The sustainability of Continuous Improvement (CI) initiatives in an Original Equipment Manufacturer (OEM) paint shop environment

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## CONTENT

1. CHAPTER 1 - INTRODUCTION ........................................................................................................... 1
   1.1. Scope of the study ...................................................................................................................... 1
   1.2. Background ................................................................................................................................. 1
   1.3. Problem statement ..................................................................................................................... 5
   1.4. Research objectives .................................................................................................................. 6
       1.4.1. Primary objective ............................................................................................................... 6
       1.4.2. Secondary objectives ........................................................................................................ 7
   1.5. Research Method ....................................................................................................................... 7
       1.5.1. Research paradigm .......................................................................................................... 7
           1.5.1.1. Positivistic paradigm (quantitative research) ............................................................... 7
           1.5.1.2. Phenomenological paradigm (qualitative research) ................................................. 8
           1.5.1.3. The paradigm of this study ....................................................................................... 8
       1.5.2. The sample ......................................................................................................................... 9
           1.5.2.1. Envisaged sample ....................................................................................................... 9
           1.5.2.2. Sample design ........................................................................................................... 9
           1.5.2.3. The measuring instrument ....................................................................................... 10
           1.5.2.4. Reliability and validity of results ............................................................................. 10
   1.6. Definitions of key concepts ..................................................................................................... 11
   1.7. Outline of the study ................................................................................................................. 14
2. CHAPTER 2 - LITERATURE REVIEW ............................................................................................. 16
   2.1. Background ............................................................................................................................... 16
   2.2. The need for Lean Thinking ..................................................................................................... 16
   2.3. Lean Manufacturing .................................................................................................................. 18
       2.3.1. Historical background of Lean Manufacturing ............................................................... 18
       2.3.2. The nature of Lean Manufacturing ................................................................................. 19
       2.3.3. Lean Implementation ...................................................................................................... 22
       2.3.4. Barriers to successful implementation ........................................................................... 29
1. CHAPTER 1 - INTRODUCTION

1.1. Scope of the study

The study as detailed in this report is performed in the South African (SA) automotive industry and is aimed at outlining key management elements to be focussed on in order to improve and ensure sustainable continuous improvement initiatives in the form of Lean Manufacturing implementation efforts within a paint shop environment.

The organisation being researched is located in Uitenhage which is situated just outside Port Elizabeth (PE) in SA. It is an original equipment manufacturer (OEM) for passenger vehicles and supplies vehicles for both the local and international markets. Further, as part of their business strategy, the organisation also manufactures and supplies automotive parts to the local and international markets.

In this study, emphasis will be placed on issues which need to be addressed in order to effectively sustain continuous improvement initiatives in the form of Lean Manufacturing implementation being pursued within the organisation.

1.2. Background

Being one of the most diverse and rapidly developing industries, the automotive industry has earned itself the reputation as being one the most turbulent and competitive industries in the world (Hill, 2011:502). The author adds that the automotive industry employs millions of people in technologically advanced factories which are scattered around the globe. With these multi-national organisations continuously battling to reduce unit cost, increase product quality and with increased globalization driving them to strive for larger market shares in various countries, they strategize and search for ways to improve their processes and to make their products more competitive and advanced than those of their rivals.

These multi-nationals aggressively engage in cost reduction initiatives in whichever way they can in order to achieve an advantage over competitors. Not only do they focus on internal operations but they drive improvement from their production line to the suppliers to cover a wider value-chain in order to achieve this competitive
advantage. To name a few, these cost reduction attempts include investing in foreign countries which have favourable labour cost with adequate skills, invest in countries which are favourably located and invest in countries which have an abundance of natural resources at low costs. Apart from the above mentioned investments, further attempts include striving for technological change and manufacturing process innovation through investing in automation that allows them to streamline processes, improve process and product stability, consistency and eliminate unnecessary labour related issues.

In today’s automotive business environment, the need to continuously improve the organisation’s processes and product innovation are essential in order to successfully compete locally as well as globally. Organisations therefore invest a lot of time and effort on improvement initiatives that will give them an advantage or edge over their competitors and take them to the next level of performance and innovation.

Apart from the initiatives listed previously, others are implemented in production plants and include improvements such as automating processes, cutting costs on raw materials and improving logistics and processes within the production process. These process improvements are directed and focussed on improving processes within the value-chain, eliminating bottle-necks and at improving the organisation as a whole. Furthermore, in order to become more competitive, organisations undergo a journey of continuously identifying and eliminating waste (muda) in various forms in an attempt to create better flow, cut costs and to streamline and make processes more efficient and thereby increasing profits as well.

Continuous improvement of processes is an essential task for any organisation to remain competitive in the current business environment. The lack of improvement would eventually result in the organisation becoming inefficient and forego business opportunities and growth which would in the end lead to job losses or even the closure of the organisation. Having this happen will result in detrimental consequences for the economy of a country and specifically for the surrounding areas that are dependent on the jobs and income that the organisation generates.

