AN INVESTIGATION INTO STRATEGIES FOR TRANSFORMING MINING ORGANISATIONS INTO LEAN PROFITABLE ENTERPRISES: A CASE OF MUROWA DIAMONDS MINE (YEAR 2008 – 2010)

BY

KUMBIRAYI GAZA
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UNIVERSITY OF ZIMBABWE
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SUPERVISOR: DR SAM RUTURI
DECLARATION

Student Declaration – I, Kumbirayi Gaza do hereby declare that this dissertation is the result of my own investigation and research, except to the extent indicated in the acknowledgements, references, and by my comments included in the body of the report and that this dissertation is therefore, my original work and has not been presented in part or in full for any other degree in any other University.

Signature  ………………………..  Date  ………………………..
Name: Kumbirayi Gaza
Student Number: R0019040

Supervisor Declaration – I, Dr Samson Ruturi confirms that the work reported in this dissertation was carried out by the candidate under my supervision as University Supervisor. This dissertation has been submitted for marking with my approval as University Supervisor

Signature  ………………………..  Date  ………………………..
Name: Dr Samson Ruturi
DEDICATION

I dedicate this dissertation to my sweetheart and loving wife, Marilyn.
ACKNOWLEDGEMENTS

This project is a product of the contributions made by different people:

This project would not have been possible without the support and guidance of my supervisor Dr Samson Ruturi, throughout the writing of this dissertation and for always being available whenever required.

I would also like to thank all the different organisations I worked with, for providing all the required information. For reasons of confidentiality, names will not be mentioned but thanks go to all the officials from Murowa Diamonds, Tarcon, Introwise, Boltgas Engineering and KW Blasting for attending to my needs.

My appreciations also go to my classmates some who ended up being my close friends, in particular, Tinotenda ‘Mukomana’ Musenyareki, Obert ‘Obiza’ Mutonhori and Timothy ‘Dehwa’ Chinyanya for encouraging me when things seemed not to be going on well!

May God bless you all!
ABSTRACT

The study sought to investigate the strategies that can be used to transform organisations into lean profitable enterprises. Its objectives were to assess the understanding of lean principles, propose strategies for removal of operational waste, ascertain whether bloated structures affect efficiency, design lean adoption methodologies and countermeasures to deal with lean transformation pitfalls.

The researcher used both epistemology and ontology research philosophies. The study utilised the case study research technique to extract both quantitative and qualitative data. A survey was conducted, on a sample size of 60 respondents picked from a population of 253 elements comprising of Murowa Diamonds employees and long term contractors.

The major findings from the research comprised of a general good understanding of the lean principles and acknowledgement of lean in improving operational excellence, strategies such as Value Stream Mapping, 5S, TPM and Kaizen were proposed to remove operational waste, rigid or bloated organisational structure was found to be affecting Murowa Diamond’s efficiency or effectiveness, 3-Staged methodology was found to be most appropriate for lean adoption, and countermeasures for sustaining lean included leadership and management commitment.

Some of the recommendations made included lean training, employee engagement, adoption of use of lean tools, and creating a culture of continuous improvement.
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CHAPTER ONE: INTRODUCTION

1.0 Introduction

Success of any organisation largely depends on its ability to react, operate and adapt to change. Change is the word that now best describes or characterises the nature of modern society. Companies are currently faced with the reality of rapid technological changes, global communication, social networks and fierce competition where old methods can no longer respond to the fast changing situations. The successful structuring and comprehending of change requires powerful tools and methods that are capable of embracing all these challenges (Kotter, 1996).

Flexibility seems to be an important issue in today’s highly competitive environment. Lean, developed as a production system eliminating waste in the Toyota’s plants in the 1960’s, is evolving in the mining industry as a management approach that improves processes at each level and can effectively respond to the new world order (Liker, 2004). Much of the research work on Lean has been focusing on manufacturing industry with special emphasis on Lean theory on processes and analysis on the extent organisational factors can enhance or impede successful transformation of an enterprise. This research however, conceptualises and theorises the implementation of lean in the mining industry. It draws on organizational theory mainly socio-technical systems to create a number of propositions for the implementation of Lean.

Planned change processes often work, if conceptualised and implemented properly, however every organisation is different hence an off the shelf program, plug it in and hope it runs by itself approach will not work. In this paper, the researcher looks at the critical strategic choices mining organisations need to make in order to change organisation into lean enterprises and turn around their fortunes towards profitability. An understanding of these strategic choices that are required, requires a general scanning of the diamond industry to indentify the key macro economic drivers and competitive forces within the industry.
1.1 General Overview

The current business world is increasingly calling for corporate strategies to be seen in a global context. This section gives the contextual overview of the external environment in which the case under study is operating in. It involved a macro environmental economic analysis and the competitive forces analysis of the diamond industry.

1.1.1 Macro Environmental Analysis

1.1.1.1 The Economic Environment

The year 2008 to 2010 had mixed fortunes for businesses around the world. The world economy went through a global economic recession which saw most companies collapsing while others forced to scale down operations. The Zimbabwean economy which already was on a free fall decade of decline was also not spared either. The economy came to a halt in 2008 due to the rampant hyperinflation. The trend in GDP was consistently on the decline, from –7.3% in 2002 to an estimated rate of –5.6% in 2010, resulting in an average 40% rate of decline since 2000 (Hawkins, 2010). This negative growth was as a result of decline in the contribution to GDP of the manufacturing, mining and agricultural sectors.

However, exporting companies like Murowa Diamonds, did not directly feel the pinch of the hyperinflation. They were cushioned from its effects as they had the much sought after foreign currency which they realised from diamonds which were being exported. However, most of their raw materials were being imported from South Africa and they managed to pay for local services cheaply as the local currency had been eroded in terms of value. It became cheap to operate in the Zimbabwean economy for exporters as these companies would pay other costs like labour, government taxes and levies in the local currency. However, with the introduction of dollarization in 2009, the honeymoon was over, companies now had to be faced with the real costs of production. Dollarization shifted market shares towards global companies that had huge capital base as they managed to switch over more efficiently. There was a sudden boom in the
informal sector especially back door suppliers operating from homes as their costs of production was low and undermined local suppliers especially those with high operational costs.

In 2008 – 2010 persistence fluctuations in the exchange rates really affected diamond companies as they sold their produce in American dollars while spares were being bought in South African Rands (ZAR). The rand exchange rates moved from 1USD = 10 ZAR in 2008 to 1USD = 7 ZAR in 2010 (Hawkins, 2010). Companies had to look at their production processes to identify areas where they could cut down costs in order to give confidence to the shareholder on the viability of the business. There were pressures from the labour force as the cost of living was rising since most of the basic commodities were being imported from South Africa.

However, not all was lost, for other organisations like the diamond producing companies there was an upside demand for rough diamonds in the global market. The emergent of the Chinese market created a huge market for luxury goods since the Chinese had disposable income. The Chinese market was consuming a lot of gem quality diamonds especially the small type which Murowa Diamonds happens to produce in large quantities. Small diamonds are most suitable for jewellery since they can be easily be embedded into metals like gold and silver without the diamond cutter generating lots of waste and less effort resulting in low costs of production. The increase in demand doubled the prices of diamonds to an all time price higher than the going rates before the recession (Murowa Diamonds, 2010). Despite the mixed fortunes characterising the economy, the political situation did not make things better as will be discussed in the next section below.

1.1.1.2 Political Environment

The political situation in 2008 was very tense as the main political parties, Movement for Democratic Change (MDC) and Zimbabwe African National Union – Patriotic Front (Zanu PF) failed to agree on the election results and this culminated into the Global Political Agreement (GPA) that was signed in 2009. Companies that had shareholders
of western origin like Murowa Diamonds were accused of sympathising with opposition parties to effect regime change. The persistently unstable political environment made it difficult for companies to attract foreign direct investments which resulted in them foregoing the mooted expansion programmes. Murowa Diamonds, for example had on several occasions failed to convince its shareholders to invest in the expansion programme that could ramp up production six fold. There were threats to the diamond industry by the Kimberly Process Organisation to withdraw the Kimberly Process certificate due to the issues around Chiadzwa diamonds which could potentially result in Zimbabwean diamonds being banned on the international market. However, this required a political solution and government had to fight hard to ensure that as a nation we return the certification as this could result in loss of much needed revenue to both government and all diamond companies in the country. These challenges in both the economic and political scenes also manifested into challenges in the social systems.

1.1.1.3 The Social Environment

On the social front, Zimbabwe’s population was hard hit by the devastating impact of HIV and AIDS and the general increase in the cost of living. The AIDS pandemic was the main contributor of increase in the bread- winner / dependency ratio that is 1:4 in 2002 to 1:10 or more in 2009 (Hawkins, 2010). Companies had to come up with various workplace programmes to assist government in curbing the AIDS scourge. Murowa Diamonds also introduced free access to anti retroviral (ARV) drugs to assist its employees.

When dollarization was introduced in 2009, shops which have been empty for a long time were now full of consumer goods. The employees had high hope in terms of the GPA improving the living conditions of the general populace. Although, there was a marked improvement in the standard of living, this was long before prices of goods started going up again, with companies offering salaries below the poverty datum line. Motivation within the workforce became low as the current government failed to turn around the country’s fortunes. Production levels in most of the companies reduced.
while other companies had to shutdown operations or worked short working hours as they were faced with high operation costs for example David Whitehead, Karina Textiles and Cairns Foods (Hawkins, 2010). This actually created anxiety in the whole industrial spectrum as employees were no longer sure about their future.

1.1.1.4 Technological Environment

Due to the decade of economic decline, growth in the Information and Communication Technology (ICT) infrastructure of the nation was stifled in 2008 – 2010 as government was battling with provision of food to the people. However, significant improvements were done in the cellular or mobile phones with companies like Econet investing in fibre optics and installation of new base stations around the country. The same developments could not be said for the government institutions as most government department had obsolete, unreliable information systems. Government institutions failed to make meaningful investments in systems upgrades.

The continual underperformance of parastatals had a huge impact on the operations of businesses in the country, for example, the non availability of power adversely affected companies operations. The non availability of power had serious implications on the costs of production; other mines had to invest in diesel powered generators while others had to close down as their processing cycles were power sensitive. Murowa Diamonds was losing 5 days worth of production per month due to power interruptions (Murowa Diamonds, 2010).

1.1.1.5 Cultural Environment

Naturally, Zimbabweans are known to be very humble, hard working, peace loving and resilient people. After what they went through in the past decade it was quite a surprise to most on lookers that they managed to hold on and live the next day to tell the story. During the hyperinflation period, people used to spend company time doing their own personal business trying to make ends meet since their salaries could not meet their requirements. Workers were pushed into unprofessional dealings, absenteeism while running with personal errands, moonlighting, and engaging into corruption. A good
example was the rampant speculation in foreign currency dealings that was synonymous with most banks. This practise was known as ‘kubhena’ which meant making quick and easy money through speculative tendencies. However, as the curtain of dollarization came down these activities came to an end and most workers could not make that extra dollar. Companies were faced with an uphill task of change management to try and stir the ship and get the workers to start producing again. They wanted to focus employees on production issues, remove the old tendencies and practises.

1.1.1.6 Legal Environment

There were various taxation laws that were gazetted in 2009 as government tried to raise money to support the fiscus. The new tax regime meant that companies had to pay 2% more than the previous corporate tax rates (Hawkins, 2010). A new levy was introduced on mining companies which was payable to the Mineral Marketing Corporation of Zimbabwe (MMCZ). This had an impact of squeezing the profit margins for the already struggling mining companies. Companies like Murowa Diamonds were now producing at higher cost as compared to its competitors around the world and in the region.

The National Empowerment and Indigenization Act of 2007 had an impact on the operations of most companies foreign owned companies as they panicked as it came with the risk of losing their licenses to operate. The law was gazetted in 2007, but government failed to come up with the requisite statutory instruments to guide companies on how to implement it. The act required all foreign owned companies to cede 51% of their shareholding to the local indigenous people. There was generally mixed feelings in the country as some see it as a way of self enrichment by the politicians as history has shown that such programmes normally benefit politicians and those well connected for example the Land Reform Programme of year 2000. On the other hand some thought that it is a noble idea but the timing might not be right since the country was broke and there was no cash available on the market. A lot of multi
national companies like Unki Platinum, Zimplats, Mimosa and Murowa had to postpone their expansion programmes as a result of the uncertainties surrounding the Act. The researcher having analysed the broad macro environment in which the case under study operates in, it was also important to give some background information of the case study to fully understand the challenges and opportunities present.

1.2 Background Of Murowa Diamonds Mine (Private) Limited

The extent of Zimbabwe’s diamond wealth is not known. Much of the country lies on the ‘Zimbabwe Archean Craton’ where kimberlitic deposits are frequently found. Diamonds were first discovered in 1971 at River Ranch close to the South African border by De Beers. Production started in 1991 and ceased in 1998 because of low diamond prices and Bubye Minerals took over the mine in 2000 and resumed operations (Hawkins, 2010). Diamonds were produced and exported on a small scale during the 1990s but commercial exports began in 2000 were worth only $1.7 million, increasing to a peak of $44 million in 2005 before halving to $22.6 million in 2008 (Hawkins, 2010).

Rio Tinto Zimbabwe (RioZim) discovered kimberlitic deposits at Murowa in 1997 and began mining in 2004, producing kimberlitic diamonds. In 2006 there was a diamond discovery at Marange in eastern Zimbabwe which spawned into a thriving black market and widespread smuggling of stones. Government through the military and police stepped in, driving out all the illegal panners outside the diamond fields. The diamond field was handed over to the state-owned Zimbabwe Mining Development Corporation to exploit the resource on behalf of government. However, the diamond field remained under siege as rampant smuggling of the stones continued.

Murowa Diamonds Private Limited (MDPL) is located in the south-western part of Zimbabwe, about 60 kilometres from Zvishavane in Mazvihwa area. It is owned and managed by Rio Tinto Private Limited Company which has a seventy eight per cent (78%) interest in the company. The remaining twenty two (22%) per cent interest is owned by RioZim Limited. Murowa’s diamonds are all gem quality, this is a big plus
since other mines have a greater percentage of industry diamonds than gem quality. Industrial diamonds fetch less on the market compared to gem quality; they are in some instance even one hundred times less that gem quality in price variations.

1.2.1 Strategy

As one of the foremost authorities on competitive strategy Porter (1990), argued that the essence of strategy formulation is coping with competition and that competition in an industry comes not simply from direct competitors, but from the underlying economies of the industry itself. In setting its corporate goals, Murowa Diamonds (Private) Limited (MDPL) is guided by its mission statement that is;

‘Maximize shareholders value through the development and management of its mineral resources’.

In managing the business MDPL considers;

- the need to recover diamonds in the most cost effective manner,
- its responsibility as a member of the local and global community,
- its employees’ needs and aspirations and,
- the needs of other stakeholders

Diamonds world over are sold through actions which makes it difficult to know with certainty the selling price before a sale is made. MDPL’s strategy has been to produce the rough diamonds at the minimum costs possible due to the nature of the diamond industry marketing systems. Producing at the lowest possible cost would cushion MDPL against loss making as they are at the mercy of the buyers who give a price tag to the final product irrespective of the cost of producing the diamonds. This arrangement means that if the company has to maximise shareholder value their costs of production should be kept at barest minimum. However, this has been a huge challenge to the organisation as the cost of production has been on the increase in the past three years. The shareholders, from 2008 – 2010, in an effort to reinvigorate the growth strategy of the organisation, provided more that US$2 million in an effort to ramp up
production (MDPL, 2010). The funds were used to purchase a new crushing and screening plant that could reduce the size fraction of the ore and unlock the diamonds. Initially the ore was soft and friable and hence it was not necessary to have this plant, however, in 2008 as the ore became hard, diamonds were locked in the ore particles, hence this necessitated the purchase of a new crushing and screening plant. Part of the funds was also used to purchase a new processing plant that doubled the capacity. The processing plant capacity increased from thirty tonnes per hour (30TPH) to eighty tonnes per hour (80TPH). However, the production figures remained depressed even after the installation of the new plant in 2009 as shown below.

![Figure 1-1: Murowa Diamonds Quarterly Production Figures (2008 - 2010)](source: Adapted From Murowa Production Reports (2010))

If we look at the figure above we notice that the trend line indicates a slight decrease in production over the past three years. Despite all this, there has been US$2 million worth of investments both in plant upgrades and redesigns, all these efforts failed to increase the production levels of the organisation.
1.2.2 Shared Values
MDPL values are the essential guiding principles for the organisation and these are:
- accountability
- teamwork
- integrity
- respect

The company encourages its employees to take ownership for the performance, decisions and their impact on the business. It also encourages collaboration to deliver the best outcomes. Focus is on commitment and capabilities of others, rather than rewards based on individual effort. The company also values the highest moral standards and never hesitates in doing what is right in their business conduct. Diversity is encouraged and respected within the company and there is encouragement on recognition of individual and team efforts. One of its common statements that the organisation has is “Murowa More Than Diamonds”. The organisation has managed to exhibit this statement in the way it deal with the stakeholders through a number of specific programmes meant to benefit the community in which it operates. The organisation has done various sustainable development projects like setting up of micro irrigation scheme, construction of classroom blocks and the heifer project. Despite the cash constraints and the non availability of cash on the market it has started off an employee housing loan scheme. These values are what makes up Murowa Diamonds, below is an analysis of the structure that is in the organisation to support the strategy discussed above.

1.2.3 Structure
Murowa Diamonds is operated and managed by Rio Tinto Group. Rio Tinto is an international organisation headquartered in Britain but has operations in Canada, America, Australia and Africa. This arrangement gives Murowa Diamonds financial muscle to undertake capital intensive projects. The big brother (Rio Tinto) is always
there to assist it during its hard times especially in cash flow challenges. The business also benefits a lot through knowledge sharing and collaboration within the group. It gets lot of technical support from the parent company in its operations. There are a lot of free lessons that the organisation can harness, through the experiences of sister operations in the journey on the learning curve. Figure 1-2 below is the organogram of Murowa Diamonds Private Limited.

![Murowa Diamonds Management Organogram](image)

**Figure 1-2: Murowa Diamonds Management Organogram**

**Source: Adapted From Murowa Operational Reports (2010)**

The above Figure 1-2 shows the top management team in the organisation. The Managing Director reports to Managing Director of Rio Tinto Diamonds Group. He has seven direct reporters and these managers have superintendents below them as well.
Supervisors who report to Superintendents, have been left out in the construction of the organogram. However, from the above diagram there are other heads of departments who have one-to-one reporting structure with their subordinates (that is Superintendents). If we include the supervisors since they are the frontline managers in the picture we will end up having on average ratio of one managerial employee as to five general employees (1:5). This ratio is high and it is also not recommended to have one-to-one reporting structures as they create unnecessary redundancy and duplication of roles.

The sluggish and rigid structure above might be the reasons for the inefficiency and ineffectiveness that exist in the structure as there are challenges with bureaucracy. Normally, it is difficult to see through the organisation’s ineffectiveness as there is a very large pool of workforce. It takes long for the organisation to make decisions, and normally after a series of never ending meetings. This has been attributed to the risk evasiveness of the organisation. A typical example has been the expansion programme that has been on the cards since 2006. This project has gone through more than four feasibility studies have been conducted and over five risk assessments have been done without a clear position being put forward. Most of the operational decisions also take time to come into effect and this takes away the agility in the organisation. This results in the organisation missing the opportunity to improve on their output and even taking corrective action.

1.2.4 Staff

Murowa Diamonds started its operations in 2004, and currently employs 365 employees both permanent and contractors. The coming in of Mbada Diamonds and Canadille Mine into the diamond industry resulted in high competition in technical staff. Murowa was not spared either, since there has been an increase in staff turnover as shown in Figure 1.3 below;
The reasons for leaving the organisation have been varying from remuneration to low motivation within the staff. Others have cited the need to move into a more challenging environment since the current operation at Murowa is small and hence the problems or rather challenges are as big as the operation.

1.2.5 Skills
Organisations can have competitive advantage with their staff, highly knowledgeable employees are especially important for the prosperity of an organisation. Murowa Diamonds has highly competent and experienced technical staff which is key in the diamond industry since it is a specialised segment in mining. It invests a lot in training and even extends its skill development programs to seconding employees to other operations within the group. This has been a major competitive advantage for the organisation. In some roles the turnover is not felt by the organisation as the remaining staff will still have the requisite skills to drive the organisation. In some instances it actually has over qualified personnel for some levels. This has created problems of employees now asking to be paid more for the qualifications they hold rather than the job they are doing. A typical example is there are store clerks who hold diplomas in
accounting and also there are plant attendances that hold diplomas in metallurgy (Murowa Diamonds, 2010). All this has created motivational problems and at times paralysis due to the large pool of technocrats within the organisation. At times these over qualified people end up not doing what they are employed to do and as a result the organisation will employ another person to do that low level job thereby creating blotted structures.

