pledge



HONOUR PLEDGE

I ……Amith Lalman Ganasram……..(full name), a registered student at the University of the Witwatersrand with student number…1968613……, pledge that the assessment task that I am submitting as part of ….ARP…….. (course code) is entirely my own work, except where I have indicated that I obtained information from other sources, such as books or internet sites (where allowed). I pledge that I have not consulted with anyone else, including other students, while completing the assessment task or copied information from any source without referencing it.

I acknowledge that if I am found to have cheated in any way or plagiarised other people's work, I will be subject to disciplinary action, which may lead to suspension or expulsion.

Signed Amith Ganasram

Digitally signed by Amith Ganasram
DN: cn=Amith Ganasram, o=Sandvik, ou=Parts and Services, email=amith.ganasram@sandvik.com, c=ZA
Date: 2020.10.31 23:07:26 +02'00'

Date _____

Permission Letter

UNIVERSITY OF THE
WITWATERSRAND,
JOHANNESBURG

University of the Witwatersrand,
Wits Business School.
2 St Davids Pl & St Andrew Rd,
Parktown, Johannesburg, 2193

Sandvik
Mr Simon Andrews and Mr Jan Prinsloo
64 Jetpark Road,
Boksburg, 1501

29th October 2020

Dear Sir Simon and Jan,

Re: Permission to conduct research at Sandvik

My name is Amith Ganasram, student number 1968613, I am studying for a Master of Business Administration degree in the Wits Business School at the University of the Witwatersrand. I am seeking permission to do research at Sandvik.

I am conducting research on "An Aftermarket parts framework for capital mining equipment in South Africa: An OEM Perspective."

Some Background:
The purpose of this research aims to Develop an aftermarket parts framework for capital mining equipment in South Africa: An OEM Perspective and expands This research study will investigate other aftermarket parts in more detail based on the supply of parts by an OEM with specific focus on surface and underground capital equipment in three stages of mining namely; development, open-pit and underground. Due to the increased level of data and information available for this research study, it can be used to test the validity of the existing framework through qualitative investigation over several mines.

The research will entail collecting data through a qualitative research method through employee and customer interviews.

I will invite individuals to participate in this study. These individuals will from the Parts and Services Division. If they agree, they will be asked to be interviewed. The interviews will be around 30 to 40mins in duration. The data collection will take place via Microsoft teams or in person and all COVID-19 safety precautions adhered to. The participant's responses will be recorded on audio for transcription after working hours.

Participants will be asked to give their written or verbal consent before the research begins. Their responses will be treated confidentially, and identities (their names and the name of the organization's) will be anonymous unless otherwise expressly indicated. Individual and organizational privacy will be maintained in all published and written data resulting from the study and Sandvik information will be anonymized in the study.

The information and results will be communicated for internal business purposes only.

The research participants will not be advantaged or disadvantaged in any way. They will be reassured that they can withdraw their permission at any time during this project without any penalty. There are no foreseeable risks in participating in this study. The participants will not be paid for this study.

All research data will be preserved anonymously for reuse within our organization.

I therefore request permission in order to conduct my research at your organisation.

Please let me know if you require any further information. I look forward to your response as soon as is convenient.

Yours sincerely,

Amith Ganasram

Amith Ganasram

Digitally signed by Amith Ganasram
DN: cn=Amith Ganasram, o=Sandvik, ou=Parts and Services, email=amith.ganasram@sandvik.com, c=ZA
Date: 2020.10.29 15:10:43 +02'00'

076 411 2263
1968613@students.wits.ac.za

Dr.Rob Venter
084 580 7587
Robert.venter@wits.ac.za

Approved by Sandvik

Mr Simon Andrews
Vice President Sales / Managing Director
29/10/2020

Mr Jan Prinsloo
HR Manager for Southern Africa
29/10/2020