Even though it is directed at placing the organisation as a whole in a better market position, the journey of continuous improvement is not always seen as positive by the various individuals and parties affected. This results in an on-going battle to
establish if these continuous improvement workshops are in the best interest of the workers and the general feeling is that these initiatives that should bring about changes are not always discussed and agreed upon by all parties involved and affected.

Furthermore, when implemented, these continuous improvement initiatives are at times not sustainable in the long run and production line supervision then has to deal with the problems that arise afterwards. Hence the sustainability of improvements becomes a problem which shop floor management must then deal with. This in itself results in a loss in commitment and alignment towards a common goal between senior management, line supervision and group leaders, loss in motivation amongst shop floor workers and even before roll-out of these workshops start, full ownership is not taken by all involved to obtain the required results.

Not having the full support of line supervisors and group leaders can result in investigations and implementation of continuous improvement initiatives being dragged out and even delayed. This in essence leads to a lack of teamwork during current and future workshops of Lean initiatives and creates an uncomfortable feeling for individuals when these initiatives are mentioned. Also, having senior management, line supervision and group leaders not fully understanding why a specific decision had been taken can lead to miscommunication that can contribute to loss in teamwork, commitment and alignment towards a common goal and loss in motivation. This brings us back to the problem of sustainability of improvement initiatives.

At the organisation being studied, the quest for continuous improvement based on process improvements within the production process is visible all around the organisation. Many of these improvement initiatives come in the form of continuous improvement workshops or Kaizen workshop which, at the organisation, is known as KVP Kaskade Workshops. Within these workshops, a specific production area in a production unit is selected and various production and industrial engineering tools such as the ones included within Lean Manufacturing principles or “toolbox” are used to eliminate waste and implement improvements.

The tools used to eliminate waste and to bring about improvements all form part of the 40 Building Blocks of the organisations Production System (Refer Appendix A for
a visual layout of all these tools which form part of the 40 Building Blocks of the organisations Production System). The elimination of waste present in processes is achieved through proper investigation and analysis of a problem. Thereafter the selection and use of the correct tools to improve process efficiency and focus on the removal of non-value adding activities is made.

Currently these KVP Kaskade workshops are held within various production units. The workshops are normally managed by a dedicated support department which has its own practitioners. Individuals, from different departments within the production unit selected for the workshop, are invited to be involved in studying and analysing the identified processes, and from observations made, come up with improvement opportunities to be implemented.

During these continuous improvement workshops, the steps of studying and analysing the selected processes as listed in the paragraph above are followed and solutions are sought or identified which could improve the current state of the process or value chain. This improved state is achieved through the systematic elimination of non-value-adding activities, or various forms of waste, in order to make processes more lean and robust. Therefore, the main focus of these workshops is on finding ways to eliminate waste within the various production facilities or units and by doing so, eliminate bottle-necks and create better production flow within these areas. In return, this will reduce the lead time and improve the value chain and flow in the complete production process as a whole. This can result in the organisation becoming more lean and eventually more competitive within the industry in terms of lead time, unit cost and quality.

The KVP Kaskade Workshop team, however, assumes that everyone is familiar with the intent of these workshops and understands the reasoning and importance behind these initiatives. Normally, very little effort, in terms of proper training and communication, is made to bring the message of continuous improvement of processes across to the shop floor workers being affected and the reason why the organisation is going about this journey of continuous improvement. This results in the non-alignment to a common goal and can lead to miscommunication which could further hamper the success and sustainability of continuous improvement initiatives. Apart from this, if there are ideas and a suggestion raised by the workers during Lean workshops, management is not always sensitive towards their opinions and
worker feedback is seldom taken into account and focussed on within workshops. This indicates a lack of interest in employee ideas, suggestions and opinions which in the end affects participation and teamwork.

Another initiative that is used at the organisation to bring about improvements within the production areas is Problem Solving Teams (PST). This initiative uses shop floor workers as participants and line supervision are tasked to form teams, select a problem and coach the shop floor workers on how to follow a standard methodology to investigate, analyse, formulate actions and execute these actions in order to address the problem. Incentives are given to the winning team in order to motivate participants as well as to stimulate interest amongst other fellow shop floor workers.

Compared to KVP Kaskade workshops, the objective of these PST initiatives is to bring about a mind-set of continuous improvement amongst the shop floor workers and to indicate to them that their ideas are worthwhile, taken into account and can bring about improvements in their direct working environment. Therefore small improvements which make a difference to the shop floor worker’s immediate environment are selected and focussed on.

In order to bring about a common vision, understanding and focus towards a common goal at the organisation, the aim of this study is to highlight to management principles for the sustainability of continuous improvement initiatives in the form of Lean Manufacturing implementation. A further aim of the study is to provide senior management with key elements to focus on in order to ensure that continuous improvement initiatives are implemented successfully and are sustainable.