1.2.6 Systems

Systems define the flow of activities in the operation of the business and these include the core processes and support systems. Murowa operates an open cast mine pit and a diamonds processing plant. The company operates two offices that is the mine site in Zvishavane. The Harare office has been put up to support the site activities and also acts as the corporate office. However, there has been a duplication of infrastructure and roles in the current set up. For example there is Information System Support personnel at Harare Office and the same as Mine Site with the same functions and same numbers.

As far as the production systems are concerned the organisation has a well structured and documented production process. The main challenges has been lots of double handling that happens in the mining processes which has been partly the cause of high production costs. The double handling is mainly due to generation of big boulders during the blasting operation and these boulders have to be re-blasted since their size cannot fit into the plant. However, apart from the re-handling there are other operational inefficiencies that exist in the value chain which add up to the high cost of production which has also been unforgiving on the raise. The cost per tonne of mining diamonds was US$50 in 2008; this figure has been on the rise to US$68 in 2010, while in 2011 it is expected to be around US$90 (Murowa Diamonds, 2010). Studies carried out in the organisation indicate that the costs of producing one carat of a diamond has been on the increase in the 4 years, from US$37/carat in 2006 to US$144/carat in 2009 as shown in Figure 1-4 below.
The organisation has very tight financial control with the commercial department well resourced in terms of skills such as business analyst, commercial specialist, administration superintendents and financial controllers. However, this effort has failed to keep the costs down and at times the organisation will spend more when they will be trying to expedite an emergency order.

1.2.7 Style
An organisation has to live up to challenges mentioned above for it to survive in this highly competitive environment. Murowa Diamonds need to build a strong culture of excellence for it to be able to remain viable in this highly globalised world. Management institutes a top down approach where all the decisions are made from above. There has been an over-reliance on consultants on all the issues that will be affecting the organisation. On average more than four consultants that visit the mine
working on various projects (MDPL, 2010). The employees have been failing to indentify themselves with the decisions and operations of the companies. The workers feel as objects or rather means to production rather than being part of the organisation. At times the consultants will come up with brilliant ideas but these ideas fail to realise their full potential as they will be alien to the people who have to implement them. Another challenge for the organisation has been the lack of urgency in the approach of management. Decisions take forever to be done and everything in the organisation takes time to be done. The apparently rigid work environment discourages employees to be innovative, creative and take chances.

1.2.8 SWOT Analysis

Table 1-1: Murowa Diamonds SWOT Analysis

<table>
<thead>
<tr>
<th>Strength</th>
<th>Opportunities</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Murowa Diamonds is part of the Rio Tinto Group</td>
<td>• Diamond market boom in China and India</td>
</tr>
<tr>
<td>• Highly skilled manpower</td>
<td>• Prices of diamonds high and on the rise</td>
</tr>
<tr>
<td>• Strong shared values</td>
<td>• Good access to markets</td>
</tr>
<tr>
<td>• Huge capital base</td>
<td>• Large pool of hard working culture labour</td>
</tr>
<tr>
<td>• Good gem quality diamonds</td>
<td>force</td>
</tr>
<tr>
<td>• Good training and development structure</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weakness</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>• High operational costs</td>
<td>• General increase in labour costs</td>
</tr>
<tr>
<td>• Blotted and rigid structure</td>
<td>• Difficulties in attracting foreign direct</td>
</tr>
<tr>
<td>• Duplication of roles and infrastructure</td>
<td>investment due to political situation</td>
</tr>
<tr>
<td>• Job design and skills levels mismatch</td>
<td>• Unstable political environment</td>
</tr>
<tr>
<td>• Over analysis leading to paralysis</td>
<td>• Loss of the country’s Kimberly Certification</td>
</tr>
<tr>
<td>• Lack of employee empowerment</td>
<td>• High taxes and levies</td>
</tr>
<tr>
<td>• Lack of organisational agility and urgency.</td>
<td></td>
</tr>
</tbody>
</table>

Source: Adapted from Murowa Operational Data Review (2010)

1.3 Problem Statement
In view of the foregoing background for the study, the overall research problem addressed is that despite the significant and huge investments made into the operational systems, the production levels have been below targets and costs overruns have been ever increasing yet little or nothing has been done to investigate the causes of the company’s failure to meet these targets.

Studies carried out indicate that mines which persistently operate at high costs are known to have closed down, examples such as Tahera Diamond Corporation which closed the Jericho Mine in 2008 due to high operating costs. The Canadian government assumed control of the mine and Tahera later applied for bankruptcy protection (http://www.infomine.com/, Accessed: 22 April 2011).

In an effort to magnify Murowa Diamonds problems, the foregoing background of the study provided a litany of symptoms of decline in the performance of Murowa Diamonds and these problem elements range from lack of strategic focus, high operational costs, duplication of roles, lack of organisational agility and urgency, job design and skills mismatch and, a bloated and rigid organisational structure. These problem elements have continued to persist despite measures that have been taken by management to address them. Nevertheless, the impact of these problem elements and ways of redressing them has hardly been critically analysed.

If the continued high operational costs by Murowa Diamonds is not treated with the seriousness it deserves, and its current challenges curbed, opportunities that would have otherwise been available will become foreclosed, the company will collapse leading to a significant loss in the economy.

1.4 Research Questions
In order to address the problem, the following research questions were raised:

1.4.1 What is the general understanding of lean principles within the organisation and its role in improving operational excellence?
1.4.2 What strategies could be adopted to remove the major sources of operational waste at Murowa Diamonds Mine?
1.4.3 Could the bloated or rigid organisational structure be affecting the organisation’s efficiency and effectiveness?
1.4.4 What is the appropriate methodology or strategy that could be used to transform Murowa Diamonds Mine into a Lean Enterprise?
1.4.5 In what ways can Murowa Diamonds Mine deal with the pitfalls or obstacles in transforming into a Lean Enterprise?

1.5 Research Objectives

From the research questions, the study seeks to address the following objectives:

1.5.1 Assess the general understanding of Lean principles in improving operational excellence.
1.5.2 Propose strategies that can be used to remove operational waste at Murowa Diamonds Mine.
1.5.3 Ascertain whether the bloated or rigid organisational structure is affecting organisation efficiency or effectiveness.
1.5.4 Design an appropriate methodology or strategy for the adoption of Lean at Murowa Diamonds Mine.
1.5.5 Propose countermeasures to address the pitfalls or obstacles in transforming Murowa Diamonds Mine into a Lean enterprise.

1.6 Proposition Of The Study
The researcher makes the research proposition that; “The transformation of Murowa Diamonds Mine into a lean enterprise will reduce production costs, increase production volumes and increase shareholder value.”

1.7 Scope Of The Research
This research will focus on the transformation of Murowa Diamonds Mine into a lean enterprise. The research is going to include respondents from Murowa Diamonds’ Harare office and from the mine in Zvishavane. Its focus will mainly be on management, employees and long term contractors of Murowa Diamonds Mine and they will form the population of the study.

1.8 Significance of Study
It is envisaged that, results of this research will provide insight and adequate knowledge on the essence of adopting lean philosophies in mining organisations in an attempt to build an adaptable and responsive organisation. In this way, organizations particularly Murowa Diamonds Mine will be able to stimulate their survival and growth and therefore ensure profitability of the business.

The findings of this research should contribute to the body of knowledge on the implementation of lean production policies and techniques which managers, change agents and academics can use to formulate strategies. This study can also become the stepping-stone and benchmark for future research. Therefore, the results of the research will have value for the individual employee, the organisation, business and academics.

The research findings can extend institutional knowledge and will improve attitude, management strategies and practice towards production. Furthermore, the study findings will be of use to other organisations outside the mining industry.

1.9 Limitations Of The Research
It is not within the scope of this research to implement any new tools; neither will it be to train employees nor coach managers. This paper will also not give detailed implementation plan; the plan presented here will be more general in its approach or should be seen as a platform for more detailed change programs. This study will focus on issues and solutions related to mining organisations and in particular Murowa Diamonds.

1.10 Conceptual Framework Of The Study
A conceptual framework is a research tool intended to assist the researcher to develop awareness and understanding of the situation under scrutiny and to communicate this effectively. When clearly articulated, a conceptual framework has potential usefulness as a tool to assist a researcher to make meaning of subsequent findings. It forms part of the agenda for negotiation to be scrutinised and tested, reviewed and reformed as a result of investigation (Guba and Lincoln, 1989).
A conceptual framework can be defined as a set of broad ideas and principles taken from relevant fields of enquiry and used to structure a subsequent presentation (Rechel and Ramey, 1987).
The Figure 1-5 below helps to illustrate the formation of a conceptual framework of study. The topic was, “An Investigation Into Strategies For Transforming Mining Organisations Into Lean Profitable Enterprises: A Case Of Murowa Diamonds Mine (Year 2008 – 2010)”.
2008 – 2011
Transforming Organisations
Into Lean Enterprise

Mining Organisation:
A Case Of Murowa
Diamonds

Behaviours and strategic responses of mining firms
in transforming into lean enterprise

Existing management theories on
strategic behaviours of firms to
transformation into Lean Enterprise
- Lean Principles
- Operational Waste
- Organisational Structures
- Lean Transformation
- Sustaining Lean

Survey empirical evidence on how
mining firms behave in transforming
into Lean Enterprise
- Lean Principles
- Operational Waste
- Organisational Structures
- Lean Transformation
- Sustaining Lean

Determine if the behaviour and strategic responses of mining firms
to the transformation into lean enterprises can be explained by
existing management theories.

Conclusions and
Recommendations

Figure 1-5: Conceptual Framework of The Study
1.11 Structure Of The Dissertation

This research paper is divided into five chapters. Each chapter begins with an introduction, and ends with a conclusion. A thematic approach is followed throughout with Chapter 1 serving as an orientation and background study of the research. The reason for the study and the objectives of the study are mentioned in this chapter. Chapter 2 gives the theoretical background through a critical review of contemporary literature on lean approach to management of organisations. Chapter 3 provides a detailed account of the research methodology used, including research design concepts such as philosophies, strategies, data collection and data analysis methods used. Chapter 4 is a summary of findings and analysis of data gathered. Finally, in Chapter 5 conclusions and recommendations on key issues are summarised. In addition to this, suggesting areas that require further study is also explored.

1.12 Conclusion

This chapter provided the backdrop against which the research was carried out. It therefore provided an introduction to the chapter, followed by a background of the study, articulation of the problem statement, research questions and objectives, as well as the business proposition. Justification and limitation of the study is also provided for. The researcher then moved on to review the literature relevant to the subject matter.
CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction
This chapter focused on key concepts, principles and frameworks emerging from the problem elements articulated in Chapter 1. The researcher sought to review literature by focussing on both negative and positive literary commentary and seek to address the challenges in the preceding chapter. The researcher starts by providing a general overview of the key concepts arising from the topic under study. The chapter proceeds to discuss the concept of lean, strategies of reducing waste, methodologies for lean implementation, appropriate organisational structures and the challenges to be overcome in the implementation of lean. The chapter ends with a conclusion.

2.1 General Overview
Over the years, companies’ operations have traditionally been driven by sales forecasts and firms tended to stockpile inventories in case they were needed. Womack, Jones and Ross (1990), were the first to introduce the term Lean in their story about Japanese automobile industry in the book, ‘The Machine That Changed the World’. The book is an in-depth description of the Toyota Production System (TPS) and explains how Toyota managed to minimise waste and identify customer need. However, it was Henry Ford in the 1920s who first introduced manufacturing concept of continuous moving assembly line as a step towards mass production. Ford is considered to be the first to practise Just-In-Time (JIT) and Lean manufacturing, even though he failed as a result of only being able to produce one product and thereby failing to satisfy all his customer’s needs. TPS learned much from Ford, but they also recognised the central role of inventory and continuous improvement for better productivity (Rizzo, 2008). TPS underpins many innovations including elimination of waste – muda, quality at the source – jidoka, continuous improvement – kaizen (muda, jidoka and kaizen – are all Japanese words). The concepts of lean production are aimed to improve processes and to make them more efficient and to make them more efficient and to reduce defects.
However, authors Hines, Found, Griffiths and Harrison (2008), developed a set of factors that criticises Lean. Much of the criticism was centred on Lean’s lack of contingency and ability to cope with variability, as well as lack of consideration of human aspects and strategic perspective. Wilson, Heyl and Sallman (2008), viewed Lean approach as Marxist, exploitative and creating high pressure to the shop floor workers, which lead to humanising effect. Although the authors, Womack and Jones (1996) on the opposite side do not support these views, they still raise issues of the importance of showing respect to the employees and creating a good atmosphere for workers to be challenging, but most of the authors argue that this is the key to a long term sustainability of any lean programme.

2.1.1 Definition Of Lean

After 30 years of studying Toyota and practising lean, Koenigsaecker (2009) defines lean as ‘Whatever Toyota Does’. Todd (1995) defined lean production as the initiative, whose goal is to reduce waste in human effort, inventory, time to the market and manufacturing space to become highly responsive to customer demand while producing world class quality products in the most efficient and economical manner. According to Bhasin (2008) lean organizations are capable of producing high-quality products economically in lower volumes and bringing them to market faster than mass producers. Lean can be regarded as a people driven continuous improvement system that can improve any work process with the ultimate goal of building a learning organisational culture that solves customer problems (Koenigsaecker, 2009). The lean strategy is to approach the elimination of non-value adding activities, which are all activities that do not directly increase the value of a service or product (Cost, Frank, Daly and Bret, 2003). Warley (2004) also concurs with other authors above as he also defined lean as the systematic removal of all waste by all members of the organisation from all areas of the value stream. Warley (2004), further highlight that, Lean management is about operating the most efficient and effective organization possible, with the least cost and zero waste. Lean is often associated with the description of doing more with less, which
explains the efforts for improving utilisation of the organisation’s resources. This definition goes beyond the original definition of lean production popularised by Womack, et al. (1990). Based on that, some authors Radnor and Boaden (2004) consider the possibility of reaching the state where the company fails to utilise or balance effectively its resources in pursuit of the company’s mission and vision.

2.1.2 Shifting From Lean Production To Lean Thinking
While Lean is associated with cost reduction and eliminating waste, Lean Thinking is about creating value. Womack and Jones (1996) argue that lean can be applied not only in manufacturing context, but also in every other organizational level. A study carried out indicated that the adoption of lean is beneficial for knowledge-based activities such as design, new product introduction, engineering and product development (Baines, Lightfoot, Williams and Greenough, 2006). It claims that today the popular emphasis is on customer value, on the “value” in a broader context of different useful activities and how to maximize this value. Baines et al. (2006) also argues that engineers need to move from the production focus where the primary focus is waste reduction to such of identifying and enhancing value in that manner they are applying lean thinking principles.

Mashell (2000) defines lean thinking as applicable to all aspects of a business and positively impacts not just production operations, but the whole range of business processes including product development, design and sales. However, Womack et al. (1990), they define lean thinking as a “multidimensional approach of doing business with the primary focus on waste reduction” which involves effort for converting waste into value. Lean thinking moves away from the perception of removal of waste in the value chain but rather looks further at how this waste can be converted into value.

2.1.3 Lean Culture
The lean culture is defined as a problem solving culture based on the concepts of continuous improvement and organisational learning (Czabke, Hansen and And, 2008).
Lean culture comes with the problem solving in the process of learning going on the path of continuous improvement. Culture is both a result and enabler for sustainable and successful lean operations (Liker, 2004). The term continuous improvement means incremental improvements of products, processes, or services over time, with the goal of reducing waste to improve workplace functionality, product performance and customer service (Emiliani, 1998). It does no matter how good the organisation becomes, a culture of continuous improvement will create new opportunities for improvement. Processes subjected to analysis by this concept characteristically reveal significant opportunities for reductions in process time or expense, and improvements in quality or customer satisfaction. Continuous improvement principles, as practised by most manufacturers, results in astonishing improvements in performance that competitors find nearly impossible to achieve (Czabke et al. 2008). Another lean belief put forward by Mefford (2009), is that the process can be improved always some more further on, no matter the fact the how good is it and the approach and the management actually should encourage the workers to think in this direction of searching always continuously better ways of doing things. Key authors including Dale (1997) and Sohal (1999), all agree that successful Lean transformation requires management to have long term focus without losing sight of important short term goals in addition to organisations creating their own culture where continuous improvement through employees is the norm.

2.1.4 Lean Enterprise
Lean enterprise is a group of individuals, functions and legally separated but operationally synchronised. Alhstrom and Karlsson (1996) define lean enterprise as a firm that uses best practices in all functional areas and see it consisting of four different parts namely; lean development, lean manufacturing, lean distribution and lean procurement. Womack and Jones (1996) focus on the external networks of the company as the strategic vision of the lean production and this vision is conceptualised by these authors in the term lean enterprise. Applying lean techniques throughout the value chain
would create a continuous value stream by adding value adding activities. Womack and Jones (1996) suggest is joining the value-creating activities which can be realized through a new organizational model: the lean enterprise. Lean thinking goes beyond the firm itself, it is about looking at the whole enterprise with its entire set of activities in creating and producing a particular product or service. The organisational state for that is what Womack et al. (1990) called the lean enterprise. It also includes all the concerned parties required to create that channel for the entire value stream eliminating muda (waste).

2.2 Lean Principles

Womack and Jones (1996) came up with five principles of lean implementation and building a lean enterprise that is; the specification of value, identification of value stream, make value flow, let the customer pull value and pursue perfection. Applying these five steps needs to happen on every organizational level and requires complete transformation of the current business system. Precisely the customers’ value is important because failure to specify value correctly could result in wrong product or service with a great waste for the organization. Second is identifying the entire value stream and eliminate waste. The three critical activities for indentifying the value stream and elimination of waste are product definition, information management and physical transformation. Next step is letting the end customer to pull the product he wants into the system when he needs it. In this case the high cost for inventory will be reduced. Pursue perfection is the final step of the implementation process. It is very important that all the steps are done at the same time, so that the influence of each of them is strong enough to enhance the outcomes of the others. Ahlstrom and Karlsson, (1996), developed further the work that had been done Womack and Jones (1996), however, the principles that they developed had strong focus on internal systems, teams and leadership. Womack et al (1990), on the other hand agreed with the authors listed above but added three more principles to the list of five that had been put forward. The list ended up having eight principles that is; elimination of waste, zero defects, pull
scheduling, multifunctional teams, delayering, team leaders, vertical information systems and continuous improvement.

2.2.1 Lean Conceptual Framework

The authors developed a conceptual framework for lean based on the work by Liker (2004), Shah and Ward (2003) and Shingopriize (2005). The framework puts together all the enablers of lean thinking and relationships between them for a successful lean implementation. It includes practises, principles and processes needed for adoption of lean thinking within the whole organisation. Below in Figure 2-1 is the lean conceptual framework.

![Lean Conceptual Framework Diagram]

Figure 2-1: Lean Conceptual Framework

Source: Adapted From Lean Management Resources Institute (2007)
As shown in the Figure 2.1 above, the house keeps all the necessary parts of the lean enterprise together. Lean thinking is operationalized as an integrated management approach that has an impact over the whole organisation including its stakeholders that is suppliers, customers and business partners. Each of these elements is important to be present, so that full benefits could be received for the company adopter. The base of the structure consists of the enablers of successful lean implementation. At the bottom is lean philosophy which refers to the appropriate leadership style and commitment of all management levels till the top management. The second layer is human resources management, employee empowerment and involvement in lean implementation as the key success factors as the focus is on teamwork (Shingoprinze, 2005). Supporting activities indicate the need of the company to improve its core processes mainly focusing on waste reduction within the organisation manufacturing utilising best practices such as just-in-time (JIT), total productive maintenance (TPM), and total quality management (TQM). On the other side are the areas that are non manufacturing supporting functions that should be influenced and improved by the implementation by the already mentioned practices. The ceiling for the lean house is the lean culture that supports the roof that is lean goal and results (Shah and Ward, 2003).

2.2.1.1 Just-In-Time (JIT)

Repenning and Sterman (2001), describe JIT as involving right part, right amount, and right time. The ultimate goal of JIT is the smooth flow of materials and information throughout the system. Its main objectives are to eliminate disruptions, to make the system flexible, and to eliminate waste such as excess inventory (Stevenson, 2007). A JIT system will minimize the inventory on stock, as carrying extra inventory creates an extra cost because inventory ties up financial capitals. The whole JIT production system should work according to the pull principle. A pull system is one of the elements in a JIT system, where the downstream process only pulls the materials that they need from the producer (Cooper, Conti, Angelis, Faragher and Gill, 2006).
2.2.1.2 Total Productive Maintenance And Total Quality Management

Total Predictive Maintenance (TPM) is a system of predictive and preventive maintenance. The goal is to optimize maintenance and improve safety (Cooper et al. 2006). TPM consists of special planning and scheduling practices and principles that are designed to maintain equipment before it breaks down. It is a methodology for achieving minimal machine downtime and makes maintenance something that is a part of everyone’s job. With a good TPM tool, it is possible to plan the downtime and to reduce the number of breakdowns by conducting maintenance on a regular daily basis (Sakakibara et al. 1997). TPM requires a cross-functional effort, in addition to a new mindset about maintenance. In a plant operating with TPM, maintenance is not only the maintenance personnel’s job, but gives a greater responsibility to the machine operators (Chan, Lau, Chan and Kong, 2005).