1.3. Problem statement

Management sees continuous improvement initiatives as a method to improve the value-chain, cut operating costs and increase revenue and business growth. The core asset of the business, which are the shop floor workers, however, feel that these efforts are not in their best interest and are only directed at increasing their work load and reducing the amount of workers within the specific area.

From the top down, line supervision is tasked to focus on the urgent quest to improve the value chain in order to stay competitive and in business. However, by
doing so, they experience pressure from the bottom up, from group leaders, workers and union representatives. These pressures come in the form of reduced employee morale, poor attendance and inconsistent or non-standardised work on the shop floor which directly affects performance in terms of stability, quantity and quality of work performed. Therefore, it becomes a management issue when these initiatives are not easily accepted by the shop floor and union representatives.

Literature reviewed has indicated that most studies on continuous improvement in the form of Lean Manufacturing detail the history and use thereof, and the implementation of tools. Many articles found detail barriers to implementation but none provides principles and key elements to be focussed on before, during and after implementation of workshops in order to ensure sustainability of initiatives. Very few articles are focussed on determining what preliminary and conclusive requirements are needed to ensure the sustainability of continuous improvement initiatives specifically in an OEM Paint shop environment.

Therefore the contribution to the field of Lean Manufacturing in the form of continuous improvement initiatives would be to determine what the main principles and key elements are that affect the sustainability of continuous improvement initiatives at an OEM paint shop environment.

1.4. Research objectives

1.4.1. Primary objective

The primary objective of this study was to identify the main principles that affect the sustainability of continuous improvement initiatives in an OEM paint shop environment. Currently the implementation of these initiatives appears to be executed successfully but the efforts to ensure sustainability thereof appear to be neglected. This, at times, results in initiatives identified during workshops not being sustained and improvements not materialising. Line supervisors are then held responsible to deal with these situations for the non-sustainability of the initiatives and lack of improvements.
1.4.2. Secondary objectives

The secondary objectives of this study are to:

- identify and measure the performance or extent to which each of these principles are present and functional within the organisation. This will identify which principles are more of a concern than others and need attention in order to improve the sustainability of continuous improvement initiatives; and
- identify and provide management with key elements on which to focus on in order to improve the current situation with respect to the sustainability of continuous improvement initiatives in the form of Lean Manufacturing implementation.

1.5. Research Method

1.5.1. Research paradigm

With any study or research conducted, the researcher must have a technique by which he/she will approach the research and collect and analyse data to substantiate statements made. The various approaches used in research to collect and analyse data are referred to as paradigms. Paradigms are viewed as methods or models used to achieve the end result of the study. Discussed below is a brief explanation of two paradigms.

1.5.1.1. Positivistic paradigm (quantitative research)

The underlying belief about reality in positivism is that there is a reality “out there” in the world that exists irrespective of people (Bassey, 1990 cited in Cheng, 2010). Further, that to positivists, reality is objective, and people can accurately describe or explain these objective reality by conducting value-free research. It is furthermore indicated that if strict methodological protocol is followed, research will be free of subjective bias and objectivity will be achieved. As a result, true knowledge gained from data can be verified between independent observers. Alvesson and Skoldberg (2009:16) explain that for positivism, all knowledge comes to us in single-sense data, and theories are just human-made linkages between these single data.

It can therefore be summarised that the positivistic approach relies heavily on experimental and manipulative methods that enforce a gap to exist between the bias
perception of the researcher and the true reality of the study. The paradigm is associated with quantitative methods which generally involve hypothesis generation and testing.

1.5.1.2. Phenomenological paradigm (qualitative research)

The phenomenological paradigm is also known as qualitative research. It can be described as qualitative, subjectivist, humanistic and interpretivist (Collis and Hussey 2003:47). By being more subjective in nature, a qualitative approach requires that the researcher examines and reflects on observations so that an understanding of social and human activities can be gained. Collis and Hussey (2003:60) further maintain that the phenomenological paradigm includes the following methodologies:

- Action research - An approach which assumes that the social world is constantly changing and the researcher and research itself are part of the change;
- Case studies - An extensive examination of a single instance of a phenomenon of interest;
- Ethnography - This stems from anthropology which is a study of people, especially of their society and customs;
- Feminist perspective - Is about change for women and parity with men in society;
- Grounded theory - Methods that are used to describe the world of the person/s under study;
- Hermeneutics - This methodology involves paying particular attention to the historical and social context surrounding an action when interpreting a text; and
- Participative enquiry - This methodology is about research with people rather than on people.

1.5.1.3. The paradigm of this study

The paradigm chosen for this study is both quantitative and qualitative. The quantitative section of the study was performed through making use of a questionnaire that had been self-constructed by taking information from the literature study conducted. This enabled the researcher to obtain information from various participants affected by the sustainability of continuous improvement initiatives.

The qualitative section was completed through conducting personal interviews with individuals at selected leadership levels. This was done to obtain additional
information on the sustainability of continuous improvement initiatives but also to obtain information that can be compared with that obtained through the quantitative approach.

1.5.2. The sample

Sampling is performed when the researcher selects a sample from a predetermined population in order to collect and analyse information. This is then used to formulate conclusions regarding the entire population. The reasoning behind selecting a sample is to make data collection easier, quicker and cheaper for the researcher as compared to collecting data for the complete population. The chosen sample however, needs to be representative.

Below is a discussion of the sample as well as the instruments used to collect and analyse the data for the study.

1.5.2.1. Envisaged sample

The envisaged sample or target population was senior management, line-supervisors and group leaders from various departments within the respective production units (paint shop). All individuals included in the envisaged sample were directly involved in or from a support function within the manufacturing process and were affected by continuous improvement initiatives or workshops that were held.

1.5.2.2. Sample design

According to Collis and Hussey (2003:155), the selection of a sample in a quantitative study is fundamental. When considering sampling methods, there are various types that researchers can use to obtain data but for the purpose of this study, the researcher used convenience and judgemental sampling. The researcher opted for convenience and judgemental sampling because only the employees and management from the organisation and of the specific production unit used for the study were involved.
1.5.2.3. The measuring instrument

Collis and Hussey (2003:17) explain that data collection within a quantitative study is performed with the intent to measure variables or count occurrences of the specific phenomenon in question. For the purpose of this study, a Five-point Likert scale questionnaire was used as a tool for data collection. This Likert scale has five ratings, consisting of the following descriptive measurements;

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

The questionnaire consisted of questions which were aimed at determining the extent to which the main principles identified have an effect on the sustainability of continuous improvement initiatives in the form of Lean Manufacturing implementation (Refer Appendix B for the questionnaire).

Further, to address the qualitative section of the study, interviews were conducted with individuals at selected management levels of the business unit being studied. Individuals selected for interviews were those who were included in the envisaged sample. Questions asked during the personal interviews were based on the main principles but were structured in a manner that encouraged open-ended answers that could be analysed to obtain a more in-depth knowledge on the independent variables.

1.5.2.4. Reliability and validity of results

Questions related to the reliability and validity of research results are inevitable and would be raised by senior management to whom the report will be handed. It is for this reason that the researcher searched for ways and means that would increase the reliability and validity of the research findings in order to address questions that might arise. Through conducting a literature review on methods by which this can be achieved, it was found that when quantitative and qualitative data are used together to analyse the same problem, the reliability and validity of research results can be
improved. The methodology of combining qualitative and quantitative research is referred to as Methodological Triangulation.

Denzin (1978, cited in Jick, 1979:602) defines triangulation as a combination of methodologies in the study of the same phenomenon. By simply collecting different kinds of data on the same issue, researchers can improve the accuracy of their findings or judgements (Jick, 1979:602). The author further confirms that apart from just allowing the researcher to be more confident about the results, other benefits include obtaining a more complete and contextual portrayal of the unit under study, the possibility of uncovering unique variances which could have gone unnoticed and through examining an issue from different perspectives, it brings about a better understanding of the topic being investigated.

In order to ensure the reliability and validity of the results, the researcher made use of both the data obtained from the questionnaire as well as the interviews to attain information that would be analysed and used to formulate the outcome. Questionnaires were handed to each individual personally and the objective of the study was explained by the researcher. Where requested, further information was given on the background of the study and the reasons for the need of performing the specific research.

Furthermore, in order to obtain prompt and un-biased feedback, the researcher requested that the questionnaires be handed back within 1 day. The different management and line-management levels that participated in this study promised that the information provided in the questionnaires and during interviews were relevant and could be used to constructively formulate conclusions and make recommendations for improvement.

1.6. Definitions of key concepts

Batch size reduction: This concept is focused on continuously reducing batch sizes in order to have it as small as possible. The result will be a reduction in the amount of work-in-process inventory (WIP), inventory carrying costs as well as production lead-time and increased inventory turn-over which allows the company to operate profitably at lower margins.
Concurrent engineering: Concepts that make use of cross-functional teams to develop and bring new products to the market.

Convenience sampling: When sampling units are selected to suit the convenience of the researcher, convenience sampling has been applied.

Defects: Waste in the form of non-conforming products that unnecessarily use up resources and increase costs.

Excess inventory: Waste in the form of overproduction which is not required or requested by the customer.

Excess motion: Waste in the form of unnecessary motion that is caused by various reasons such as poor workflow, poor layout, housekeeping etc.

Flow: The direction of the material or products as it moves through the process.