Total Quality Management (TQM) can consist of several practices and principles and quality management programs. Tools of quality like Pareto charts, story boarding, poka yoke, cause and effect diagrams, 5 why’s, and others can be deployed to guarantee top quality products (Choi, 1995). Quality circles, easy to see quality, zero defects, statistical process control, and six-sigma are quality management programs that are designed to reach the highest quality standards. In a lean setting, it is also important to have some kind of formal quality improvement program in place since continuous improvement and learning are key lean practices and principles (Cooper et al. 2007). In addition to this, more customer involvement, cross-functional product design, and quality function deployment are all practices and principles that are designed to manufacture high quality goods in an efficient manner.

2.2.1.3 Kaizen

According to Schonberger (1982), Kaizen is a Japanese term which means to change and make good. However, it is translated to Continuous Improvement in English. Kaizen seeks to continually improve product development and production processes (Womack and Jones, 1996). Implementing Kaizen events help to create a culture of
continuous improvements by focusing on solving the cause of the problems, so that they will not happen again. Kaizen, together with 5S, is one of the starting tools for a plant to become a Lean Enterprise. In Kaizen events, cross-working teams are created to identify problems causing waste, and then to analyze and to eliminate the problems (Cooper et al. 2006). Kaizen events will help remove the real constraints and will reduce quality variability, encourage consistent performance, and improve safety in the workplace. Authors Brown, Willis and Prussia (2000), further emphasises the need for kaizen processes to have cross-functional team that are assembled for a given period with specific functions of measuring, analysing and sustaining continuous improvement initiatives. Radnor and Boaden (2004), refer lean to be a ‘management by stress’, which is improvement programmes add stress to the organisation, because the work pressure is higher and oppose to investing more time in improvements in addition to their normal duties. In situations where people are allocated some time in improvement programmes, the result is short term drop in performance as the time spent on working other operational issues diminishes (Berggren, 1993). This happens when improvement programme are not giving positive results and when these initiatives are not embedded into the role description of employees.

2.2.1.4 5S and Visual Management

5S is a method of sustaining a workplace using disciplines, such as Sort, Straighten, Shine, Standardize, and Sustain (DeHamers, 2008). It is a good starting point, and the key to waste elimination. It helps in maintaining a clean and organized working environment to ensure a smooth flow of production. The first step of 5S is to sort, which means that the unneeded items must get clearly distinguished from the needed items and get removed from the process. After the items are sorted, they should be arranged and labelled in a way that anyone can find them. This will make every tool easy to find; it also becomes easier to identify missing items. Basically, this step is to put every item in order. Once unnecessary items are removed and the remaining items are labelled, the purpose of the Shine stage is to keep the working environment clean. Standardize
creates standard ways of implementing tasks. It should establish procedures for when and how the first three steps should take place on a regular basis. The last step is making sure that there are checklists and audit forms to ensure that 5S is integrated into the daily routines which is sustaining. This is normally the difficult part and most organisations always slide back at this stage (Cooper et al. 2006; Rizzo, 2008). 5S is imperative for handling a Lean organization with continuous improvements, reduced costs, and safe working conditions (Rizzo, 2008). 5S is a way to visually communicate by using simple signals, giving an immediate understanding. Visual communication helps to give the workers the needed information quickly, with fewer errors, and less misunderstanding (Huskins, 2008). The visual communication could be in the form of information boards, where all the operational metrics are shown in forms of bar graphs, pie charts, robots and line graphs. Operational work instructions can also be changed from sentence descriptions to pictures.

2.3 Operational Waste

Lean is a set on management principles and techniques geared up towards the elimination of waste in the manufacturing process and increase the flow of activities that from the customer’s perspective add value to the product (Womack and Jones, 1996). The essence of lean is to eliminate waste wherever it exists within the firm and along the whole supply pipe (Kippenberger, 1997). The traditional batch and queue mentality of mass production is seen as carrying large amounts of waste along the length of the supply chain. Processes either add value or waste to the production of a good or service. In an effort to eliminate waste, it is important to understand exactly what waste is and where it exists. While products significantly differ between factories, the typical wastes found in manufacturing environments are quite similar (Womack and Jones, 1996).
2.3.1 Types Of Waste

The elimination of waste is the goal of Lean, and Toyota defined three broad types of waste: muda, muri and mura (Liker, 2004). Muri (unevenness) can be avoided through standardized work while Mura (overburden) is avoided through Just In Time (JIT) systems. Muda has been given much greater attention as waste than the other two which means that whilst many Lean practitioners have learned to see muda, they fail to see in the same prominence the wastes of mura and muri (Shah and Ward, 2003). It is from this understanding that the literature review on the types of waste will focus on ‘Muda’.

Toyota’s Chief Engineer Taiichi (1988) came up with the seven wastes to further categorise ‘Muda”, these formed the core of the Toyota Production System, also known as Lean Manufacturing. The seven wastes included: mistakes, rectification, overproduction, unnecessary production steps, unnecessary movement or transport of employees, unnecessary movement or transport of goods, people waiting downstream, goods or services that do not meet customer needs. However, subsequent to research Liker (2004) came up with the eighth type of waste known as underutilised people or resources. While the elimination of waste may seem like a simple and clear subject it is noticeable that waste is often very conservatively identified. However, most managers whilst they are focused on getting their process under control they do not give enough attention to process improvement by redesign (Hirano and Makota, 2006). Below Figure 2-2 shows the various types of operational waste (Muda).
From Figure 2-2 above, simply put, overproduction is to manufacture an item before it is actually required. Overproduction is highly costly to a manufacturing plant because it prohibits the smooth flow of materials and actually degrades quality and productivity. Overproduction manufacturing can also be referred to as “Just in Case” (Liker, 2004). It creates excessive lead times, results in high storage costs, and makes it difficult to detect defects. Whenever goods are not moving or being processed, the waste of waiting occurs. Much of a product’s lead time is tied up in waiting for the next operation and this is usually because material flow is poor, production runs are too long, and distances
between work centres are too great (Taiichi, 1988). Transporting product between processes is a cost incursion which adds no value to the product. Excessive movement and handling cause damage and are an opportunity for quality to deteriorate. Sanchez and Perez (2001) stated that transportation not only does it add no value to a product, it also increases manufacturing lead times. Excess inventory increases lead times, consumes productive floor space, delays the identification of problems, and inhibits communication. Motion waste is related to ergonomics and is seen in all instances of bending, stretching, walking, lifting, and reaching. These issues transform into health and safety risks, which in today’s litigious society are becoming more of a problem for organizations (Philips, 2002). Rework or scrap is another type of waste that has a direct impact to the bottom line, quality defects resulting in rework or scrap are a tremendous cost to organizations. Associated costs include quarantining inventory, re-inspecting, rescheduling, and capacity loss. Liker (2004) adds to the list the unused employee creativity as a major type of waste. The author emphasizes that all the employees within the organization must accept and understand the goals of lean thinking adoption and to be engaged in it. Organizations employ their staff for their nimble fingers and strong muscles but forget they come to work everyday with a free brain. It is only by capitalizing on employees’ creativity that organizations can eliminate the other seven wastes and continuously improve their performance. For each waste, there is a strategy to reduce or eliminate its effect on a company, thereby improving overall performance and quality (Mashell, 2000).

### 2.3.2 Dealing With Operational Waste

In lean system the emphasis is basically on reducing waste of all types. The emphasis on elimination of waste as well as continuous improvement is combined with a strategic focus of the company over the quality ensuring that the reduction of defects will always be at first place. To accomplish this goal, companies invest their time and resources in looking for of variation and wastes, and develop ways to eliminate them (Rother and Shook, 1996). Table 2-1 below is summarised details of ways of dealing with waste.
Table 2-1: Dealing With Operational Waste

<table>
<thead>
<tr>
<th>Types Of Wastes – “Muda”</th>
<th>Summarised Definition</th>
<th>Examples</th>
<th>Causes</th>
<th>Countermeasures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over-production</td>
<td>Producing more than the customer needs right now</td>
<td>Producing product to stock based on sales forecasts Producing more to avoid set-ups Batch process resulting in extra output</td>
<td>MRP push rather than kanban pull Large batch sizes Looks better to be busy! Poor people utilisation Lack of customer focus Forecasting Long set-ups “Just in case” for breakdowns</td>
<td>Pull system scheduling Heijunka – level loading Set-up reduction TPM</td>
</tr>
<tr>
<td>Transportation</td>
<td>Movement of product that does not add value</td>
<td>Moving parts in and out of storage Moving material from one workstation to another</td>
<td>Push production Push production Storage Functional layout</td>
<td>Flow lines Pull system Value Stream organizations Kanban</td>
</tr>
<tr>
<td>Motion</td>
<td>Movement of people that does not add value</td>
<td>Searching for parts, tools, prints, etc. Sorting through materials Reaching for tools Lifting boxes of parts</td>
<td>Workplace disorganization Missing items Poor workstation design Unsafe work area</td>
<td>SS Point of Use Storage Water Spider One-piece flow Workstation design</td>
</tr>
<tr>
<td>Waiting</td>
<td>Idle time created when material, information, people, or equipment is not ready</td>
<td>Waiting for parts Waiting for prints Waiting for inspection Waiting for machines Waiting for information Waiting for machine repair</td>
<td>Push production Work imbalance Centralized inspection Order entry delays Lack of priority Lack of communication</td>
<td>Downstream pull Takt time production In-process gauging Jidoka Office Kaizen TPM</td>
</tr>
<tr>
<td>Processing</td>
<td>Effort that adds no value from the customer’s viewpoint</td>
<td>Multiple cleaning of parts Paperwork Over-tight tolerances Awkward tool or part design</td>
<td>Delay between processing Push system Customer voice not understood Designs “thrown over the wall”</td>
<td>Flow lines One-piece pull Office Kaizen 3P Lean Design</td>
</tr>
<tr>
<td>Inventory</td>
<td>More materials, parts, or products on hand than the customer needs right now</td>
<td>Raw materials Work in process Finished goods Consumable supplies Purchased components</td>
<td>Supplier lead-times Lack of flow Long set-ups Long lead-times Paperwork in process Lack of ordering procedure</td>
<td>External kanban Supplier development One-piece flow lines Set-up reduction Internal kanban</td>
</tr>
<tr>
<td>Defects</td>
<td>Work that contains errors, rework, mistakes or lacks something necessary</td>
<td>Scrap Rework Defects Correction Field failure Variation Missing parts</td>
<td>Process failure Mis-loaded part Batch process Inspect-in quality Incapable machines</td>
<td>Gemba Sigma Poka yoke One-piece pull Built-in quality 3P Jidoka</td>
</tr>
</tbody>
</table>

Source: Adapted From Lean Management Resources Institute(2007)
2.3.3 Value

Buzzell and Gale (1987) describe value as the relationship between quality and prize by stating that a customer who gets superior quality at a low prize gets better value; a customer who gets inferior quality at a high prize gets worse value. However, Porter (1990) came with a different perspective as he described value as to what buyers are willing to pay for a product. Any process for it to add value to a product or service, it must make only what the upstream process needs and when it needs it, and it must meet the customers’ requirements (Huskins, 2008). Apart from the different versions put forward by the authors above in the definition of value, the common denominator is customer’s needs; this is the starting point for lean thinking. Hence, lean is about creating more value for the customers by eliminating what is considered to be wasteful in the company’s activities (Womack and Jones, 1996).

2.3.4 Value Stream Mapping.

As previously mentioned, it is crucial to identify value from the customers’ perspective. However, to be able to entirely understand value, the activities in the value streams must be described. Porter (1990) introduces the concept of the value chain as a devise to diagnose the ultimate enhancers of a competitive advantage for a company. Porter (1990) suggests that value chain analysis would help a manager to separate the underlying activities of the firm regarding the functions of designing, producing, marketing and distributing its products or services. The value stream contains all activities that are required to prepare, to process, and to deliver the product to the customer (Huskins, 2008). The value chain takes the view over a set of interdependent activities, which are all together the building blocks of competitive advantage in two ways that is optimisation of the process and dividing of the responsibilities to the members depending on who is best in which activity, and secondly as a coordination to achieve a superior performance. According to Womack and Jones (1996), the objective in creating a value stream map is to define exactly every step in manufacturing process required to design, order raw materials and make the final product.
2.4 Organisational Structure

The term organization has been defined in several ways by various authors. Radnor and Boaden (2004) define it as the specific configuration of structure, people, task and techniques. Structure describes the form of departments, hierarchy and committees. It influences the organization's efficiency and effectiveness. People refer to the skills, attitudes and social interaction of the members of the organization. Task refers to the goals of the individual and the organization. Techniques refer to the methodical approach used to perform tasks. Sachdeva (1990) also describes organizational structure as the institutional arrangements and mechanisms for mobilizing human, physical, financial and information resources at all levels of the system. Organization can also be defined as a system incorporating a set of sub-systems (Katz and Kahn, 1978). These sub-systems are related groups of activities which are performed to meet the objectives of the organization. Structure is thus an integral component of the organization. Nystrom and Starbuck (1981) have defined structure as the arrangement and interrelationship of component parts and positions in an organization. It provides guidelines on division of work into activities, linkage between different functions, hierarchy, authority structure, authority relationships and coordination with the environment. Another author, Robbins (1989), defines organisational structure as having the following component complexity, formalisation and centralisation. Complexity refers to the degree to which activities within the organization are differentiated. Formalization refers to the extent to which jobs within the organization are specialized. The degree of formalization can vary widely between and within organizations. While centralization refers to the degree to which decision making is concentrated at one point in the organization.

2.4.1 Principles Of Organization Structure

Modern organizational structures have evolved from several organizational theories, which have identified certain principles as basic to any organization. These include
specialisation, coordination, departmentalisation, and decentralisation (Anderson, 1988). Specialization facilitates division of work into units for efficient performance. It enables application of specialized knowledge which betters the quality of work and improves organizational efficiency. At the same time, it can also influence fundamental work attitudes, relationships and communication. Coordination refers to integrating the objectives and activities of specialized departments to realize broad strategic objectives of the organization. It includes two basic decisions pertaining to which units or groups should be placed together; and the patterns of relationships, information networks and communication (Anderson, 1988). Hierarchy facilitates vertical coordination of various departments and their activities and departmentalization is a process of horizontal clustering of different types of functions and activities on any one level of the hierarchy (Luthans, 1986). As organizations increase in size and diversify, functional departmentalization may not be very effective. The organization has to be further divided into separate units to limit the span of control of a manager to a manageable level (Luthans, 1986). Departmentalization by users is grouping of both activities and positions to make them compatible with the special needs of some specific groups of users. De-centralization refers to decision making at lower levels in the hierarchy of authority. In contrast, decision making in a centralized type of organizational structure is at higher levels. The degree of centralization and de-centralization depends on the number of levels of hierarchy, degree of coordination, specialization and span of control (Luthans, 1986).

Line authority refers to the scalar chain, or to the superior-subordinate linkages, that extend throughout the hierarchy (Koontz et al. 1980). Line employees are responsible for achieving the basic or strategic objectives of the organization, while staff plays a supporting role to line employees and provides services. The relationship between line and staff is crucial in organizational structure, design and efficiency.
2.4.2 Type Of Organizational Structure

Organizations can have simple to complex structures, depending upon organizational strategies, strategic decisions within the organization and environmental complexities. The structure of the organization can be traditional (bureaucratic) or modern (organic), according to needs (Gullick and Urwick, 1987). The traditional organizational structure is mechanistic and characterized by high complexity, high formalization and centralization. The classical organizations which are a traditional structure designs are simple, de-centralized, bureaucratic and divisionalized. Classical organisational structure is a simple centralized organizational structure, decision making authority and responsibility for goal setting are vested in one person at the top. This structure is usually found in small and single-person-owned organizations. In large organizations and under well defined conditions, organization structure may be bureaucratic (Mintzberg, 1981). The divisionalized organizational design refers to a multiproduct or service design that separates different products or services to facilitate management planning and control. Modern approaches to organizational design include project, matrix and adhocracy types. Project design is also called the team or task force type. It is used to coordinate across departments for temporary, specific and complex problems which cannot be handled by a single department (Kolodny, 1979).

The matrix design blends two different types of designs, namely project and functional organizational designs. The main advantage of this combination is that the matrix design balances both technical and project goals and allocates specific responsibilities to both. Matrix organizations are not without their problems (Davis and Lawrence, 1978), responsibility and jurisdiction are not clearly defined in matrix organizations. are also not clearly identified. Consequently, matrix organizations could lean towards chaos and disorder, and even lead to power struggles unless power between line and project manager is skilfully balanced. Matrix organizations need more human resources, particularly during initial periods and this higher overheads and increased expenditure and are usually found at the lower level of the organization. Adhocratic structures are also called 'free form' or organic organization structures (Radnor and Boaden, 2004).
They stress managerial styles which do not depend upon formal structures. They are well suited for complex and non-standard work and rely on informal structures. An adhocratic structure is flexible, adaptive and organized around special problems to be solved by a group consisting of experts with diverse professional skills (Robbins, 1989). The choice of any type of organizational design should be in consonance with the organizational requirements, strategy and environment.

2.4.3 Designing Organizational Structures

Organizational structure must support the critical success factors and corporate values (Burnes, 2000). The structure should consolidate resources and responsibility for value streams and eliminate functional silos. Independent silos that don’t communicate well can hamper our striving to speed everything up and provide quick response to our customers. The greatest gains will come from cross-functional integration of the company (Gullick and Urwick, 1987). It is essential that the organizational structure eliminate barriers between staff thinkers and line doers, between functions, and between the company and the outside world. Lean is centred on people and requires partnering with all employees and indeed our corporate values demand empowerment at all levels. There are some important considerations required in designing effective organizational structure and these are clarity, understanding, decentralisation, stability and adaptability. The structure of the organization should be such that there is no confusion about people's goals, tasks, style of functioning, reporting relationship and sources of information. The structure of an organization should provide people with a clear picture of how their work fits into the organization. This also brings about the theory that was brought about by Chandler (1962) as cited in Burnes (2000), that structure should always follow the strategy. The design of an organization should compel discussions and decisions at the lowest possible level. While the organizational structure should be adaptable to environmental changes, it should remain steady during unfavourable conditions.
2.4.4 Lean and Hierarchical Levels

Managers should base hiring decisions on whether the value addition being brought in by new recruits exceeds the cost of hiring them (Radnor and Boaden, 2004). The minimum chain of command principle states that a company should choose the minimum number of hierarchical levels needed for goal achievement. To avoid becoming too tall, an organization can increase the span of control, the number of subordinates a manager directly oversees. The study by Ahlstrom and Karlsson (2000) indicated the importance of delayering of the organisation at the early stages of process improvement to create a platform for further improvements. This improves communication and coordination between management and cross-functional teams. The hierarchical organisation needs to be decentralised and responsibilities spread through the operators in making the right decisions through their work for lean adoption to take place. Delayering, decentralisation and downsizing as outcomes of lean has lead the managers towards cost reduction, which makes some authors use the analogy of a human body as a way of describing leanness within the organisational context (Radnor and Boaden 2004). They define leanness as ‘not fat, thin’ and use the analogy of elimination of waste of non-productive capacity within starvation of the body. Smart, Tranfield, Deasley, Levene, Rowe and Corley, (2003) criticise the Lean model for achieving efficiency gains through cost reduction at the expense of loss of mission and strategic intend.

2.4.5 Organizational Effectiveness And Efficiency

Organizational effectiveness is a measure of the extent to which an organization realizes its goals (Smart et al. 2003). Organizational efficiency refers to the amount of resources an organization uses in order to produce a unit of output. Efficiency is a primary criterion of the internal life of the organisation and is concerned with economic and technical aspects of the organisation but effective is very broad concept that considers the survival prospects of organisations. Efficiency and effectiveness are highly dependent on the ability of the organization to adjust itself to rapid changes in its
environment, resources or technology (Burnes, 2000). The effectiveness of the organization depends greatly on how well the social and technical systems are designed with respect to each other and also with respect to the demands of the external environment (Goett, 1999). There should be a 'fit' between various design elements and the external environment. If there is a change in the external environment, resources or technology, the organization has to respond through appropriate structural changes. According to Albrecht (1983), there are four processes which may lead to organizational effectiveness which are evaluation of processes and methods, adaptation to formal and disciplined planning process, graduation of organization identifying and developing future leaders and lastly nurturing talents and innovation. Considering the degree and type of differentiation and the integration mechanisms for coordination within and amongst departments, Burnes (2000) observe that organizational efficiency is increased when the complexity of the environment is matched by the complexity of structures.

Significant attributes (Mehtan and Shah, 2004) which characterize an effective organization in today's environment include change is continuing organizational process, learning, lateral relationships become increasingly important, particularly in decision making, diluting the traditional focus on hierarchy. The function of management alters from one of control to that of leadership. Management practices for people in the organization are oriented towards involvement rather than control.

2.4.6 Characteristics of Efficient Organisations

Organisations in an effort to have efficient and effective system are characterized by simplicity, flexibility, reliability, economical and acceptability (Kinicki and Kreltner, 2008). Thus, efficient organisations need not to be complex since problems of communication will multiply with each successive stage of complexity. An existing system should not always be modified to accommodate change in the environment but should be sufficiently flexible to integrate change. Reliability is consistency with which operations are maintained and is related to maintenance of assets. Economical also
relates to the cost that the organisation incurs in delivery a service or product. In
addition to this, efficient operations are always acceptable to people who operate them
(Kinicki and Kreltner, 2008). However, Peter and Waterman (1995), in their famous
book ‘In Search Of Excellence’, highlighted that for organisation to be efficient and
effective they must pursue excellence. Excellent organisations must demonstrate that
they have a bias of action, always stick to the knitting, as close as possible to the
customers, have autonomy and entrepreneurship, productivity is through the people,
hands on and value driven, simultaneous loose tight properties and simple form or lean
staff (Peter and Waterman, 1995).

2.5 Lean Transformation

Lean implementation is seen as a process of adoption (Shah and Ward, 2003). The term
implementation process is taken for meaning a progression of events (Alhostrom and
Karlsson 2000). The implementation as a process of adoption involves the necessity of
innovation and adaptation of the organisation, not just following a certain sequence of
steps from a preliminary designed plan. Liker (2004) spent over 20 years studying
Toyota and he states that there in one way to do any of the lean processes. He mentions
that the one reality of the ‘Toyota Way’ is that there is always more than one way to
achieve the desired results. Liker(2004) mentions that the most important thing is to
learn, to think about what you have learned and to apply it, and to reflect on the process
and continually improve to strengthen your organisation in the long term. Many leading
scholars of lean (Emiliani, 1998; Hines and Taylor, 2000; Liker 2004, Shingoprize,
2008, Womack and Jones, 1996) state that it takes three to five years to embed a true
lean culture.

2.5.1 Lean Implementation Methodologies

Several lean implementation models have been developed by scholars over the years to
guide organisations through lean transformations. Five such implementation
methodologies are discussed next sections.
2.5.1.1 The 3-Staged Approach

Wilson et al. (2008), suggested a 3 staged approach to the implementation of lean that is;

1. Engagement – this stage serves to introduce the lean principles to the business owners and senior management team and demonstrate the benefits it offers. Senior management is key for participation and support for the lean transformation programme.

2. Implementation – this were the actual lean programme and implementation is unrolled.

3. Sustainability – this is the final stage of the process that focuses on how to maintain momentum of lean change within firms.

2.5.1.2 The 20 Keys

Kobayashi (1995) developed the 20 keys concept as a simple improvement method with concrete and systematic steps for drastically reforming and strengthening every facet of the organisation as shown below in Table 2-2;

Table 2-2: 20 Keys For Lean Implementation

<table>
<thead>
<tr>
<th>Key 1</th>
<th>Key 11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleaning and organising</td>
<td>Quality assurance system</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Key 2</th>
<th>Key 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rationalising the system</td>
<td>Developing your studies</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Key 3</th>
<th>Key 13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improvement team activities</td>
<td>Eliminating waste</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Key 4</th>
<th>Key 14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce inventory</td>
<td>Empowering the workers to make improvements</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Key 5</th>
<th>Key 15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quick changeover technology</td>
<td>Cross training</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Key 6</th>
<th>Key 16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method improvement</td>
<td>Production scheduling</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Key 7</th>
<th>Key 17</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zero monitor manufacturing</td>
<td>Efficiency control</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Key 8</th>
<th>Key 18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coupled manufacturing</td>
<td>Using information systems</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Key 9</th>
<th>Key 19</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintaining equipment</td>
<td>Conserving energy and materials</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Key 10</th>
<th>Key 20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time control and commitment</td>
<td>Leading technology</td>
</tr>
</tbody>
</table>

Source: Adapted from Kobayashi (1995)
The 20 Keys as summarised in table 2-2 above, is a way of looking at the health of organisations’ operations and systematically upgrade it through 20 different but interrelated aspects all of which are addressed at once. Depending on the particular conditions and characteristics, companies may give priority to certain keys over others, and the order in which the keys are implemented always differs. Although the combination of priorities and implementation sequences are almost limitless, the proper combination becomes apparent as one better understands the 20 Keys. These keys are closely interrelated, making progress in one key automatically tie in the progress in the other 19 Keys. Kobayashi (1995) state that full commitment is needed from all levels for successful implementation and this whole programme takes three years on average.

2.5.1.3  Going Lean

Hines and Taylor (2000) developed a guide of a company’s journey going lean. They developed a set of objectives that companies need to follow and the methods used to achieve these objectives. Below in Table 2-3 are the details of the objectives and methods used in ‘Going Lean’.

Table 2-3: How To Go Lean

<table>
<thead>
<tr>
<th>Objective</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understand customers and what they value</td>
<td>Setting the direction, targets and checking results</td>
</tr>
<tr>
<td>Define the internal value stream</td>
<td>An internal framework for delivering value</td>
</tr>
<tr>
<td>Eliminate waste, make information and product flow, pulled by customer needs</td>
<td>Appropriate methods to make necessary change</td>
</tr>
<tr>
<td>Extend the definition of value outside your own company</td>
<td>Externalise the value focus to the whole value stream</td>
</tr>
<tr>
<td>Continually aim for perfection</td>
<td>Strive for perfection in the product and in all processes and systems</td>
</tr>
</tbody>
</table>

Source: Adapted from Hines and Taylor (2000)
In going through the ‘Going Lean’ process as shown Table 2-3 above, organisations need to firstly understand their customers and what they value. Organisation must define the value streams inside the company and the value streams in their wider supply chain as well. Elimination of waste and allowing product to flow through the value chain will lead to removal of those products or services which customers would not wish to pay for. Next organisations have to find a way setting the direction, fixing targets and seeing whether or not change is actually accruing (Hines and Taylor, 2000).

2.5.1.4 The Eight Stage Process

Lean is not implemented in a static corporate environment, but it is deployed in organizations under a change process imposed by the dynamic business landscape (Kotter, 1996). In fact, Lean implementations could easily be limited to short-lived events interrupted in the short-term, if these implementations would not be organically aligned to the organizational change process phases. Based on empirical research in more than one hundred companies along ten years, Kotter (1996), a Harvard researcher, identified eight main phases necessary for an effective change process in the companies. The first change management phase consists of creating a ‘sense of urgency’ in the organization to motivate the change. In the second phase, the successful companies in the change process created an integrated group of leaders committed to really improve the performance of the company. While the third phase, aimed to clearly stated and defined vision, an image of the desired future easily communicable to the company employees and investors, so that all involved understand which the company’s future trajectory involves. In the fourth phase, the companies that successfully managed the change also communicated their vision effectively. This communication must be both broad and without contradictions. The fifth phase is where the company identifies and removes the organizational obstacles blocking the implementation of the vision. In the seventh phase, the company searches for bigger goals to ensure that the performance remains improving beyond the achievement of short-term goals. Finally, in the eighth
phase the organization incorporates the achieved changes into its culture, into the company's dominant work style (Kotter, 1996).

**2.5.1.5 Womack and Jones Action Plan**

Womack and Jones (1996) came up with specific sequence of steps and initiatives from getting started to completing the lean transformation. They argue that full lean transformation takes about five years of commitment. The steps will be discussed in the Table 2-4 below;

**Table 2-4: Lean Implementation Framework**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Specific Tasks</th>
<th>Time Frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Getting Started</td>
<td>- find the change agent, get lean knowledge, map value streams, begin radical improvements activities to eliminate waste and expand your scope</td>
<td>6 months</td>
</tr>
<tr>
<td>Creating a New Organisation</td>
<td>- re-organise by product family, create a lean function, devise a policy for excess people, devise a growth strategy, and remove anchor draggers</td>
<td>6 months – 1.5 years</td>
</tr>
<tr>
<td>Install business systems</td>
<td>- introduce lean accounting, relate pay to firm performance, implement transparency, initiate policy deployment, introduce lean learning, and find right sized tool</td>
<td>2 – 3 years</td>
</tr>
<tr>
<td>Complete Transformation</td>
<td>- apply these steps to customers/suppliers, develop a global strategy and transition from top-down to bottom-up improvement</td>
<td>1 year</td>
</tr>
</tbody>
</table>

*Source: Adapted from Womack and Jones (1996)*

**2.5.1.6 Shingo Prize Model**

The Shingo Prize Model is based the lean management approach and model taught by Shigeo Shingo (2008). The mission of the Shingo Prize is to build operational excellence in organisations through the promotion of enduring principles of lean, lean
systems of management and the wise application of lean tools and techniques across the entire organisational enterprise. The model describes three levels of business improvement—principles, systems, tools and equipment techniques. Shingoprise (2008), advocates that the true innovation is not achieved by superficial imitation or the isolated or random use of tools and techniques and systems but instead requires an understanding of underlying principles. The model composed of the following dimensions:

Dimension 1- This has cultural enablers that is leadership and ethics, people development, empowerment and involvement and environmental and safety systems.
Dimension 2 – has continuous process improvement initiatives like lean principles.
Dimension 3 – involves consistent lean enterprise thinking and policy deployment.
Dimension 4 – is all about business results, people development, quality, delivery, cost, financial impact and competitive impact. Organisations have to adapt and move through levels of transformation within each dimension (Shingoprise, 2008).

2.5.2 Key Lean Implementation Considerations

The success of lean implementation is determined by the employees, the organisation and the selected approach (Liker, 2004). Some of the common key lean implementation include; management and leadership, poor deployment methods and people issues. However, among these considerations there are overlaps, and interdependence between these main considerations which will be discussed individually in the following sections.

2.5.2.1 Management And Leadership

Flinchbaugh and Carlino, (1996) maintains that leadership is one key factor that determines lean success of failure. They further elaborate that lean is most successful when implementation is based on social principles behaviour and thinking of leadership. Leadership is ultimately responsible for everything that happens, or fails to happen, in the company. One of the challenges in management is the poor development of the
business case. Unless there is a strong business case for lean, it is very hard for top management to develop the passion and determination necessary to implement it, and the initiative likely will fail. The reduced responsibility of management and empowerment of the employees changes the management’s role from the boss and controlling function to a mentor and supervision’s function (Mehta and Shah, 2004). A powerful way to decrease resistance to change is to increase the participation of employees in making decisions about various aspects of the process (Packard, 1989). The transition from decision making to being a coach for the employees is the lesson that firms need to master in their attempt to adopt lean approach. In order to empower people we should have an organization structure that supports giving more responsibility to lower-level employees as shown in Figure 2-3 below.

**Figure 2-3: Top-Down Leadership Approach**

**Source:** Adapted from Lean Management Resource Institute (2010)
Employee empowerment does not, however, abrogate management’s authority or responsibility. Lean leaders are firm and inspiring, relentless and resilient, demanding and forgiving, focused and flexible. Above all, they have to be smart and highly respected in the organization. These people must be a passionate part of the lean leadership team. Another challenge highlighted by Lewis (2000) indicate that if key influential leaders leave the organisation at an advanced stage of implementation the project is more likely to fail.

2.5.2.2 Poor Deployment Methods

Lean also can fail because of faulty or weak deployment methods. The practise of change management focuses on ensuring that the deployment methods are properly aligned with the business strategy (Kimberly, 2002). Companies must determine ahead of time what core elements are to be deployed and the order of deployment. They also must determine where to start and how lean will expand throughout the operation. Companies can fail by attempting too much or by attempting too little and proper strategy must assign clear responsibilities and show what resources are to be committed. Senior management must have a sufficient knowledge base to provide strong, informed direction. Further, it is difficult to build a proper deployment order and structure without understanding how the elements self-reinforce and contribute to the goals of the company. Crute, Ward, Brown and Graves (2003) highlighted that some firms have failed in their endeavours to turn their organisations into lean enterprises due to their over reliance on experts. There must be a sufficient amount of knowledge among a sufficient number of people for lean to work initially and spread. Further, the expertise must reside with line people as well as staff. The preferred method of gaining expertise is through a combination of formal (classroom) training and on-the-job coaching. Reliance on an outnumbered staff expert who has no line authority to implement lean simply is not realistic (Lareau, 2002).
2.5.2.3 People Issues

Lean manufacturers sincerely view their employees as their most important assets (Womark and Jones, 2004). They actively seek to establish a safe, secure, and fulfilling work environment where workers can flourish. Lean workers are valued for their minds more than their hands. Balle (2005) indicated that people are the soul of lean processes, having the right perspective and attitude towards lean is crucial to successful lean transformation. People for both their personal fulfilment and the benefit of their employer, they are expected to make intellectual contributions on process improvements. The benefits realised from these improvements are recognised to outweigh by far, the costs of establishing such a work environment. The authors Mehta and Shah (2004), highlight that the most important for the organisation is to provide high quality work life, good relations good working environment and good conditions of service. On one side taken by those who point out negative effects of lean such as formalisation, high level of stress to complete task on time and, pressure to produce high quality goods. Many people report a cultural shock when organisation started to implement lean (Czabke et al. 2008). Employees were worried of losing their jobs, but when they gained enough knowledge about the system and its benefits there is an increased positive feeling. Also, Vroom and Yetton (1973), reinforces the need for managers to consider the possibility for employee participation, with the understanding that participation is not always appropriate in the decision making processes as well.

2.6 Sustaining Lean

Sustaining the gains from lean transformations has become a challenge for many organisations that have started the journey (Woods and Robert, 2008). Companies generally experience good initial gains to productivity, quality, staff morale but the majority fail to sustain these improvements in the long term (Shin, Kalinowski and El-Enein, 1998). Hines, Found, Griffiths and Harrison, (2006) also express concern about the sustainability of lean organisations where improvements in productivity are followed by a steady decline to baseline, and sometimes even below baseline levels. In
a relatively short time span, strategies and processes are abandoned and shop floor employees regress to previous methods of working. Several models and frameworks have been developed by many authors to guide companies achieving sustainability. These models will be discussed below.

2.6.1 The 4P Model

There are various authors who have written on the principles of lean implementation. Liker (2004) describes in his book “The Toyota Way” fourteen principles which present the foundation of getting Lean at Toyota Production System (TPS). The author divides these principles into four categories all starting with the letter "P" – Philosophy, Process, People and partners and Problem Solving. This becomes known as so called “4 P” model of Toyota as shown in the Figure 2-4 below.

![Figure 2-4: 4P Toyota Model](source: Adapted from Liker (2004))

From the above figure, the most important aspect is the ability to base management decisions on the long term philosophy of the company. Organisations have failed to sustain lean as they have been dabbling at the Process level without adopting the other
3Ps. This has led to the collapse of the initiative as improvements will not be sustainable through the company (Liker, 2004).

2.6.2 The House of Sustainability
The house of sustainability has five lenses which organisations can be viewed through. It was introduced by Hines et al (2006) addressing constituting of the following lenses, people, technology, processes, leadership, strategy and alignment. The five lens commonly known as ‘house of sustainability’ considered the linkages between the five elements and can be applied at a series of intervention levels. It is only through employing each of these lenses that a truly sustainable business is created.

2.6.3 Sustainable Lean Iceberg Model
Having worked on the house of sustainability Hine et al. (2008) extended this concept into a broader model called the ‘Sustainable Lean Iceberg Model’ as shown in the Figure 2.5 below.

Figure 2-5: Sustainable Iceberg Model
Source: Adapted from Hines et al. (2008)
The iceberg model as shown in the figure above was developed through a research programme which ran from 2004 to 2008 that was designed to extend the focus of lean away from implementation to sustaining it over the medium to long term. Hine et al. (2008) argue that applying lean is best explained by an analogy with an iceberg. They mention that it is generally not what you see that which is above the water line but what you do not see that is more important to sustaining lean. A sustainable lean thinker needs to learn to see and act below the water line as well as above it.

### 2.6.4 Theoretical Framework For Lean Transformation

Found, Baele and Rich, (2006) came up with the theoretical framework which was made up of ten distinct steps to enable successful sustaining business process improvements as shown in Table 2-5 below;

**Table 2-5: Sustainability Framework**

<table>
<thead>
<tr>
<th>Step No.</th>
<th>Description</th>
<th>Tool or Technique</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Recognise the need for change</td>
<td>Environmental sensing</td>
</tr>
<tr>
<td>2</td>
<td>Understand the customer requirements and develop strategy for change</td>
<td>Hoshin Kanri</td>
</tr>
<tr>
<td>3</td>
<td>Clearly communicate the need and strategy for change</td>
<td>Effective communication</td>
</tr>
<tr>
<td>4</td>
<td>Understand current process capability and identify waste</td>
<td>Perception questionnaire</td>
</tr>
<tr>
<td>5</td>
<td>Understand current process capability and identify waste</td>
<td>Value stream mapping</td>
</tr>
<tr>
<td>6</td>
<td>Develop a model of current organisational climate and capability</td>
<td>Synthesis of current state maps and behaviours</td>
</tr>
<tr>
<td>7</td>
<td>Remove waste from current state, create early wins, knowledge transfer and training</td>
<td>5S, training programmes, motivate workforce and gain commitment</td>
</tr>
<tr>
<td>8</td>
<td>Make choices regarding process, technology, polices, employee structure and incentives</td>
<td>Senior management approval</td>
</tr>
<tr>
<td>9</td>
<td>Develop future state</td>
<td>Ideal state mapping</td>
</tr>
<tr>
<td>10</td>
<td>Embedded future</td>
<td>Implement plan, set KPI, and monitor progress</td>
</tr>
</tbody>
</table>

*Source: Adapted from Found et al. (2006)*
From the table above, the authors Found et al. (2006) suggest that business process improvements cannot be a piecemeal as it involves appropriate technology, people management and process routes, all of which must be aligned to the strategy and objectives of change. Skills and capabilities in human, technological and process resources have to be developed, managed and maintained. The change process requires the involvement of the whole organisation; it cannot be a simply top-down approach. It is through operations within this framework that Lean can be sustained.

2.6.5 Lean Management System
Mann (2005) developed the lean management system as a crucial ingredient for sustaining lean transformation and creating a lean culture. The management system consists of four principle elements standard work, visual controls, accountability and discipline. Leader standard work involves having daily checklist for line manager or leaders that state explicitly the expectations and targets for what it means to focus on the process. Visual controls require having charts and other visual tools that reflect actual performance against or compared to expected performance. Daily accountability process are brief structured, tiered meetings that focus on performance with visual action assignment and follow up to close gaps between actual results versus expected performance. Discipline is required amoung leaders themselves consistently following up on others, adherence to the processes that define the first three elements (Mann, 2005).

2.6.6 Analysis Of The Sustainability Models
A comparison of the models discussed above show that there are numerous similarities between these models. The principles discussed in each of these models were grouped under five categories of management, culture, tools and technology, strategy and business process as shown in Table 2-6 below
Table 2-6: Analysis Of Lean Sustainability Models

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Management</td>
<td>People</td>
<td>Leader standard work</td>
<td>Leadership</td>
<td>Make choices regarding process, technology options, employee structure and incentives.</td>
<td>Leadership</td>
</tr>
<tr>
<td>Strategy</td>
<td>Philosophy</td>
<td>Daily accountability process</td>
<td>Strategy and alignment</td>
<td>Recognise the need for change and understand the customer requirements. Develop and clearly communicate the change strategy</td>
<td>Strategy and alignment</td>
</tr>
<tr>
<td>Culture</td>
<td>Problem solving and people</td>
<td>Discipline</td>
<td>Behaviour</td>
<td>Monitor employee perceptions and understanding</td>
<td>Behaviour and engagement</td>
</tr>
<tr>
<td>Tools and technology</td>
<td>Process</td>
<td>Technology</td>
<td>Remove the waste from current system and create early wins that create motivation and involvement</td>
<td>Technology, tools and techniques</td>
<td></td>
</tr>
</tbody>
</table>

Source: Adapted from Murti (2009)
From Table 2-6 above, breaking the models down into five categories help to pinpoint the key themes within each model and make it easier to compare and contrast the commonalities and differences between them. The analysis revealed that the categories covered in the five models are quite similar however; the depth of coverage within each of the categories had greater depth with the recently developed models. Besides Mann (2005), all models discussed the process improvement tools

2.6.7 Critical Success Factors For Lean Transformation
Organisational change is not easy, firstly philosophies need to be changed, roles should be different and responsibilities divided and accepted as such (Baines et al. 2006). This whole process requires truly commitment from the top management. They should be convinced that this is the right thing to do for the success of the organisation and as leaders should continually urge and share values of commitment to everybody within the organisation. Patience for the final results is needed because often the predictions for superior performance miss to take into consideration the exact time horizon of the implementation of lean. It generally takes time for employees to achieve best results in a short term when they need to perform new acquired improvement skills. Czabke et al. (2008) supports the idea that if the entire organisation undergo a lean transformation only then the impact of the lean system could be significant. The underlying key to maximise the success of lean is actually to adopt the culture across all areas of business (Baines et al. 2006). Kettinger and Grover (1995) as also point out that any significant process change requires the following success factors; strategic initiative of top managers, willingness to learn, culture readiness, balanced network relationships, knowledge sharing and prescribed process management and change management practices
However, Motwani (2003), emphasis the need to have dissatisfaction with the current state of the organization, a vision for the future and well-managed change process for corporate transformation to take place. Management needs to be fully committed to lean
implementation and to view the problems they face as opportunities and turn every challenge into a learning experience (Motwani, 2003).