Judgement sampling: When the researcher uses personal judgement alone to select whom he or she considers to be the most appropriate sampling units to include in the sample.

Kanban: A technique for ensuring the systematic flow of material or parts and is normally used to indicate when to re-order, the quantities required, from where ordered and to whom delivered.

Kaizen: Series of activities where teams meet for a short period with the intention to analyse, recommend and create an improvement activity.

Lean Manufacturing: System or methodology for continuously identifying and eliminating waste in all work activities.

Lean tools: Methods or techniques used to eliminate waste and to bring about improvements.

Non-value-added-activities: Waste in the form of activities that do not add value to the end product such as rework and inspection.
Overproduction: Waste indicating that production has produced more than the customer demands.

Pull System: Indicates that one process will demand the material or product from the process before it or the supplier.

Point-of-use Storage: Storage of material at the location where it will be used.

Point Kaizen: Process Improvement through the use of Lean Manufacturing tools.

Set up reduction and Single Minute Exchange of dies (SMED): In order to allow for more frequent changeovers and to increase the flexibility of production. The focus of this technique is on reducing the time to change over from one product to another.

Stability: Ability to consistently produce a product without any stoppages as a result of equipment breakdown, labour unbalances or quality problems.

Standardised work: Documented procedure or method on how to go about doing a certain activity to maintain productivity, quality and safety.

Takt-time: The rate by which the customer demands a product to be produced or available for use in the next process.

Underutilised people: Waste in the form of underutilizing the mental, creative and physical skills and abilities of people.

Work-in-progress (WIP): Work in various stages of the production process which is not in the final or completed state.

Transportation: Waste directed at the unnecessary movement of parts from one point to another.

Total Productive Maintenance (TPM): Maintenance method which makes use of various personnel such as operators, engineers and maintenance personnel to uphold and optimise machine performance.
Total Quality Management (TQM): Quality management system used to continuously improve processes and operations.

Waiting: Waste that highlights the loss of time due to waiting for parts, machinery, information etc.

Work cells: Arrangement of people and/or workstations in a cell (normally U-shaped) in order to achieve better utilization and communication amongst people.

5S Workplace Organisation: Tool for organising and standardising the workplace.

Visual controls: Visual signals that will provide someone who walks into the workplace with an understanding of a condition or situation regarding production schedule, inventory levels, quality, etc.

1.7. Outline of the study

In Chapter 1 the research topic is introduced and a background is provided on the problem or dilemma with which management within the organisation is faced. The researcher introduces his research proposal and indicates how to go about to improve the current situation. Explanations are given on why the proposal is valid and what positive contributions it will bring in solving the management dilemma. Research objectives are stated and the research paradigm, sample and the measuring instrument to be used are briefly explained.

Chapter 2 is concerned with the literature review conducted for the study. It provides the reader with an overall understanding of the research topic and sets the tone for the study by detailing why Lean is important for organisational success and how proper implementation and sustainability of initiatives can bring about improvements in the various operations of the organisation.

In Chapter 3 the researcher broadly clarifies the dependant variable and funnels the discussion to the independent variables identified. The manner in which the independent variables are selected is briefly explained. This is followed by an explanation of the impact the independent variables have on the dependent variable.
Lastly the relationship between the dependent and independent variables are explained and the statements for the study are listed.

Chapter 4 guides the reader through the methodology by which the study was conducted. Within the chapter the research paradigm is explored, the choice of sample explained and the various measuring instruments which were used to gather data is described.

Chapter 5 indicates how information was acquired from the measuring instruments. Also discussed within the chapter is how this information was compared, combined and graphically displayed for analysis purposes.

In the first section of Chapter 6, discussions are held around the findings of the study and the relationships which were highlighted within the various charts are explored and similarities discussed. This is followed by the researcher concluding on the results as well as making recommendations based on the findings on how the business unit can improve the sustainability of continuous improvement initiatives within its operations.
2. CHAPTER 2 - LITERATURE REVIEW

2.1. Background

Even though various techniques to improve production processes do exist and are practiced in industry, the most common and significant approach taken within the automotive industry in order to improve processes, increase market share and to improve margins, sales revenue and increased profitability has been the implementation of Lean Manufacturing. It is therefore important to understand why Lean Manufacturing has been so successful in being the preferred choice for the industry.

In the sections that follow, various aspects of Lean Manufacturing will be explored in order to bring about a better understanding of the concept, shed light on what it all entails as well as to set the tone for the study that follows.

2.2. The need for Lean Thinking

According to Kilpatrick (2003:1), the operating principles of “Lean” originates in manufacturing environments and is now known by a variety of synonyms such as Lean Manufacturing, Lean Production and the Toyota Production System (TPS). The author is of the opinion that there is more to Lean than just the normal process related savings and that the benefits of Lean can be broken down into three broad categories, namely, organisational, administrative and strategic improvements. However, most organisations implement Lean solely for organisational improvements whereas the benefits in the other categories can be equally impressive. The author maintains that those companies that are competent in properly marketing the full impact and benefits gained by Lean initiatives will enable themselves to become more successful in their venture to increase market share.