Crute et al. (2003) also came up with five significant factors for implementation of lean that is change strategy targeted and holistic, company’s cultural change, product focus, senior management commitment, and good timing for performance. Womack and Jones (1996) suggest that managers have drowned in techniques as the tried to implement isolated parts of lean system without understanding the whole system. This tentative approach is being adopted mainly as a result of resistance from the employees to the new ideas. However, from the research that was carried out by Achanga, Shehab, Roy and Nelder, (2006), identified four key factors for lean implementation that is finance, leadership, organisational culture, skills and expertise. Other studies carried out by Czabke et al. (2008) indicated that only three elements were important for lean implementation that is communicating the vision at every organisational level, and necessary change in the organisational culture.

2.6.8 Barriers to Lean Implementation

Managers encounter many impediments for improving productivity in their firms and supply chains. Most difficult to overcome is organisational resistance to change and finding the proper means of dealing with it (Mefford, 2009). The Lean approach requires changes not only in the organisational practices but in the philosophy of management that guides it. Another challenge for the management is to actually trust the employees and respect them as an important change factor in the Lean enterprise (Mefford, 2009).

Despite the fact that many researchers (Womack and Jones, 1990; Baines et al. 2006; Crute et al. 2003) claim that applicability of the Lean approach throughout variety of organisations despite of their industry they operate in and countries they are situated, they are some challenges in terms of political and economical instabilities, infrastructure deficiencies and shortage of skilled workers and managers. These factors may degrade productivity and quality standards required for Lean transformation.
The research by Reppening and Sterman (2001) suggest that the inability of most organisations to gain the full benefits of the implementation of an innovation is less connected with a particular technique that is being selected. The roots of the problem lay at the way this improvement programme has been introduced and how the process reflects the whole system. The real problem in implementation is the way the two interacts with the physical, economic, social and psychological structures of the organisation. It is a systematic problem created by the interaction between improvement programme, the employees, equipment and management. Sim and Rogers (2009) came up with three most inherent barriers which have been identified in most organisations that have implemented Lean. The first barrier is Leaders and internal implementers lack the necessary knowledge and vision of Lean concepts and tools to provide required leadership. The second barrier is leader’s inability to create focus and challenged by the need to sustain motivation and required culture change. The last one is counter-productive work structures, reward systems, roles and relationships that limit effectiveness of the organization’s change efforts. Countering the effects of these three barriers is the essence of success in Lean Transformation.

2.7 Conclusion

In this chapter, the researcher provided a critic of the available literature relevant to the subject matter, in an effort to have an informed understanding of the various facets of Lean transformation. In the next chapter the researcher will discuss the research methodology that was used in coming up with the data required for analysis of the problem statement.
CHAPTER THREE: RESEARCH METHODOLOGY

3.0 Introduction
The purpose of this chapter is to indicate what the researcher did in the research in order to fulfil the requirements of the research objectives. It focuses mainly on the research philosophies and strategies that were selected by the researcher. Its main thrust is looking at how the researcher gathered the data, analyses data and the particular reasons of selecting a certain method over others. This entails defining the sampling techniques, the different types of data, introducing and discussing development of research instruments and how data will be processed, analysed and presented.

3.1 Research Philosophy
The research philosophies can be divided into epistemology and ontology. Researchers need to aware of the philosophical commitments they make in choosing a certain research strategy since this has a significant impact on the understanding what is being investigated and how the data is collated (Johnson and Clark, 2006). This means that a research follows the wrong philosophy the systematic knowledge or the truth cannot be ultimately found out. For the purposes of this report, the researcher will discuss both strategies.

3.1.1 Epistemology
Epistemology concerns what constitute acceptable knowledge in a field of study and refers to the relationship between the reality and the researcher (Saunders, Philip and Thornhill, 2007). In this methodology, the researcher sought to discover this reality, and refers to the assumptions about knowledge and how it can be obtained (Hierschheim, 1992). This research approach was used by the researcher in discovering the phenomenon that had besieged Murowa Diamond Mines. The researcher being part of the middle management at the company used his experiences and privileged company
information with regards to company’s operations, in narrating the problems within the organisation as provided in Chapter 1. In effort to come up with the reality, the researcher also used open ended questions to obtain the employee’s own experiences in the organisation. However, there are two approaches to epistemology research that is positivism and phenomenology.

3.1.1.1 Positivism

Positivism refers to working with an observable social reality and that the end product of such research can be law-like generalizations similar to those produced by the physical and natural scientists, (Bless and Higson-Smith, 1995). The researcher assumed the role of an objective analyst through the use of graphs and figures to highlight the problems in the organisation as shown in Chapter 1. The researcher detached and maintained independence when interpretation of data was being done. The quantitative data that was collected was analysed and presented in forms of graphs to clearly highlight the issues arising from the questionnaires.

3.1.1.2 Phenomenology

On the other hand, phenomenology focuses on the social process and how individuals shape and give meaning to the social world. Understanding and interpreting these meanings underpins phenomenological methodology, (Converse and Presser, 1986). Phenomenology is a research approach where social reality is multiple, divergent and interrelated, analysis from the actor’s own perspective, human behaviour is how people define their own world and reality is the meaning attributed to experience and is not the same for everyone, (Finn, Elliot-White and Walton, 2000). A detailed comparison of the two research philosophies is given in the following section.
3.1.1.3 Epistemology Research Philosophies Compared

Easterby-Smith, Thorpe and Lowe, (1991) summarised the key features of what they call paradigms that is two ways of looking at things in Table 3-1 below as follows;

Table 3-1: Key Features Of Different Research Paradigm

<table>
<thead>
<tr>
<th>Basic Beliefs</th>
<th>Positivist Paradigm</th>
<th>Phenomenological Paradigm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>▪ World is external and objective (ontology)</td>
<td>▪ World is socially constructed and subjective (ontology)</td>
</tr>
<tr>
<td></td>
<td>▪ Observers is independent and science is value free (epistemology)</td>
<td>▪ Observer is part of what is observed and science is value – laden (epistemology)</td>
</tr>
<tr>
<td>The Researcher Should:</td>
<td>▪ Focus on facts</td>
<td>▪ Focus on meaning</td>
</tr>
<tr>
<td></td>
<td>▪ Seek causality and fundamental laws</td>
<td>▪ Try to understand what is happening</td>
</tr>
<tr>
<td></td>
<td>▪ Reduce phenomena to simplest elements</td>
<td>▪ Try to examine the totality of each situation</td>
</tr>
<tr>
<td></td>
<td>▪ Formulate hypotheses from theory and test them</td>
<td>▪ Develop ideas via induction from data</td>
</tr>
<tr>
<td>Preferred Methods Include</td>
<td>▪ Operationalising concepts so they can be measured</td>
<td>▪ Using multiple methods to establish different views</td>
</tr>
<tr>
<td></td>
<td>▪ Taking large samples</td>
<td>▪ Investigating small samples in depth</td>
</tr>
</tbody>
</table>

Source: Adapted from Easterby-Smith et al. (1991)

As detailed in Table 3-1 above, positivism is manifested in the processes of proving or disproving hypotheses with quantitative measurement of variables. It is in this respect that the researcher adopted the positivist approach which enabled the researcher to take more informed decisions on the data collection and analysis methods. It enabled the researcher to come up with an objective research as the data analysis was supported with figures.

3.1.2 Ontology

Blaikie (2000) described ontology as claims and assumptions that are made about the nature of social reality, claims about what exists, what it looks like, what units make it
up and how these units interact with each other. In summary, ontological assumptions are concerned with what we believe constitutes social reality. The researcher eliminated subjectivity through the use of operational costs, employee turnover and quarterly production data to show the true reflection of the operational environment for Murowa Diamonds. For the purposes of this research, the researcher will discuss objectivity and pragmatism.

3.1.2.1 Objectivism
This position represents social entities existence in reality to social actors (Saunders et al, 2007). The researcher took Murowa Diamonds as an objective entity and decided to adopt the objective stance to the study of the particular aspects of Murowa Diamonds that could have led to the performance below expected levels. In an effort to substantiate this view, Murowa Diamonds has operating procedures with well defined goals and set targets, and this view assumes that the reason for existence of organisations is the same. What would differ from each organisation might be aspects with regard to structure, organisational procedures but the goal is the same of making a profit.

3.1.2.2 Pragmatism
Mertens (1998) argue that researchers should study that what interests them and of value to them. The results from such studies should be able to bring about positive consequences to the organisation. The researcher made use of theoretical literature and methodological rigor in carrying out the research. In selecting the literature, the theories documented were also weighed for relevance to the subject matter. Thus, the literature was filtered so that it assists in answering the formulated research questions. There was also high level consideration of practical relevance of each theory that was selected. Information that was not valid to the subject matter was rejected and solutions discussed were also tested for practical relevance.
3.2 Research Approaches
The research approach can either be deductive or inductive.

3.2.1 Deductive
Deduction involves the development of a theory that is subjected to rigorous test. As such it is the dominant research approach in natural sciences where laws provide the bases of explanation, permit the anticipation of phenomena, predict their occurrence and therefore allow them to be controlled (Hussey and Hussey, 1997). The researcher sought to test the theories that were put forward by the various authors on Lean. Data collected was meant to test the relevance and practicality of the literature that was put forward by these Lean authors.

3.2.2 Inductive
An alternative to deductive approach is the inductive approach which aims at building theory by studying the occurrence of events in a given social setting (Saunders et al. 2007). This theory is common in research relating to business studies and other social studies. It is subjective and relies on qualitative data. Gill and Johnson (1997) add that deductive is firmly based within the positivist paradigm, whereas inductive approaches exhibit and interpretivist or phenomenological orientation to research. Having said all this, Saunders et al. (2007), point that it is misleading seeing divisions between the two approaches to research. The researcher as a result combined the two approaches that is inductive and deductive, to enrich the research project.

3.3 Research Strategies
Research strategies are many and varied. These range from experiments, surveys, case studies, ground theory, ethnography and action research. Each strategy has specific advantages and disadvantages depending on the type of research question, the control a researcher has over behavioural events and the focus on contemporary as opposed to historical phenomena (Miles and Huberman, 1994). Given the above, the researcher
took cognisance of the fact that each researcher has his own bias. In this instance, this research was based on case studies and survey research strategies.

3.3.1 Case Studies
According to Miles and Huberman (1994), a case study focuses on a phenomenon within a bounded context. Yin (2003) argues that case studies can contribute in a unique way to our knowledge of individual, organizational, social, and political phenomena. Case studies typically combine data collection methods such as archival searches, interviews, questionnaires, and observation (Eisenhardt, 1989). The researcher being part of the management team has been on the ground trying to give solutions to the problems the company is experiencing. In choosing Murowa Diamonds as the case study it allowed detailed and in depth investigation of complex relations among the various operational variables. Murowa Diamonds was selected as it was easy for the researcher to access the data. In addition to this, the researcher found it more prudent to plough back to the company some of the learning’s gained during the degree studies. Choosing a case study research strategy allowed the researcher to have a detailed in depth investigation of complex relations between data gathered from the organisation be it qualitative or quantitative.

3.3.2 Survey Research Strategy
The researcher combined the case study strategies with the survey research strategies. Surveys are popular because they allow the collection of large amounts of data from a sizeable population in a highly economical manner (Saunders et al. 2007). This was beneficial to the researcher as there were time constraints and the limited resources available to conduct the research. The researcher since he had taken a positivist approach, surveys would allow quantitative data to be collect and analysed quantitatively using inference and descriptive approaches. The researcher also had more control of the process and sampling could be easily be done to ensure that it is representative of the entire population.
3.4 Classification Of Research Enquires

Enquries can be classified in terms of their purpose as well as by the research strategy used (Robson, 1993). The classification most often used is in three fold that is exploratory, descriptive and explanatory. Exploratory studies were used in this research in finding out what was happening in Murowa Diamonds; to seek new insights to resolve its current challenges faced by Murowa Diamonds; to ask questions and to assess phenomena in which the organisation finds itself in. The exploratory was also combined with the descriptive and explanatory research enquiry. The objective of descriptive research was to portray an accurate profile of Murowa Diamonds, while explanatory research establishes the casual relationships between variables found in the organisation. The emphasis was to study the problems affecting Murowa Diamonds in order to explain the relationships between variables.

3.5 Triangulation Research Methods

Triangulation occurs when multiple sources from different data collection methods support the same conclusion or, at least, do not contradict it”, (Miles and Huberman, 1994). It is important to note that triangulation was not a technique that was performed after collection but it was into the study before data collection took place. The commonly identified types of triangulation are data triangulation, investigator triangulation, theory triangulation, and methodological triangulation (Miles and Huberman, 1994). The focus of this study was both qualitative and quantitative approach, researching on the strategies for transforming an organisation into a Lean enterprise. Qualitative research methods are sometimes used together with quantitative research methods to gain deeper understanding of the causes of social phenomena, or to help generate questions for further research. Unlike quantitative methods, qualitative research methods place little importance on developing statistically valid samples, or on searching for statistical support for hypotheses (Adams and Schvaneveldt, 1991). However, the quantitative approach is scientific, aims to be objective, collects and uses numerical data. Quantitative research takes the view that it is difficult for researchers to
stand back and be objective since they are really part of the processes being researched (Saunders et al. 2007). These two approaches at times do not exist in isolation and therefore it is the main reason why the researcher mixed and matched and this is the reason why this research is based on triangulation.

### 3.6 Population

Eisenhardt (1989) suggests that the definition and choice of the research population should be related to the way initial research subject was defined. This concept of a population is crucial because it defines the set of entire form from which the sample was drawn from. The study population included all the permanent employees and long term contractors Murowa Diamonds both in Zvishavane and Harare. The long term contractors are employees for other companies working for Murowa Diamonds that is; Tarcon, KW Blasting, Introwise Catering, Capfare Investments and Boltgas Engineering. These contractors are integrated into the systems and due to them being from a different paymaster they are expected to give an independent opinion of the operations at Murowa. Below in Table 3-2 is the population and sample characteristic.

**Table 3-2: Population and Sample Characteristic**

<table>
<thead>
<tr>
<th>Company</th>
<th>Position</th>
<th>Number</th>
<th>Location</th>
<th>Size</th>
<th>Sampling Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murowa Diamonds</td>
<td>Managers</td>
<td>40</td>
<td>Harare</td>
<td>3</td>
<td>Stratified Simple Randomly selected</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Zvishavane</td>
<td>8</td>
<td>Stratified Simple Randomly selected</td>
</tr>
<tr>
<td></td>
<td>Employees</td>
<td>80</td>
<td>Harare</td>
<td>9</td>
<td>Stratified Simple Randomly selected</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Zvishavane</td>
<td>20</td>
<td>Stratified Simple Randomly selected</td>
</tr>
<tr>
<td>Tarcon</td>
<td>Manager</td>
<td>3</td>
<td>Zvishavane</td>
<td>1</td>
<td>Stratified Simple Randomly selected</td>
</tr>
<tr>
<td></td>
<td>Employees</td>
<td>30</td>
<td>Zvishavane</td>
<td>4</td>
<td>Stratified Simple Randomly selected</td>
</tr>
<tr>
<td>KW Blasting</td>
<td>Managers</td>
<td>2</td>
<td>Zvishavane</td>
<td>1</td>
<td>Stratified Simple Randomly selected</td>
</tr>
<tr>
<td></td>
<td>Employees</td>
<td>14</td>
<td>Zvishavane</td>
<td>2</td>
<td>Stratified Simple Randomly selected</td>
</tr>
<tr>
<td>Company</td>
<td>Role</td>
<td>Gender</td>
<td>Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td>------------</td>
<td>--------</td>
<td>-------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Introwise Catering</td>
<td>Manager</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Employees</td>
<td></td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capfare Investments</td>
<td>Managers</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Employees</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boltgas Engineering</td>
<td>Manager</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Employees</td>
<td></td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td></td>
<td></td>
<td>30</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3.7 Data Collection

3.7.1 Sampling

McPhail (2001) defines sampling as a process of selecting a few (a sample) from a bigger group (the sampling population) to become the basis for estimating or predicting a fact, situation or outcome regarding a bigger group. In carrying out this research it was impractical for the researcher to survey the entire population due to the time and resource constraints and hence the need for samples. However, to yield quality data, the researcher ensured that the sample was a representative of the population, and must permit accurate collection of data and all population units had a fair chance of being included. Sampling techniques can be narrowed down to two broad types, namely, probability and non-probability sampling.

3.7.2 Non-Probability (Random) Sampling

Wegner (1993) defines non-probability sampling as any sampling method in which the observations are not selected randomly. In this case, criteria other than randomness are the basis for selecting observations from the population. On the other hand, non-random (non-probability) sampling is such that the probability of each case being selected from the total population is unknown and cannot answer questions that require statistical inferences about the population’s characteristics. The commonly used non probability
sampling methods are quota, judgemental, and convenience. However, for the purposes of this research, non probability sampling methods were not utilised.

3.7.3 Probability (Random) Sampling
Probability sampling includes all selection methods where the observations to be included in a sample have been selected on a purely random (chance) basis from the population (Wegner, 1993). Employing random (probability) sampling ensures that the probability of each case being selected from the population is known and is usually equal for all cases. It is only through the random selection of sampling units from the population to be included in a sample that sampling errors can be measured and, is able to establish the representative nature of the sample drawn. The random selection methods are includes simple random, systematic, stratified, and cluster sampling.

3.7.4 Stratified Simple Random Sampling
The researcher in sampling combined simple random selection methods and stratified random selection methods. In stratified sampling a sub-sample is drawn using a simple random sample within each stratum, (Zigmund, 2003). Wegner (1993) states that stratified sampling divide the population into segments or strata. At the time of constructing the strata the researcher ensured that there was perfect homogeneity in the different units of strata, well defined and free from overlapping. The strata identified were Managers for Murowa Diamonds, Employees of Murowa Diamonds, Management of Contractors and Employees of Contractors.

Each specific number of elements was now selected using simple random sampling methods from each stratum that corresponds to the proportion of that stratum in the population. Simple random sampling ensures that each item in the entire population has an equal chance of being included in the sample (Creswell, 2007). This study shall use probability sampling, specifically, stratified simple random sampling.
3.7.5 Sample Size
In most populations in research, there exists very little similarity among elements and the situation dictates that a subset (sample) of the population be used to estimate the overall responses of a population, (McPhail, 2001). Sample findings in the research will be used to deduce the likely overall behaviour of the variables under study. The size of the sample was governed by a number of factors. The factors which influenced the researcher was the need to have confidence in the characteristics of the data collected that it will represent the characteristics of the total population and margin of tolerable error. The researcher will consider a sample size of 60 elements which can be broken down to constitute 40 elements from Murowa Diamonds employees and 20 elements from the contractors working at Murowa Mine. The response rate of elements or subjects is quite critical when establishing the sample size and one has to estimate the response rate first, (Saunders et al, 2007). At the time of conducting the research, the researcher failed to get the response rate from previous researches conducted. However, Saunders et al. (2007) citing a research by Salant and Dillman (1994) give a benchmark for response rate of questionnaire at between 50 percent and 92 percent.

3.8 Types Of Data
3.8.1 Secondary Research Data
Secondary research conducted in this research was mainly based on historical data. The data used was gathered from various sources which included websites, various textbooks, journals and company documents like business plans, and annual company reports. Zikmund (1998), also reiterates that secondary data gathered should be data that was gathered and recorded by someone else prior to (and for purpose other than) the current project. It is not primarily intended for the study under review. Secondary data collection was inexpensive to collect for the researcher as opposed to primary data.
3.8.2 Primary Research Data

Zikmund (1998), states that primary data is gathered and assembled for a specific research project. There are three major methods of collecting primary data and these are observations, interviews and questionnaires. Setting up the questionnaire is essential for development of a survey research design (Zigmund, 2003). For the purposes of this research the questionnaire research instrument shall be discussed in the following section.

3.8.2.1 Questionnaires

A questionnaire is a research instrument consisting of a series of questions that prompts respondents to give information (Wegner, 1993). The researcher made use of this research instrument as it was easy to administer and it offered standardised answers making it easier to compile the data. In conducting this research, the researcher used a questionnaire as the major research instrument. Data was collected through self administered survey questionnaires as its primary source of information. This research instrument as attached in Appendix 2, comprises of two sections; Section A used to collect demographic data and Section B used to collect data for the research questions. The researcher paid attention to the length and clarity of the questions when preparing research instruments. In Section A simplified questions were designed which required the respondent to tick in the appropriate box. Information that was gathered included the category to which the contractor belonged that is if the respondent is a contractor or Murowa employee. There was also need to know if the responded was a manager (team leader) or an employee (team member). Length of service was important to gather since the understanding of the operational issues in the organisation also depends on the time people have spent in the organisation. It was also important to gather information on which department each responded represented. In Section B, the research objectives had the following questions; Objective 1: 1-Yes/No question, 6 – ranking questions, 5 – Likert question and 1-open ended question were included in the questionnaire. Objective 2: 8 - Likert questions, 1-Yes/No question and 2- open ended questions.
Objective 3: 2–Yes/No questions, 1- True/False question, 5-Likert questions, 5 – ranking questions and 1-open ended. Objective 4: 5-ranking questions, 1-close-ended question, 6-Likert question. Lastly Objective 5: 8 – Likert questions, 5 – ranking questions and 1 – open ended question. As a result, an average of 13 questions was asked on each objective. The researcher had to ensure that all the objectives to the research are adequately covered in terms of the primary data collection. An introductory letter was attached on the questionnaire to introduce the researcher and the motive for carrying out the research (Appendix 1). The deadline as to when the questionnaires should have been completed was also indicated on the questionnaire. Respondents were given contacts of the researcher so that if for any reason they required clarity on any issues they could get in touch with the researcher. Confidentiality was explicitly expressed so that respondents freely give information.

Respondents prefer close-ended questions to open-ended questions since they are simple to answer, (Fraenkel and Wallen, 1996). However, close-ended questions have limited breath of responses, are harder to construct and require more questions to cover the research topic than the open-ended type. Open-ended questions were included to allow respondents to express their views independently. The advantages of these questions were that they allowed more freedom of response, were easier to construct and permitted follow-up by the interviewer. However, the disadvantages were that the responses tended to be inconsistent in length and content across respondents, which made them susceptible to misinterpretation and were more difficult to process (Fowler, 1984).

3.8.3 Pilot Study
Fraenkel and Wallen (1996), claim that the issue of objectivity refers to the absence of subjective judgments. It is important in research to try to eliminate subjectivity from the judgments made concerning the subjects under study. In addressing these key issues about research instruments, the questionnaires were pre-tested before administering them at full to the sample. The aim of doing this was to reveal the ambiguities, poor
worded questions, unclear choices and also to indicate whether the instructions to the respondents were clear. In the pre-test, the questionnaire was administered to ten employees. Question 16 in the questionnaire was found to be ambiguous and had to be reconstructed. Question 21 in the questionnaire had to be changed as well since it was too long and respondents were not be keen on answering such questions.

3.9 Data Analysis, Results And Discussions
Once the fieldwork has been completed, the data must be converted into a format that will answer the decision maker’s questions. When analysing the data collected, the intentions were to find evidence or at least indications to back up or give input to changes in the plan (objectives). Miles and Huberman (1994), present the following three parallel flows of activity to explain the analysis that is data analysis, data display and lastly verification/conclusion drawing. In carrying out data reduction, the researcher codified the responses, entered the data using Microsoft Excel and cleaned it. The purpose of this step was to organise the data so that the final conclusion can be drawn and verified. After entry, the data was cleaned to remove inconsistent responses by running frequency tables in the Statistical Package for Social Sciences (SPSS) version 11. During the coding and analysis the researcher was noting patterns, seeing plausibility and clustering were some of those strategies. Making conceptual/theoretical comparison with the developed theoretical background further enhanced the logic. Also, the follow up on surprises and unexpected occurrences helped assure valid results.

In data analysis and interpretation, frequencies, percentages and mean were used. Data display involved taking the reduced data and displaying it in an organised compressed way so that conclusions can be more easily drawn. The information was displayed using tables, graphs, and charts and testing of hypotheses to enable easy comparison and clear projection of the situation. This was explored in Chapter 4, together with detailed discussions.
3.10 Research Validity Credibility and Reliability

Validity, reliability and credibility are the benchmarks on which research instruments are measured. Fraenkel and Wallen (1996) argue that validity revolves around the “defensibility of the inferences researchers make from the data collected through the use of an instrument”. Moreover, the instruments must always be considered within the context inferences, the researcher makes regarding particular areas or topics. In other words, the researcher needed instruments that would permit him to validate conclusions about the characteristics (perceptions, attitudes, and so on) of the individuals under study. In order to give the reader the ability to make her or his own verdict on the quality of the research conducted, Yin (2003) suggests four tests to be performed. These four tests are designed to assure construct validity, internal validity, external validity, and reliability. In order to achieve construct validity in this research, various techniques were applied. Different data sources (that is MDPL employees and independent contactors) were used to gather information and are documented to allow the reader to judge data quality. Chains of evidence were constructed to illustrate to the reader the logical links between a conclusion and the initial research objective or vice versa. In the methodology and study design chapters all the applied techniques and methods were comprehensively described to allow the reader a better understanding of how the data was analyzed and how conclusions were drawn. To increase internal validity, the researcher used methods such as coding the data and performing pattern matching with the coded data, performing explanation building (another way of pattern matching), or creating time-series analysis of events. In terms of importance, external validity is ranked highest when it comes to evaluating results of a case study, since external validity determines the generalizability of the research findings (Yin, 1994). In an effort to ensure external validity, the researcher came up with recommendations of addressing the objectives useful in resolving the problems affecting Murowa Diamonds.

The second consideration was credibility. The issue of the credibility of research findings shadows the above discussion. Findings should be subjected to the question ‘How do I know this to be true?’ (Eisenhardt, 1989). Although this is always difficult to
ascertain, all that can be done is to reduce the possibility of getting the results wrong and that is the reason sound research designs were used. The researcher throughout this report explained the procedures and further organised the thesis in a way so that any reader or researcher can retrieve any desired material. There is a risk that personal biases might have been present to some extent, therefore the results could be questioned due to the influence from the respondent as well as my own attitudes and values. One of the corner stones in the Lean philosophy is “Continuous Improvement” and by so there is a possibility that over the years the objectives, procedures, techniques and processes might be better and more credible.

The third consideration was reliability. Reliability refers to the stability and consistency of the results derived from research: to the probability that the same results could be obtained if the measures used in the research were simulated (Ferber, 1974). Recognising that threats to reliability exist is paramount in designing research. The researcher, having been part of the organisation, approached the research with a clean mind and removed himself from the current problems being faced by the organisation. The introductory letter on the questionnaire explained the purpose of the research and assured respondents of confidentiality issues. It is however possible those respondents might be stressed by other factors which in turn may alter the results of events. The impression as far as the researcher was concerned was however that the participants were relatively relaxed and enjoyed talking to me and that they really supported the findings.
3.11 **Summary and Conclusion**

Chapter 3 covered the research methodology. It laid out how the researcher is went about doing his research and covers aspects such as procedures, definitions and explanations of techniques used to collect, analyze and present information as part of a research process. The chapter also explains why the researcher opted for the particular research strategy. It also dwells on the research ethics such as honest, accountability, confidentiality which the researcher constantly observed during the process. The researcher having exhausted all data collection tools and techniques shall analyze and evaluate the data in the following chapter. The summarized relationship between objectives, literature review and the research methodology has been attached in Appendix 3 which gives an insight of the study framework. The following chapter will have the results from the self administered questionnaires and this data will be analysed and discussed.
CHAPTER FOUR:
RESEARCH FINDINGS AND ANALYSIS

4.0 Introduction
The following chapter is a presentation of the major findings of the research in a summarised form and details of the analysis which have been performed. The data is obtained from the self administered questionnaires that were sent to the study respondents. The study findings are discussed in relation that was provided in the study. These findings formed the basis on which the study conclusions were made.

4.1 Response Rate
A total of 60 questionnaires were administered to the study respondents, 47 were successfully completed and returned representing a study response rate of 78.3%. Below in Table 4-1 is the response rate.

Table 4-1: Response Rate

<table>
<thead>
<tr>
<th></th>
<th>Sent</th>
<th>Returned</th>
<th>Response Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Questionnaires</td>
<td>60</td>
<td>47</td>
<td>78.3%</td>
</tr>
</tbody>
</table>

From the table above the response rate is high enough to warrant validity of the study findings. This position is also confirmed by the fact that Saunders et al. (2007) in citing Salant and Dillman (1994), came up with a benchmark of between 50-92% as the response rate which could validate the data given.
4.2 Analysis, Results And Discussions

4.2.1 Demographics

4.2.1.1 Employment Category

The figure below, Figure 4-1 presents the research findings on the employment categories of the respondents.

![Figure 4-1: Employment Categories](image)

From the findings in Figure 4-1 above, majority of the respondents (66.0%) were Murowa employees whereas 34.0% were contractor employees. This entails that since majority of the respondents were Murowa Diamonds employees they were in position to provide information as required by the study. Murowa Diamonds employees are more informed of the processes in the organisation and hence would provide valuable information for the study. However, a sizeable number of the contractor employees would bring about the balance that is required by the study as they tend not to be biased and will freely give their opinions. The findings also indicate that there was 19% more team leaders that responded to the questionnaire as compared to the team members as shown in Figure 4-2 below;
As shown in figure 4-2 above, the mix of leaders and team members show that there has been a balance of respondents and thus reduces the element of bias on the research findings. It is obvious that management and employees have different views with regards to any workplace programs and as such it is important to capture their thoughts so that when the workplace program is designed it is able to take into considerations the desires of each workgroup. It therefore entails that capturing their views will result in a wealth of information which will be valid and reliable due to the balance in the respondents as responses were coming from different perspectives in relation to one’s position in the organisation.

4.2.1.2 Length In The Organisation

In Figure 4-3 below are the various years that the respondents have spent working for Murowa Diamonds.
According to Figure 4-3, majority (89%) of the respondents have been with Murowa Diamonds for 1-5 years and 11% have been with the organisation for 6-10 years. Given that the organisation started its operations in 2004 (Murowa Diamonds, 2010) all of the respondents have been with organisation for long now and hence may be aware of the organisational processes in line with lean. Some of the respondents have been with organisation since its inception it would appear and thus may have provided valuable information for the study. Below is the cross tabulation between the employment category and the length of time working in the organisation.

Table 4.2 Cross Tabulation Employment Category: Length In Organisation

<table>
<thead>
<tr>
<th>Employment category</th>
<th>Length In The Organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1-5 years</td>
</tr>
<tr>
<td>Murowa Employee</td>
<td>26</td>
</tr>
<tr>
<td>Contractor Employee</td>
<td>16</td>
</tr>
<tr>
<td>TOTAL</td>
<td>42</td>
</tr>
</tbody>
</table>
The results show that all of the respondents who have been with organisation for 6-10 years were Murowa employees as shown in Table 4.2. Most of the contractors joined the mine in 2005, this is main reason they all have less than five years working at Murowa Diamonds.

4.2.1.3 Departments For The Various Respondents

The Figure 4-4 below show the departments in which the respondents work for at Murowa Diamonds.

![Figure 4-4: Departments](image)

At least 26% of the respondents were from the processing department, 20% were from the engineering department, 17% administration and site services, 10% were from external relations, HSEQ and mining departments whilst 7% were from the commercial/Human resources. The results indicate that the survey managed to cover almost all parts of the organisation and hence eliminating the chances of bias.
4.3.2 Objective 1

4.3.2.1 Familiarity With Lean Tools

4.3.2.1.1 Analysis

The researcher sought to establish if the respondents were familiar with the tools, concepts, and techniques of lean. The findings are presented in Figure 4-5.

![Figure 4-5: Familiarity With Lean Tools](image)

4.3.2.1.2 Results

The results in Figure 4-5, indicate that the majority (89.4%) of the respondents were familiar with the tools, concepts and techniques of lean whereas 10.6% respondents were somewhat familiar. There was no one in the organisation who did not have an idea of what Lean is all about.

4.3.2.1.3 Discussion

The findings reveal that all of the respondents may have heard about lean or are familiar with concepts, tools and techniques of lean. This therefore puts the respondents in a better position to respond to the requirements of the study as they may be familiar with
the concept under study. According to Liker (2004), implementation of a enterprise wide Lean strategy engages the entire organization and enables the firm to leverage every opportunity to improve its overall performance. It if from this perspective that understanding of lean concepts, tools and techniques by the employees at Murowa puts the organisation in a better position to successfully implement it as the employees would be aware of the benefits that are derived from lean implementation.

4.3.2.2 Importance Of Lean Tools To Murowa Diamonds

4.3.2.2.1 Analysis

In this section the respondents were asked to rate the importance of each lean tool to the operations of Murowa Diamonds and the results are shown in Figure 4-6.

![Figure 4-6 Importance Of Lean Tools](image)

**Figure 4-6 Importance Of Lean Tools**

4.3.2.2.2 Results

As indicated in the Figure 4-6 above, Standardised Work was rated 60% very improtant, 5S and Visual Management rated 62% very important, TPM 62% very improtant, TQM 63% very important, JIT 47% very important whilst Continuous Improvement was scored 81% very important.
4.3.2.3 Discussion
Continuos improvement was scored highest by respondents which is a clear sign that people are aware of the value that it brings in Lean. If organisation focus on contnuous improvement they will be able to create cross functional teams to identify wate, encourage consistance performance and eliminate such problems (Cooper et al., 2007). In light of the findings it would appear as if Murowa Diamonds is making efforts in implementing the above tools for organisational improvements. Continuous improvement lead to increased efficiency in organisational processes which in turn would result in cut in operational costs. Visual Management on the other hand is also very important to organisations like Murowa as alluded to in the study findings in that visual tools such as the roadmap communicate the improvement plan and results to the entire organisation. Continuous improvement seeks to continually improve product development and production processes (Womack & Jones, 2003). Implementing Kaizen events help to create a culture of continuous improvements by focusing on solving the cause of the problems, so that they will not happen again. According to Cooper et al (2007) having a culture for and a strong focus on, improvement strategies helps to address constraints and bottlenecks in any sections of the organisation. Kaizen events will help remove the real constraints and will reduce quality variability, encourage consistent performance, and improve safety in the workplace.

JIT was scored lowest when compared with the other Lean tools; in some instances other respondents indicated that they were not sure of where they would place it. The main reason for it being scored lowly is mainly driven by the fact that its importance is mainly emphasised in the manufacturing industries rather than mining since its roots was in assembling plants.

4.3.2.3 Benefits of Lean Implementation
4.3.2.3.1 Analysis
The benefits of lean implementation for Murowa Diamonds are presented in Figure 4-7.
4.3.2.3.2 Results

According to the findings presented in Figure 4-7, the respondents scored the following benefits of Lean as follows, inculcating a performance culture 63% strongly agree, cut in operational costs 55% strongly agree, increased efficiency 67% strongly agree, increased customer focus 67% strongly agree, and safety performance 47% strongly agreed. However, about 20% of the respondents also disagreed with Lean benefits of reduction in operational costs.

4.3.2.3.3 Discussion

The above benefits of lean implementation for Murowa Diamonds which also Cost and Daly (2003) concurs to are that it inculcates a performance culture within the organisation, cut operational costs, increase operational efficiency, customer focus within work teams and improvement in safety performance. In light with the study findings in Figure 4-6, lean implementation help in creating a radical shift in...
organisational performance in that Murowa Diamonds as it strives to become a lean enterprise is committed to continuous improvement throughout the organisation as was said in earlier findings where continuous improvement was rated as very important to Murowa Diamonds by majority of the respondents. Though there are benefits that are accrued by organisations through lean implementation they are authors who are of a different view though acknowledging the benefits presented in Table 4-4 above. Radnor and Boaden (2004) referred lean to the increased autonomy of workers and the intensification of work, which they described as ‘mean production’ or ‘management by stress. They argued that improvement programmes add stress to the organisation, because the work pressure is higher and oppose to investing more time in improvements. Smart, et al (2003) criticise the lean model for achieving efficiency gains through cost reduction at the expense of loss of mission, integrity and failure.

4.3.3 Objective 2

4.3.3.1 Types of Operational Waste At Murowa Diamonds

4.3.3.1.1 Analysis

In this section respondents were asked to rate the most common type of operational waste at Murowa Diamonds on a four point Likert scale and the results are presented in Table 4-3;

Table 4-3: Types of Production Waste

<table>
<thead>
<tr>
<th>Operational Waste</th>
<th>Percentage of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Very Low</td>
</tr>
<tr>
<td>Keeping excessive inventory in the warehouse</td>
<td>14%</td>
</tr>
<tr>
<td>Rectification or rework to suit desired specifications</td>
<td>13%</td>
</tr>
<tr>
<td>Overproduction resulting in chocking the process line</td>
<td>27%</td>
</tr>
</tbody>
</table>
4.3.3.1.2  Results

The Table 4.3 above it is clear that the various types of operational waste exist in the organisation. The only difference is the amounts in which each type of waste is found. Rectification or rework to suit desired specification was rated to be more prominent in the organisation with a total of 64% and this is closely followed by the presence people waiting downstream and upstream for various inputs with a total of 63%. Presence of underutilised people is almost on the borderline with 54% saying its low in the organisation and the other 46% saying that it is high. Overproduction resulting in the chocking of the process stream was rated to be the one which is not common in the organisation.

4.3.3.1.3  Discussion

The results above indicate that over production resulting in chocks in the pocess stream is common in the organisation, this confirms the findings that were discussed in chapter one of the research as it was found that Murowa Diamonds is actually failing to meet the production targets (Murowa Diamonds, 2010). Given the above it is clear that the process stream is actually being starved of material flow. The most common type of production wastes at Murowa Diamonds are rectification or rework to suit desired specifications and people waiting downstream for inputs from upstream processes as most respondents suggested these were very high and high respectively. Rectification or rework to suit desired specifications lengthens the lead time which affects customer
satisfaction in the end. The value stream contains all activities (upstream or downstream) that are required to prepare, to process, and to deliver the product to the customer (Huskins, 2008) thus people waiting downstream for inputs from upstream processes would affect the delivery of products to the customers. However, on the other hand respondents suggested that some of the types of production wastes like keeping excessive inventory, overproduction, over-processing, unnecessary movement, unnecessary transport and presence underutilised people were low at Murowa Diamonds. Excess inventory increases lead times, consumes productive floor space, delays the identification of problems, and inhibits communication. By achieving a seamless flow between work centres, many manufacturers have been able to improve customer service and slash inventories and their associated costs. In light of the above keeping excessive inventory, overproduction, over-processing, unnecessary movement, unnecessary transport, and presence underutilised at low works as strategies for reducing operational waste at Murowa Diamonds hence improves company’s performance in the long-run. Lean Management Resources (2007), came up with the various ways of dealing with these operational waste if they happen to be found in the organisation.
4.3.3.2 Existence of Operational Waste

4.3.3.2.1 Analysis

The respondents were asked to either confirm or deny the existence of operational waste in their own work station, the results were analysed and presented in Figure 4-8 below.

![Figure 4-8: Existence of Waste](image)

**Figure 4-8: Existence of Waste**

4.3.3.2.2 Results

The study findings reveal that majority (72.3\%) of the respondents concurred that there exist operational waste on their own work station, while 27.7\% of the respondents suggested otherwise. Operational waste is all of the non value adding work and its repercussions in the process (delays, excess inventory, etc.). The respondents who suggested that there was operational waste at their work stations identified examples of non value adding activities that resulted in operational waste such as access control procedures (64\%), doing other people’s work (59\%), highly skilled labour in positions of semi skilled labour (52\%), ore feeding above stipulated parameters, unwarranted movement of people and spending time on no productive issue like meetings (56\%).
Discussion

The above results are in line with Buzzell and Gale (2007) who put forward that non-value adding activities are activities that do not add value from the customer’s perspective (they wouldn’t want to pay for it if they knew it was happening) and is not required to run the business; this is everything else that happens in the process. In addition to this, non-value adding activities include fixing mistakes, excessive motion of employees or movement of materials and unnecessary process steps. Below in Table 4-4, is the cross tabulation between the departments each respondent work and the existence of waste.