Shuker (2000) states that the goal of the Toyota Production System (TPS) is to maximise profits by eliminating waste and improving throughput. By reducing waste, the organisation can become Lean and by identifying and eliminating waste from the operations, one can increase profits without raising the price.
According to Alukal (2003:29), Lean is a philosophy of continuously striving to shorten the lead time in a given process between a customer order and the final shipment. This can be achieved through the elimination of all forms of waste. This philosophy of continuous improvement on processes assists firms in reducing costs, cycle times and unnecessary non-value adding activities, resulting in these firms becoming more competitive, agile and market responsive in their competitive environments.

Lean manufacturing, during its implementation, becomes an accepted vehicle for organisational transformation and it brings a basis for disciplined action, clarifies the intuitive knowledge gained from experience, and puts an organisation on the path to improved business results (Shulka, 2005:1). The author continues by indicating that Lean Management in itself is an adaptive system for the continuous improvement of numerous linked processes and that it is important for employees within the organisation to understand the interrelationships between the key elements of Lean Management.

Melton (2005:662) characterises Lean as a revolution and states that it isn’t just about using tools or changing a few steps in the manufacturing processes but rather that it’s about a complete change of the business. This includes how the supply chain operates, how the directors direct, how managers manage and how employees go about their daily work.

Mann (2009:24) is of the view that Lean is more than a cost reduction system and that at its core, Lean is an improvement system for organisations. The author maintains that Lean designs serve both as operational processes and as hypotheses and that it challenges the mind-set that the current design of an operation is the best way to perform these steps or procedures.

The benefits of Lean in non-process industries such as the automotive industry, are well documented. Some of them are decreased lead times for customers, reduced inventories for manufacturers, improved knowledge management and more robust processes (Melton, 2005:663). The author asserts that this makes Lean a very real and physical concept especially for manufacturing and that Lean should be applied to all aspects of the supply chain if the maximum benefits within the organisation are to be sustainably realized.
The discussion above dealt with the general thinking behind Lean. In the discussion that follows, the concept of Lean Manufacturing will be explored in more detail. Its history and the need for its existence will be unravelled and the elements and methodologies used to bring about improvements will be unpacked. Substance will be given to why these initiatives, if implemented correctly, are important for organisational success and also why barriers to implementation exist. Further, a brief discussion will be given of why the implementation of Lean Manufacturing at times does not bring about sufficient results or is even unsuccessful.

2.3. Lean Manufacturing

2.3.1. Historical background of Lean Manufacturing

Lee (2003:2) maintains that Taiichi Ohno and Shigeo Shingo developed Lean Manufacturing at Toyota over a period of 20 to 30 years and that their intention was not to develop some sort of “Unified Field Theory” for all manufacturing operations but simply to solve Toyota’s specific production problems. Ohno’s ideal production system, inspired by Henry Ford, was a series of adjacent workstations, balanced and synchronized with no inventory between stations and delivered finished products to the customer exactly when needed, and drawing materials Just-in-Time (JIT). Lee (2003:2) is of the opinion that understanding the history and background of Lean Manufacturing in terms of its development over the period of 20 to 30 years as well as the development of the tools to solve specific problems, can assist in implementing Lean Manufacturing.

According to Jacobs and Chase (2008:225), the term Lean Manufacturing originates from the JIT production concept pioneered in Japan by Toyota and that it gained worldwide prominence in the 1970’s. Some of its philosophy, however, can be traced to the early 1900’s in the United States where Henry Ford used JIT concepts when he streamlined the moving assembly lines to make automobiles. Furthermore, although elements of JIT were being used by the Japanese industry as early as the 1930’s, it was not fully refined until the 1970’s when Taiichi Ohno of Toyota Motors used JIT to take Toyota’s cars to the forefront of delivery and quality.

Melton (2005:662) maintains that contrary to the belief of the Western world, the need for the Japanese inventing Lean Production or the Toyota Production System
(TPS) was based upon the desire to produce a continuous flow which did not rely on long production runs to be efficient. Rather, it was based on the recognition that only a small fraction of the total time and effort to process a product added value to the end customer.

According to Gryna (2001:434), Lean Manufacturing is the process of creating manufacturing systems in such a way that it reduces unnecessary costs by eliminating non-value-adding-activities. These activities include producing defective products, holding excess inventory, excessive internal and external transportation of products, excessive inspection, and idle time of equipment or workers.

In summary one could conclude that Lean was founded in Japan but many of the principles thereof were already practiced elsewhere in the West and that these principles were simply altered and improved in order to resolve the situation in which Toyota was. As indicated above, these principles were developed to solve Toyota’s specific problems and were modified and refined over several years to a point where it is now known as the Toyota Production System (TPS) or Lean Manufacturing.