Table 4-4: Cross Tabulation Department: Existence of Waste

<table>
<thead>
<tr>
<th>Department</th>
<th>Existence of Waste</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Mining</td>
<td>0</td>
</tr>
<tr>
<td>Engineering</td>
<td>2</td>
</tr>
<tr>
<td>Administration and Site Administration</td>
<td>2</td>
</tr>
<tr>
<td>Commercial/Human Resources</td>
<td>0</td>
</tr>
<tr>
<td>Processing</td>
<td>4</td>
</tr>
<tr>
<td>External relations</td>
<td>2</td>
</tr>
<tr>
<td>Health, Safety and Environment</td>
<td>3</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td><strong>13</strong></td>
</tr>
</tbody>
</table>

The Table 4-4 above departments such as Commercial/Human Resources and Mining all of the respondents acknowledge that there is waste in their work areas which require attention. All of the departments there were more respondents who acknowledged existence of waste in the work station except for Processing and Health, Safety and Environment department. It is also important to note that most of respondents were able
to give details of the waste that is found in their workstation as this is the first step of lean transformation and also defining the value stream map (Shingoprize, 2008)

4.3.4 Objective 3

4.3.4.1 Link Between Organisational Structure And Efficiency

4.3.4.1.1 Analysis

![Figure 4-9: Organisational Structure And Efficiency](image)

4.3.4.1.2 Results

Almost all (93%) of the respondents said that there is a link between organisational structure and efficiency whilst an insignificant 7% were of a different view.

4.3.4.1.3 Discussion

Organisational structure is an essential element in lean implementation process and high performing companies are those with a culture of sustainable and proactive improvement efforts. Organisational structures must be able to support the corporate goals and objective (Burnes, 2000). The results as shown in Figure 4-7 above also confirm the theory brought about by Chandler (1962) that structure follows strategy. It is therefore important that if Murowa Diamonds would want to increase its profitability its structure should be able to support such a strategy. Good organisational structure
enhances effective communication within an organisation and that also allows employees at different levels of the organisation to make decisions in relation to their work without really going through many channels. This in turn improves effectiveness and efficiency in organisational processes as problem solving will be done fast. This also leads to reduced time in decision making which quickens process within the value chain system of the organisation.

4.3.4.2 Murowa Is It Efficient or Inefficient

4.3.4.2.1 Analysis

Figure 4-10: Murowa Is Effective Or Efficient

4.3.4.2.2 Results
In Figure 4-10, majority (66%) of the respondents said they consider Murowa Diamonds to be effective or efficient, 29% did not whereas 5% did not know.

4.3.4.2.3 Discussion
In light of the findings above, Murowa Diamond is an effective or efficient organisation. Murowa Diamonds might be exhibiting some of the pointers of effectiveness or efficient like cost effectiveness, meeting customer needs, low levels of waste, short turnaround time and lead time. Efficiency and effectiveness can both
improve speed, on-time delivery, and various other process baselines. Lon Roberts (1994: 19) defines efficiency as to the degree of economy with which the process consumes resources—especially time and money, while he distinguishes effectiveness as how well the process actually accomplishes its intended purpose from the customer's point of view.

4.3.4.3 Departments That Are Bloated

4.3.4.3.1 Analysis

Figure 4.11: Bloated Structure Results

4.3.4.3.2 Results

In Figure 4-11, majority of the respondents (63%) in Figure 4.9 above concurred that there are other departments with bloated structures that are making it difficult to operate efficiently whilst 37% were of a different view.

4.3.4.3.3 Discussion

From the results it can be said that bloated structures are highly inefficient and not results oriented. This is because there will be too many employees in the structure thus promote bureaucratic tendencies hence inefficiencies. Information flow is also affected so are the organisational processes.
4.3.4.5 Characteristics of Murowa Diamonds

4.3.4.5.1 Analysis

The respondents to rate the characteristics of Murowa Diamonds as an organisation on a 5 point Likert scale and the results of the findings are presented in Table 4-5 below:

Table 4-5: Characteristics of Murowa Diamonds

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Percentage of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strongly Agree</td>
</tr>
<tr>
<td>Flexibility within organisation</td>
<td>11%</td>
</tr>
<tr>
<td>Cost effective measures are inherent in its production process</td>
<td>10%</td>
</tr>
<tr>
<td>A sense of urgency and bias for action within the organisation</td>
<td>7%</td>
</tr>
<tr>
<td>Productivity that is driven through people</td>
<td>23%</td>
</tr>
<tr>
<td>Management which is hands on and value driven</td>
<td>17%</td>
</tr>
</tbody>
</table>

4.3.4.5.2 Results

The respondents indicated that they did not agree that the organisation has a sense of urgency and bias for action with 60% of the respondents affirming this. They also scored high on agreeing that productivity is the organisation was through the people (73%).

4.3.4.5.3 Discussion

The characteristics of Murowa Diamonds from the results above include flexibility, cost effectiveness measures inherent in its production process, productivity that is driven through people and management being hands on and value driven. It is also however not conclusive to suggest that the organisation is characterised by a sense of urgency.
and bias for action within the organisation as there appear to be a balance between the
respondents who strongly agree or agree and those who strongly disagree or disagree
who collectively have 50% of respondents respectively. It is also interesting to note that
almost all collectively (96%) of the respondents either strongly agreed or agreed that
Murowa Diamonds’ productivity is driven through people. Murowa Diamonds may be a
people oriented organisation where everyone at whatever level of the organisation is
involved in the production process of the organisation. Involvement of people in
production process can be used as a strategy to reduce resistance within the production
process and hence people buy in when instituting changes that enhances improvements
in productivity in this case lean implementation. This is in line with Reppenning and
Sterman (2001) who noted that much of the literature on the subject has to do with
general change management, and a lot has to do with effective deployment and top
management leadership. While lean, like almost everything else related to business,
relies on the brains, commitment, and energies of people, the causes for the most
common lean failures related to individuals can be summed up in two main categories.
The company might be faced with the lack of middle management buy-in. In light of the
above it therefore implies that productivity improvements within organisations must be
people driven or might face resistance.
4.3.4.6 Relationship Between Organisational Structure And Efficiency

4.3.4.6.1 Analysis

The respondents were asked to rate the statements about the relationship between organisational structure and efficiency in a lean environment.

Table 4-6 Organisational Structure and Efficiency

<table>
<thead>
<tr>
<th>Statement</th>
<th>Percentage of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strongly Agree</td>
</tr>
<tr>
<td>Delayaring, decentralising and downsizing are outcomes of lean</td>
<td>11%</td>
</tr>
<tr>
<td>Delayaring improves communication and coordination between management and employees</td>
<td>27%</td>
</tr>
<tr>
<td>There is a link between the structure of the organisation and the strategy</td>
<td>40%</td>
</tr>
<tr>
<td>The function of management should alter from one of control to leadership</td>
<td>53%</td>
</tr>
</tbody>
</table>

4.3.4.6.2 Results

From Table 4-6 above, respondents rated highly that they agreed to delayering improving communication (87%). In addition to this, they also rated 70% agreeing to the thoughts around delayering as an outcome of lean.

4.3.4.6.3 Discussion

According to the findings in Table 4-6 majority of the respondents either agreed or strongly agreed that delayering, decentralising, and downsizing are outcomes of lean, delayering improves communication, coordination between management and employees, there is link between the structure of the organisation and the strategy, and that the function of management should alter from one of control to leadership. It is also generally argued that use of new HRMPs is part of a broader tendency to reorganize production along the lines suggested by the “lean production” paradigm (Womack et al.
1991). Such paradigm implies, among other aspects, the simplification of the managerial hierarchy, with the elimination of intermediate managerial layers, and the decentralization of decision authority to the hierarchical level where the relevant information resides, so as to exploit localized competencies.

4.3.5 Objective 4
The following sections assess the methodologies that are appropriate for the adoption of lean at Murowa Diamonds.

4.3.5.1 Encouraging Continuous Improvement
4.3.5.1.1 Analysis

![Diagram](image)

Figure 4-12: Encourage Continuous Improvement

4.3.5.1.2 Results
Figure 4-12 shows that majority (50%) of the respondents agreed that encouraging continuous improvement as an appropriate methodology for the adoption of lean at Murowa Diamonds, 33% strongly agreed, 13% disagreed whereas a paltry 4% remained neutral on the issue.
4.3.5.1.3 Discussion

Continuous improvement requires that Murowa Diamonds continually strive to be better through learning and problem solving. Because we can never achieve perfection, we must always evaluate our performance and take measures to improve it. This is also in line with Smart et al. (2003) who put forward that the aim of continuous improvement is to attain levels of performance that are significantly higher than current levels, so the company can attain long-term survival and development. It focuses on process not events. Radnor and Boaden (2004) stated that continuous improvements are based on systematic, incremental, and habitual improvements of processes rather than on breakthroughs and innovative advances. This process requires eliminating error, removing slack, and reducing variation. That is asking everyone to do their jobs and ensure processes that are more effective, efficient, and adaptable. However, taking into account the sentiments by different authors above it would appear as if continuous improvement may be an appropriate methodology for the adoption of lean at Murowa Diamonds. Further, the continuous improvement principle embodies the tools and methods used to improve productivity. The respect for people approach principle embodies leadership behaviour and business practises that must be consistent with the efforts to eliminate waste and business practises that must be consistent with efforts to eliminate waste and to create values for the customers. Hence lean can be regarded as a people driven continuous improvement system that can improve any work process with the ultimate goal of building a learning organisational culture that solves customer problems (Koenigsaecker, 2009).
4.3.5.2 Explaining Decisions

4.3.5.2.1 Analysis

It is evident from above that explaining decisions to those who carry them is an important factor in the implementation of lean at Murowa Diamonds as majority (71%) of the respondents agreed, 10% disagreed, 9% strongly agreed, 7% remained neutral whereas 3% strongly disagreed.

4.3.5.2.2 Results

In light of the study findings, explaining decision to those to carry them out entails that employees would be involved in the decision making of the decisions that would affect their day to activities. This results in employees to feel being part of the decision taken and would certainly work to fulfil what would have been stipulated in the decision. A sense of recognition will be felt on the employees and hence would be committed

Figure 4-13: Explain Decisions

4.3.5.2.3 Discussion

In light of the study findings, explaining decision to those to carry them out entails that employees would be involved in the decision making of the decisions that would affect their day to activities. This results in employees to feel being part of the decision taken and would certainly work to fulfil what would have been stipulated in the decision. A sense of recognition will be felt on the employees and hence would be committed
towards achieving organisational goals or objectives in the case the implementation of Lean. This encourages employees’ buy-in thus lean would be successfully implemented. This also supported by earlier sentiments by Koenigsaecker (2009) who asserted that the respect for people approach principle embodies leadership behaviour and business practices that must be consistent with the efforts to eliminate waste and business practices that must be consistent with efforts to eliminate waste and to create values for the customers. Hence lean can be regarded as a people driven continuous improvement system that can improve any work process with the ultimate goal of building a learning organisational culture that solves customer problems.

4.3.5.3 Encouraging Contributions

4.3.5.3.1 Analysis

Figure 4-14: Encourage Contribution Of All People

4.3.5.3.2 Results

On the same vein majority (57%) of the respondents agreed that encouraging contribution of all the people involved in the job as also an appropriate methodology for the adoption of lean at Murowa Diamonds and 27% strongly agreed to that as shown in Figure 4.-14
4.3.5.3.3 Discussion

This is participatory methodology in which every employee at whatever level of the organisation contributes towards how their duties should be carried out. This gives a sense of ownership to employees on whatever outcome that would have been achieved by the organisation as a result of their involvement. Czabke et al. (2008) put forward that viewing employees as capable and valuable for the organisation is required if the managers want them actively participating in improvement program. They will only contribute to the organisational goals if they believe that these goals are aligned with their own individual interests. Individual characteristics of employees also play an important role for the successful job enrichment. If some people are have unfulfilled dreams of self actualisation and personal achievement they would be motivated to participate in employee engagement programmes. Employees are the most important asset.

4.3.5.4 Employee Empowerment

4.3.5.4.1 Analysis

![Circle chart showing distribution of responses to the statement: "Listen To, Rather Than Talk At Subordinates"]

- Strongly Agree: 47%
- Agree: 23%
- Neutral: 10%
- Disagree: 17%
- Strongly Disagree: 3%

Figure 4.15: Listen To, Rather Than Talk At Subordinates
4.3.5.4.2 Results
According to the study findings in Figure 4-15, most (47%) of the respondents agreed that management should rather listen to than talk at its subordinates as a design of appropriate methodology for adoption of lean at Murowa, 23% disagreed, 17% strongly disagreed, 10% strongly disagreed and 3% remained neutral.

4.3.5.3.3 Discussion
Management should give its subordinates the opportunity to communicate to them on how things should be done rather just giving orders to them. This also gives a sense of belonging to the subordinates and hence is motivated to carry out their duties. In the case of lean implementation given the opportunity to talk to the management on who the process should be implemented lead to the successful implementation of lean at Murowa Diamonds.

4.3.5.3.3 Objective 4 Summary Discussion
Looking at the findings presented in the sections above it can be said that the design of an appropriate methodology for adoption of lean at Murowa Mine should be designed in a way that encourages continuous improvement of processes and thinking of employees, explain decisions to those who carry them out, encourage contribution of all the people involved in the job, listen to rather than talk at their subordinates and also empower employees to make decisions to improve the quality of products and services. All these are aimed at encouraging employee buy-in towards implementation of lean at Murowa and at the same instilling a sense of belonging within employees hence increases employee commitment. On the same note suggested that the Wilson et al. (2008) 3-staged approach as the most applicable methodology for transforming Murowa Diamonds into a lean enterprise as it involves engagement, implementation, and sustainability. These 3 staged approaches are more like the designs that are explained in the previous section hence almost all of the respondents held that the 3-staged approach was very high at Murowa diamonds. In line with findings in the earlier sections the
respondents held that the change agent that is most suitable for lean implementation at Murowa Diamonds is employee from current establishments as is aware of the processes at the organisation and hence knows how best lean can be implemented. Looking at the previous findings the above in consistent with the earlier findings hence hold water.

4.3.6 Objective 5
4.3.6.1 Challenges in Transforming Murowa Into a Lean Enterprise
4.3.6.1.1 Analysis
The following as presented in Table 4-9 are the challenges that were being encountered by Murowa Diamonds in transforming into a lean enterprise.

Table 4-7: Challenges of Lean Implementation

<table>
<thead>
<tr>
<th>Challenges In Lean Transformation</th>
<th>Percentage of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strongly Agree</td>
</tr>
<tr>
<td>Lack of knowledge and implementation know how</td>
<td>20%</td>
</tr>
<tr>
<td>Lack of training on new phenomenon</td>
<td>13%</td>
</tr>
<tr>
<td>Resistance to change</td>
<td>28%</td>
</tr>
<tr>
<td>Lack of management commitment</td>
<td>10%</td>
</tr>
<tr>
<td>Lack of resources for implementation</td>
<td>27%</td>
</tr>
<tr>
<td>Involvement in other projects</td>
<td>17%</td>
</tr>
<tr>
<td>Backsliding to old methods</td>
<td>30%</td>
</tr>
<tr>
<td>No clear benefits known to employees</td>
<td>13%</td>
</tr>
</tbody>
</table>
4.3.6.1.2 Results
From the study findings in Table 4-7 above, most of the respondents pointed out that the main challenges of lean implementation were lack of knowledge and implementation know how (37% agree), resistance to change (28% strongly agree), lack of resources for implementation (30% agree), and involvement in other projects (37% agree). However, from the findings it can be also said that management of Murowa Diamonds is committed to the implementation of lean at the organisation as collectively 10% strongly agreed while 13% of the respondents agreed that lack of management commitment was a challenge towards implementation of lean.

4.3.6.1.3 Discussion
Managers encounter many impediments for improving productivity in their firms and supply chains. Most difficult to overcome is organisational resistance to change and finding the proper means of dealing with it (Mefford, 2009). The Lean approach requires changes not only in the organisational practices but in the philosophy of management that guides it. Lean is new paradigm of how to manage and affect everything that a firm does. These barriers can be overcome with the truly commitment of the management in a long term perspective. It is also important to note that the respondents scored lowly the lack of knowledge of benefits of Lean and management commitment as challenges to Lean implementation. These two facets are the proper ingredient if the transformation process is to be successful. This position is also affirmed by Crute et al. (2003) who also emphasises the need for senior management commitment if the transition to Lean enterprise is to be successful.
4.3.6.2 Aspects for Sustaining Lean in Organisation

4.3.6.2.1 Analysis
In this section respondents were asked to rate the importance of each theme/aspect in sustaining lean transformation.

![Figure 4-8: Aspects of Sustaining Lean Implementation](image)

4.3.6.2.2 Results
As indicated in the Figure 4-8 above majority on average (57%) rated all the aspects of operations as very important in sustaining lean in an organisation.

4.3.6.2.3 Discussion
Organisational change is not easy, firstly philosophies need to be changed, roles should be different, and responsibilities divided and accepted as such. This whole process requires truly commitment from the top management. They should be convinced that this is the right thing to do for the success of the organisation and as leaders should continually urge and share values of commitment to everybody within the organisation. McNeel (2004) supports the idea that if the entire organisation undergo a lean transformation only then the impact of the lean system could be significant. The
underlying key to maximise the success of lean is actually to adopt the culture across all areas of business (Baines et al. 2006)

4.4 Testing Of Research Proposition

4.4.1 Objective 1
Assess the general understanding of Lean principles in improving operational excellence.
The majority of the research findings from the research objective when tested against the research proposition, it appears that all the results support the research proposition as outlined in Chapter 1.

4.4.2 Objective 2
Propose strategies that can be used to remove operational waste at Murowa Diamonds Mine.
The majority of the research findings from the research objective when tested against the research proposition, it appears that all the results support the research proposition as outlined in Chapter 1.

4.4.3 Objective 3
Ascertain whether the bloated or rigid organisational structure is affecting organisation efficiency or effectiveness.
The majority of the research findings from the research objective when tested against the research proposition, it would appear that all the results support the research proposition as outlined in Chapter 1.
4.4.4  Objective 4
Design an appropriate methodology or strategy for the adoption of Lean at Murowa Diamonds Mine.

The majority of the research findings from the research objective when tested against the research proposition, it appears that all the results support the research proposition as outlined in Chapter 1.

4.4.5  Objective 5
To draw up countermeasures to deal with the pitfalls or obstacles in transforming Murowa Diamonds Mine into a Lean enterprise.

The majority of the research findings from the research objective when tested against the research proposition, it appears that all the results support the research proposition as outlined in Chapter 1.

4.5  Summary and Conclusion
In this chapter the data in the self administered questionnaire was presented in a graphical form. Responses were analysed and interpreted to determine if the empirical study supported concepts discussed in Literature Review (Chapter 2). Responses were interpreted in order to evaluate if transforming of Murowa Diamonds into Lean Enterprise would increase profitability. On the basis of these interpretations and presentations, conclusions and recommendations were drawn and these will be presented in the following chapter.
CHAPTER FIVE:

CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

The following chapter shall draw together issues of the research and link back to the aim and objectives which were outlined in the Chapter 1 and Chapter 3. It will evaluate the aims and objectives that were set at the beginning of the research if they have been met. Conclusions are drawn on the key points made in the findings and analysis (Chapter 4). Suggestions are made for further research on areas that require a closer interrogation.

5.1 Conclusions

In response to the research questions outlined in Chapter 1, the researcher came up with the following conclusions

5.1.1 Objective 1

Assess the general understanding of Lean principles in improving operational excellence.

- Lean tools were found to be important to the operations of Murowa Diamonds especially Kaizen (Continuous Improvement), because these contribute towards waste reduction in the organisation.
- Visual management is important at Murowa Diamonds since these visual tools such as road map communicate the improvement plan and results to the entire organisation.
- The benefits of lean implementation at Murowa are that it cuts operational costs, increases efficiency, increases customer focus within the work team and it improves safety performance.
• Standardised work procedures were found to be an important Lean tool as this allows work to be done repetitively a number of cycles without changing the service or product quality.

5.1.2 Objective 2
Propose strategies that can be used to remove operational waste at Murowa Diamonds Mine.

• Value stream mapping was found to be a useful tool in removing operational waste. It allows the organisation to be able to identify the value adding activities, removes redundancies and noise in the system.

• The most common types of production waste at Murowa Diamonds are rectification or rework to suit desired specifications and people waiting downstream for inputs from upstream processes.

• Rectification or rework is one of the major types of waste that requires management attention. This comes as a result of poor or defective quality.

• There is high operational waste at work stations at Murowa Diamonds as a result of non value adding work or activities such as access control procedures or doing other people’s work.

5.1.3 Objective 3
Ascertain whether the bloated or rigid organisational structure is affecting organisation efficiency or effectiveness.

• Organisational structure is an essential element in lean implementation process and a good organisational structure enhances effective communication within the organisation.

• The characteristics of Murowa Diamonds organisational structure are flexibility within the organisation, cost effective measures inherent in the production process and productivity being driven through people.
The relationship between organisational structure and efficiency in a lean environment are delayering, decentralising and downsizing because delayering improves communication, coordination between management and employees. This also leads to a shift in the function of management from one of control to leadership.