2.3.2. The nature of Lean Manufacturing

Fellows (2002:2) states that on its own, Lean is only a label under which very effective business principles and practices have been collected and disseminated. For those organisations that have struggled with the reality that Lean delivers to an organisation, the cognitive human changes are subtle, almost imperceptible, but unbelievably effective in improving the bottom line.

Lean is more than just a kit of tools to improve flow and quality (Mann, 2009:25). It is a business philosophy, and to be effective over the long run, discipline is essential. The author further states that every leader must spend some of his or her time focusing on the adherence to the Lean process, and noting the improvement opportunities such focus reveals.

Foster (2004:83) states that there are two views on Lean Manufacturing. The first is that it has a philosophical view of waste reduction and secondly, a systems view that Lean is a group of techniques or systems focused on optimising quality processes. When these views are combined, Lean Manufacturing can be defined as a
productive system whose focus is on optimising processes through the philosophy of continuous improvement.

Jacobs and Chase (2008:225) have a similar perspective of Lean and describe it is an integrated set of activities designed to achieve production using minimal inventories of raw material, work-in-progress, and finished goods. The authors further assert that Lean production also refers to a focus on eliminating as much waste as possible and that motions that are not needed and unnecessary processes and excess inventory in the supply chain are targets for improvements during the “Lean”ing process.

According to Kilpatrick (2003:1), Lean initiatives are directed at eliminating the eight types of waste which are commonly known as non-value-adding activities. These wastes are:

- overproduction: producing more than what the next operation or customer requires;
- waiting: time lost due to waiting for material;
- transportation: movement that is unnecessary;
- non-value-added-processing: work elements that do not add value to the product or service;
- excess inventory: added stock caused by overproduction;
- defects: non-conforming products;
- excess motion: unnecessary movements in the process; and
- underutilised people: people not used to their full capacity.

Kilpatrick (2003:2) explains that in order to reduce or eliminate these different types of waste, Lean practitioners utilize many tools or Lean building blocks. The author continues by indicating that the most common building blocks are Pull Systems, Kanban, Work Cells, Total Productive Maintenance, Total Quality Management, Point-of-use-storage, Quick Changeover, Batch Size reduction, 5S Workplace Organisation, Visual Controls and Concurrent Engineering.

Alukal (2003:30) is in agreement with Kilpatrick regarding the elimination of the eight types of waste and indicates that the continuous reduction and elimination thereof results in surprisingly large reductions in costs and cycle times. The appropriate root
cause analysis of each of these eight wastes will allow one to come up with the appropriate Lean tool to tackle the causes thereof.

Roper (2002:1) indicates that obtaining success through Lean Manufacturing is often defined as the existence of a "kaizen culture" within the organisation where Lean tools are effectively applied by enthusiastic employees to eliminate waste every day. The following points characterise a kaizen culture:

− extensive knowledge of, and success with, the tools of Lean manufacturing;
− ability to apply the tools every day to improve operational performance without overt management direction; and
− knowledge of where to apply the tools, or a process for continuously refocusing on problems and opportunities.

Lastly, Pieterse (2010:2) defines Lean as a systematic way of designing or improving a process or value stream that eliminates waste; improves quality, reduces costs, delights customers, improves employee satisfaction and increases safety. Further, the purpose of Lean is to satisfy customers through faster, cheaper, and better quality products or services and that it is achieved through the relentless reduction of waste or non-value-adding activities to create a smooth flow of products.

To summarise the literature from the various authors and to conclude on this section, Figure 1 has been constructed to illustrate Lean as theory.

![Figure 1](image-url)
Figure 1 above illustrates a model for Lean Manufacturing theory. During Lean workshops, practitioners and team members involved in the process are focussed on searching for and reducing waste which are present in the current processes of the organisation. This occurs when a specific work area is selected and these individuals physically go to the production line, focus on the specific process or area and observe what is happening. Once the area has been studied and the different types of waste identified (indicated by the blue block on the left of the model), practitioners can move onto investigating and analysing the causes of this type of waste. These steps are shown by the green circular arrows that indicate the cycle of investigation and analyses.

After the investigation and analysis have been completed, the practitioners and team members should shift on from the identification, investigation and analyses phase to the selection of improvement tools. This shift is represented by the orange arrows which are pointed towards the right-hand-side. At this point the practitioners and team members start searching through the Lean “toolbox” (represented by the red block) to find the most appropriate tool or tools to be used in order to analyse the types of waste and to solve discrepancies in the process.

After improvements have been realised and in the spirit of continuous improvement, the Lean team then moves on to another process or simply revisits the same process in order to identify, investigate, analyse and achieve further improvements. This notion of continuous improvement is indicated by the blue arrow that moves back from “Lean Toolbox” to “Types of Waste”. At this point, a new workshop will be held and the process will repeat itself.