5.1.4 Objective 4
Design an appropriate methodology or strategy for the adoption of Lean at Murowa Diamonds Mine.

- Continuous improvement is an appropriate methodology for the adoption of lean thinking and management at Murowa Diamonds.
- The 3–Staged approach was found to be an appropriate methodology for adoption of Lean at Murowa Diamonds. However, this can be used in combination with the other approaches so as to counteract its loopholes as well.
- Management should engage employees, explain their decisions, encourage contribution from employees and empower in decision making processes.

5.1.5 Objective 5
To draw up countermeasures to deal with the pitfalls or obstacles in transforming Murowa Diamonds Mine into a Lean enterprise.

- Challenges in transforming Murowa Diamonds into a lean enterprise are lack of knowledge and implementation know how, resistance to change and lack of resources from implementation and involvement in other projects.
- Management commitment is one of the key pitfalls of lean transformation. It is important that Lean transformation becomes part of the company wide strategy if it is to be sustained.
5.2 Validation of Research Proposition

After testing each research objective against the research proposition it was found that four out of five were in support of the proposition. Given the above statement we can safely conclude that the research confirms the proposition that, “The transformation of Murowa Diamonds Mine into a lean enterprise will reduce production costs for the company, increase production volumes and increase shareholder value”. Therefore the research proposition has been proved correct.

5.3 Recommendations

The study recommends that:

- Management at Murowa Diamonds should explain decisions to those who carry them out and this entails that employees should be involved in the decision making of the decisions that affect their day to day activities.
- Management at Murowa Diamonds should encourage contribution of all people involved since this gives a sense of ownership to employees on whatever outcome that would have been achieved by the organisation as a result of their involvement. This can be done by viewing employees as capable and valuable.
- Management at Murowa Diamonds should listen rather than talk at subordinates because this approach entails that management should give its subordinates the opportunity to communicate to them on how things should be done rather than just giving orders to them.
- Value stream mapping, 5S and Visual Management are tools that can be adopted by Murowa to deal with operational waste
- Murowa Diamonds is likely to derive more benefit by the use of its own employees in implementation of Lean rather than use of a consultant. The use its own employee is likely to increase the ownership of the transformation project.
- It is important that everyone has a deeper understanding of the importance and the need of transforming the organisation into a Lean Enterprise. In so doing
there is need to invest in the training of all the employees so that they can have a
deeper understanding of Lean concepts.

- Employee engagement is one key aspect that management need to continually
work on as it forms the basis of Lean transformation.
- There is no project that can be successful if it is not resourced properly. The
commitment of management can only be seen by the amount of resources
management is keen to put aside for the project. Thus, there is need to have a
full time resources person working on implementation of Lean if its going to be
successful.

5.4 Areas Of Further Study
It is important to note that Lean is a journey and not a destination. The end of the road is
never near. The study recommends a further study on what other factors are affecting
the operational efficiency of the organisation since bloated structures was found not to
be affecting Murowa Diamonds effectiveness or efficiency.
REFERENCES:


Of Manufacturing, Cardiff University, Innovative Manufacturing Research Centre, Cardiff


40. Hines, P And Taylor, D (2000), Going Lean, Lean Enterprise Research Centre, Cardiff


86. **Salant, P & D.A Dillman (1994).** *How to Conduct Your Own Survey,* John Willy & Sons Inc.


APPENDICES

Appendix 1: Introductory Letter

30 June 2011

RE: MASTER IN BUSINESS ADMINISTRATION DEGREE RESEARCH QUESTIONNAIRE

The researcher is a final year student studying for a Masters Degree in Business Administration with the University of Zimbabwe. The researcher is conducting a research which seeks to investigate ‘The strategies for transforming mining organisations into Lean profitable enterprises: A case of Murowa Diamonds Mine 2008 – 2010.’ This topic is an issue of great importance within the Zimbabwean mining industry yet little is currently known about the benefits of lean enterprise.

You are one of a small number of people who are being asked to give your opinion on this issue. The researcher would greatly appreciate it if you could assist by completing and returning the attached questionnaire by 19 July 2011.

If you have any questions you wish to ask or there is anything you wish to discuss, please do not hesitate to telephone the researcher on the following number (04) 746614 ext 510 or email kumbirayi.gaza@riotinto.com.

All information you provide will be totally confidential and will not be disclosed to third parties without your permission. You will notice that your name and address will not appear on the questionnaire and that there is no identification number. This is purely an academic research and all information received will be treated with the strictest of confidentiality.
Thank you in advance for your assistance in this matter.

Yours faithfully,

Kumbirayi Gaza.
MBA Research Candidate.
University of Zimbabwe
Appendix 2: Survey Self-Administered Questionnaire

SURVEY: SELF-ADMINISTERED QUESTIONNAIRE

Instructions To Respondents
This questionnaire is for Murowa Diamonds employees and the long term contractors. Please tick against the response of your choice for each question and write additional information in the spaces provided. There are no wrong or right answers.

Section A – Demographics
1. What is your employment category?
   a) Murowa Employee [ ]
   b) Contractor Employee [ ]

2. What is your position in the organisation?
   a) Team Member [ ]
   b) Team Leader [ ]

3. For how long have you been working at Murowa Mine?
   a) 1-5 years [ ]
   b) 6-10 years [ ]
   c) 11-15 years [ ]
   d) 16-20 years [ ]
   e) Above 20 years [ ]

4. Which department do you work for?
   a) Mining [ ]
   b) Engineering [ ]
   c) Administration and Site Services [ ]
   d) Commercial/Human Resources [ ]
   e) Processing [ ]
   f) External Relations [ ]
g) Health, Safety, Environment and Quality [ ]

Section B – Data Gathering

Objective 1: The following statements refer to the assessment of the general understanding of Lean Principles in improving operational excellence.

5. Are you familiar with the tools, concepts and techniques of Lean?
   a) Yes [ ]
   b) Somewhat familiar [ ]
   c) No [ ]

6. Listed in the table below are the commonly used Lean tools, please could you rate how important is each tool to the operations by ticking in the appropriate box for each statement.

<table>
<thead>
<tr>
<th>No.</th>
<th>How do you rate the importance of:</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1</td>
<td>Standardised work?</td>
<td></td>
</tr>
<tr>
<td>6.2</td>
<td>5S &amp; Visual management (information centres)?</td>
<td></td>
</tr>
<tr>
<td>6.3</td>
<td>Total Preventive Maintenance (TPM)?</td>
<td></td>
</tr>
<tr>
<td>6.4</td>
<td>Total Quality Management (TQM)?</td>
<td></td>
</tr>
<tr>
<td>6.5</td>
<td>Just-In-Time (JIT)?</td>
<td></td>
</tr>
<tr>
<td>6.6</td>
<td>Kaizen (Continuous Improvement)?</td>
<td></td>
</tr>
</tbody>
</table>

7. Please rate how strongly you agree or disagree with the following benefits of lean implementation by ticking the appropriate box for each statement. Use Likert’s 5-point scale with the following key; Disagree Strongly – 1, Disagree – 2, Agree Strongly – 3, Agree – 4 and Don’t Know – 5.
8. In your own opinion what is the general understanding in Murowa Diamonds of Lean as a useful tool in improving performance?

……………………………………………………………………………………………………
……………………………………………………………………………………………………
……………………………………………………………………………………………………

Objective 2: The following statements refer to the strategies that can be used to remove operational waste at Murowa Mine.

9. Using a four-point Likert-type scale, what is the most common type of operational waste at Murowa Diamonds? Please tick in the appropriate box for each statement given below.

<table>
<thead>
<tr>
<th>No.</th>
<th>How do you rate?</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Very Low</td>
</tr>
<tr>
<td>9.1</td>
<td>Keeping excessive inventory in the warehouse</td>
<td></td>
</tr>
<tr>
<td>9.2</td>
<td>Rectification or rework to suit desired specifications</td>
<td></td>
</tr>
<tr>
<td>9.3</td>
<td>Overproduction resulting in chocking the processing line.</td>
<td></td>
</tr>
<tr>
<td>9.4</td>
<td>The presence of unnecessary production steps or over-processing</td>
<td></td>
</tr>
</tbody>
</table>
9.5 | Unnecessary movement or transport employees |  
9.6 | Unnecessary transport or movement of goods. |  
9.7 | People waiting downstream for inputs from upstream processes |  
9.8 | The presence of under-utilised people |  

10. In your own work station is there existence of operational waste?
    a) Yes ☐  b) No ☐

11. If your answer is Yes in Question 10 above, please could you identify two examples of non value adding activities resulting in operational waste in order of importance?
    a) ..........................................................  
    b) ..........................................................

Objective 3: The following statements refer to the assessment whether bloated/rigid structures affect the organisational efficiency/effectiveness.

12. There is a link between organisational structure and efficiency?
    a) Yes ☐  b) No ☐

13. Do you consider your organisation to be effective or efficient?
    a) True ☐  b) False ☐  c) Do not know ☐

14. In your department there are enough people to carry out tasks efficiently?
    a) Enough ☐  b) Somewhat enough ☐  c) Not Enough ☐

15. There are other departments that have bloated structures making it difficult to operate efficiently?
    a) Yes ☐  b) No ☐
16. If your answer is **Yes** in **Question 15** above, in your own opinion which department do you consider as having rigid/bloated structures?

………………………………………………………………………………………………

17. The following statements relate to the characteristics of Murowa Diamonds as an organisation. Using the Likert 5 –point scale below, please rate how you agree or disagree with these statements. Please tick the appropriate box for every statement

<table>
<thead>
<tr>
<th>No.</th>
<th>Murowa is characterized by;</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>DISAGREE</td>
</tr>
<tr>
<td>17.1</td>
<td>Flexibility within the organisation</td>
<td></td>
</tr>
<tr>
<td>17.2</td>
<td>Cost effective measures are inherent in its production process</td>
<td></td>
</tr>
<tr>
<td>17.3</td>
<td>A sense of urgency and bias for action within the organisation</td>
<td></td>
</tr>
<tr>
<td>17.4</td>
<td>Productivity that is driven through people</td>
<td></td>
</tr>
<tr>
<td>17.5</td>
<td>Management which is hands-on and value driven.</td>
<td></td>
</tr>
</tbody>
</table>

18. Delayering refers to the reducing of levels within the organisational structure. Using the Likert 5 –point scale below, please rate how you agree or disagree with the following statements about the relationship between organisational structure and efficiency in a lean environment. Please tick the appropriate box for every statement.

<table>
<thead>
<tr>
<th>No.</th>
<th>Statements</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>DISAGREE</td>
</tr>
<tr>
<td>18.1</td>
<td>Delayaring, decentralising and downsizing are outcomes of lean</td>
<td></td>
</tr>
<tr>
<td>18.2</td>
<td>Delayering improves communication and coordination between management</td>
<td></td>
</tr>
</tbody>
</table>
and employees

18.3 There is a link between the structure of the organisation and the strategy

18.4 The function of management should alter from one of control to leadership

Objective 4: The following statements refer to the design of an appropriate methodology for adoption of lean at Murowa Mine.

19. Please indicate as appropriate the extent to which you agree or disagree with each statement by ticking in the appropriate box.

<table>
<thead>
<tr>
<th>No.</th>
<th>The management at Murowa Mine;</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>DISAGREE</td>
</tr>
<tr>
<td>19.1</td>
<td>Encourage continuous improvement of processes and thinking of employees.</td>
<td></td>
</tr>
<tr>
<td>19.2</td>
<td>Explain their decisions to those who carry them out.</td>
<td></td>
</tr>
<tr>
<td>19.3</td>
<td>Encourage contribution of all the people involved in the job</td>
<td></td>
</tr>
<tr>
<td>19.4</td>
<td>Listen to, rather than talk at, their subordinates.</td>
<td></td>
</tr>
<tr>
<td>19.5</td>
<td>Empower employees to make decisions to improve the quality of products and services.</td>
<td></td>
</tr>
</tbody>
</table>

20. What type of change agent is most suitable for lean implementation in Murowa Diamonds?
   a) Consultant ☐
   b) Employee from current establishment ☐
21. There are various authors that who have come up with different implementation methodologies guidelines. Please could you rate the most applicable methodology for transforming your organisation into a lean enterprise? Use Likert’s 5-point scale with the following key: Very Low – 1, Low – 2, High – 3, and Very High – 4.

<table>
<thead>
<tr>
<th>No.</th>
<th>How do you rate the appropriateness of the following Lean Transformation at Murowa Mine</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>21.1</td>
<td>Wilson et al (2008) came up with the 3-staged approach which involves engagement, implementation and sustainability.</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>21.2</td>
<td>Kobayshi (1995) developed the 20 Keys that is organising, rationalising the system, improvement activities, reduced inventory, quick changeovers, method improvement, zero monitor manufacturing, maintaining equipment, commitment, quality assurance, eliminating waste, empowering employees, training, production scheduling, efficiency control, conserving energy and leading technology.</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>21.3</td>
<td>Hines and Taylor (2000) developed the “Going Lean” concept which had the following objectives understanding customer and value, define value system, eliminate waste, extend value outside the company and strive for perfection.</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>21.4</td>
<td>Kotter (1996) after his research came up with an eight staged processes that is creating sense of urgency, leadership commitment, define vision, communicate vision, identifies and remove obstacles, search for bigger goals and incorporate achieved changes into its culture.</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>21.5</td>
<td>Womack and Jones (1996) came up with an action plan that has the following phases, getting started, creating a new organisation, install business systems and transformation</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>21.6</td>
<td>Shingo (2008) developed the Shingo Prize Model with four dimensions that is, cultural enablers, continuous improvement principles, lean thinking and policy deployment, and people development and business results.</td>
<td>1 2 3 4</td>
</tr>
</tbody>
</table>
Objective 5: The following statements refer to the countermeasures to deal with obstacles in transforming Murowa Mine into a Lean Enterprise.

22. Please could you rate the following challenges of lean implementation that Murowa is likely to be faced with by ticking the appropriate box in the statements below. Use Likert’s 5-point scale as follows; Disagree Strongly – 1, Disagree – 2, Agree Strongly – 3, Agree – 4 and Don’t Know – 5.

<table>
<thead>
<tr>
<th>No.</th>
<th>How do you rate the impact of the following lean challenges to Murowa Mine?</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>22.1</td>
<td>Lack of knowledge and implementation know how</td>
<td></td>
</tr>
<tr>
<td>22.2</td>
<td>Lack of training on new phenomenon</td>
<td></td>
</tr>
<tr>
<td>22.3</td>
<td>Resistance to change</td>
<td></td>
</tr>
<tr>
<td>22.4</td>
<td>Lack of management commitment</td>
<td></td>
</tr>
<tr>
<td>22.5</td>
<td>Lack of resources for implementation</td>
<td></td>
</tr>
<tr>
<td>22.6</td>
<td>Involvement in other projects</td>
<td></td>
</tr>
<tr>
<td>22.7</td>
<td>Backsliding to old methods</td>
<td></td>
</tr>
<tr>
<td>22.8</td>
<td>No clear benefits known to employees</td>
<td></td>
</tr>
</tbody>
</table>

23. Various models that have been developed for sustaining lean in organisation, with each model having different emphasis on the specific theme/aspect of the operation. Using Likert’s 5-point scale as follows; Very Important – 1, Important – 2, Not Important – 3, and Not Sure – 4; rate the importance of each theme/aspect in sustaining lean transformation.

<table>
<thead>
<tr>
<th>No.</th>
<th>How do you rate the importance of the following aspect/theme in sustaining lean?</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>23.1</td>
<td>Management and leadership approaches</td>
<td></td>
</tr>
<tr>
<td>23.2</td>
<td>Strategy</td>
<td></td>
</tr>
<tr>
<td>23.3</td>
<td>Culture of the organisation</td>
<td></td>
</tr>
<tr>
<td>23.4</td>
<td>Business Processes found e.g purchasing process, recruitment, etc</td>
<td></td>
</tr>
<tr>
<td>23.5</td>
<td>Technology &amp; Tools</td>
<td></td>
</tr>
</tbody>
</table>
24. In your opinion, what is the likely pitfall of Murowa Diamonds in its quest to become a lean enterprise?

___________________________________________________
___________________________________________________

END OF QUESTIONNAIRE
THANK YOU FOR YOUR TIME AND EFFORT
## Appendix 3: Summary Concept Of The Research Design

<table>
<thead>
<tr>
<th>Objective</th>
<th>Theory From Literature [Chapter 2]</th>
<th>Secondary Research [Chapter 2]</th>
<th>Primary Research [Chapter 3]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Introduction</td>
<td>2.0 Introduction</td>
<td></td>
<td>3.0 Introduction</td>
</tr>
<tr>
<td>1.2 Background of the study</td>
<td>2.1 General Overview</td>
<td></td>
<td>3.1 Research Philosophies</td>
</tr>
<tr>
<td></td>
<td>2.1.1 Definition of Lean</td>
<td></td>
<td>- positivism</td>
</tr>
<tr>
<td></td>
<td>2.1.2 Shifting From Lean Production To Lean Thinking</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.1.3 Lean Culture</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.1.4 Lean Enterprise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.3 Assess the general understanding of Lean principles in improving</td>
<td>2.2 Lean Principle</td>
<td>1. textbooks</td>
<td>3.2 Research Approaches</td>
</tr>
<tr>
<td>operational excellence</td>
<td>2.2.1 Lean Conceptual Framework.</td>
<td>2. journals of TQM and TPM</td>
<td>- both inductive and deductive</td>
</tr>
<tr>
<td></td>
<td>2.2.1.1 Just In Time</td>
<td>3. journals on lean manufacturi ng</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.2.1.2 Total Productive Maintenance &amp; Total Quality Management</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.2.1.3 Kaizen</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.2.1.4 SS And Visual Management</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.4 Propose strategies that can be used to remove operational waste at</td>
<td>2.3 Operational Waste</td>
<td>1. textbooks</td>
<td>3.2 Research Approaches</td>
</tr>
<tr>
<td>Murowa Diamonds Mine.</td>
<td>2.4.1 Types Of Waste</td>
<td>ii. journals on lean manufacturing</td>
<td>- both inductive and deductive</td>
</tr>
<tr>
<td></td>
<td>2.3.1.1 Dealing With Operational Waste</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.4.2 Value</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.4.2.1 Value Stream Mapping</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>i. textbooks</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ii. journals on lean manufacturing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td>Ascertain whether the bloated or rigid organisational structure is affecting organisation efficiency or effectiveness.</td>
<td><strong>2.4 Organisational Structures</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.4.1 Principles of Organisational Structures</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.4.2 Type Of Organisational Structures</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>2.4.3 Design Of Organisational Structures</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.4.4 Lean and Hierarchical Levels</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.4.5 Organisational Effectiveness And Efficiency</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.4.5.1 Characteristics Of Efficient Organisations.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>a. textbooks</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. journal and other publications on organisational structures</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>c. journals on lean.</td>
<td></td>
</tr>
<tr>
<td>1.6</td>
<td>Design an appropriate methodology or strategy for the adoption of Lean at Murowa Diamonds Mine.</td>
<td><strong>2.5 Lean Transformation</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.5.1 Lean Implementation Methodologies</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.5.1.1 The 3-Staged Approach</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.5.1.2 The 20 Keys</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.5.1.3 Going Lean</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.5.1.4 Eight Staged Approach</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.5.1.5 Womack And Jones Action Plan</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.5.1.6 Shingo Prize Model</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.5.2 Key Lean Implementation Considerations</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.5.2.1 Management &amp; Leadership</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.5.2.2 Poor Deployment</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.5.2.3 People Issues</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>a. textbooks</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. journals and publications on lean</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. journals on organisational behaviours</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. 2 X Open ended questions</td>
</tr>
<tr>
<td>c. 1 X Yes/No Questions</td>
</tr>
</tbody>
</table>

| 3.2  | Research Approaches |
|      | - both inductive and deductive |

| 3.3  | Research Strategies |
|      | - case study strategies |
|      | - survey strategies |

| 3.4  | Classification Of Research Enquiry |
|      | - Part Explanatory |
|      | - Part Descriptive |

| 3.6  | Data Collection Methods |
|      | - Self Administered Questionnaires |
|      | a. 9 X Likert’s 5-point Scale Questions |
|      | b. 1 X True/False Questions |
|      | c. 2 X Open ended questions |
|      | d. 2 X Yes/No Questions |
| 1.7 | To draw up countermeasures to deal with the pitfalls or obstacles in transforming Murowa Diamonds Mine into a Lean enterprise. |
| 2.6 | **Sustaining Lean** |
| 2.6.1 | The 4-P Model |
| 2.6.2 | The House Of Sustainability |
| 2.6.3 | Sustainability Lean Iceberg Model |
| 2.6.4 | Theoretical Framework |
| 2.6.5 | Lean Management System |
| 2.6.6 | Analysis Of The Sustainability Models |
| 2.6.7 | Critical Success Factors |
| 2.6.8 | Barriers To Lean Implementation |
| 1.8 | Conclusion |
| 2.7 | **Conclusion** |
| 3.10 | Summary and Conclusion |