2.3.3. Lean Implementation

Shuker (2000:110) maintains that to reduce waste, one needs to have the cooperation of employees but for that, managers must understand and be unswervingly committed to the idea and methods of the TPS. Any initiative to put Lean Manufacturing to work will fail if managers are not unflinchingly determined to make it work. Managers must first know what’s going on in the company and the best way this is done is by means of first-hand observations and involvement on the shop floor. This first-hand observation is referred to as Genchi Genbutsu.
According to Fellows (2002:1), Lean disciplines require persistence in the face of adversity, and a positive behavioural change throughout the organisation. It is imperative that during the phases of Lean implementation, active listening becomes a valued work habit rather than a conscious ‘to do’ and that barriers to thinking at all levels of the organisation begin to shrink and local initiative replaces unthinking compliance.

Many companies today are repeating the mistake of the past when they attempt to implement Lean without accounting for social issues (Lathin and Mitchell, 2001:40). The authors maintain that in the past, quality improvements were only achieved after companies implemented comprehensive change management programs such as Total Quality Management (TQM) that addressed both social and technical aspects of quality management. The authors continue by stating that Lean methods will yield promised benefits where the characteristics of the existing social system are capable of supporting and sustaining the new technical system. Lathin and Mitchell (2001:40), however, indicate that where there is misalignment between the social and technical subsystems, the implementation of Lean methods can be problematic and promised economic gains may not materialise.

Mann (2009:15) indicates that people often equate “Lean” with the tools that are used to create efficiencies and standardize processes but highlights that implementing tools represent at most 20 percent of the effort in Lean transformations and that the other 80 percent of the effort is expended on changing leaders practices and behaviours, and ultimately their mind-set. Senior management has an essential role in establishing conditions that enable 80 percent of the effort to succeed.

Mann (2009:16) continues by indicating that senior leaders play a central role in Lean Management and that their contributions are essential in:

− developing and implementing structures and processes that anticipate and respond to the difficulties of a Lean initiative that crosses internal boundaries;
− transforming commitments to change into actual change, supporting and sustaining new behaviours and practices;
− increasing the odds that process improvements survive the transition from project mode to on-going process;
establishing and maintaining new, process-focused measures alongside conventional measures of results; and

creating conditions in which a sustainable Lean culture of continuous improvement can develop.

Pieterse (2010:181) is of the opinion that a big danger in the implementation of Lean is that it is regarded as a set of tools and that one simply has to utilise the tools one by one to achieve implementation. The author highlights the following basic implementation criteria that need to be fulfilled in order to make implementation successful:

- ensuring that management is committed to change;
- obtaining operator buy-in;
- proper communication; and
- Lean training.

Kilpatrick (2003:1) indicates that although individual components or building blocks of Lean may be tactical and narrowly focussed, one can only achieve maximum effectiveness by using them together and applying them cross-functionally through the production system. Successful practitioners recognise that although most of the Lean Building Blocks can be implemented as stand-in programs to eliminate waste, few have significant impact when used alone. Additionally, the sequence of implementation affects the overall impact and that implementing some of the tools in the wrong way may actually produce negative results.

Paitkowski (2008:1) is of the view that what practitioners are forgetting is that one needs to have a total understanding of all Lean processes in order to successfully implement the program and that one needs to have the right people involved in the implementation. The author continues by indicating that one cannot expect long-term results by rushing the implementation or not investing in training and indicates that many companies initiate training activities and attempt to implement different aspects of Lean looking for a quick fix.

Krichbaum (2007:2) is of the view that a great start does not make a great finish and in order to finish well, a company needs to transform its culture. The author advises that paying attention to the following 10 lessons will maximize the opportunity to finish well:
motivated management: without demand from top management, Lean efforts will fail;
expert guidance: find someone who has been through Lean deployments before;
full time Lean: form a Lean implementation team to build a Lean culture and one will see immediate results and long term improvements;
Just-In-Time training: incrementally change the culture of the organisation;
move decision making to the production floor: management cannot make all the decisions;
do not wait too long to establish a Total Productive Maintenance (TPM) system;
get rid of the “Concrete Heads”; especially those in management;
establish a Lean Deployment team (steering committee);
follow up: Lean only begins when the project is “complete”; and
shift the activity to the production floor immediately.

Krichbaum (2007:4) further points out that it is critical to get everyone tuned into the upcoming efforts and the reasons why the Lean journey is being taken. The production lines are normally staffed with skilled workers with years of experience working in a specific culture and on the products sold and that managers must take the time to listen and truly discuss the issues with employees. Only then will gains be quickly made, trust built and relationships formed. The author feels that in order to be successful at transforming the company and its culture, it is necessary to have good oversight which can be provided by an oversight or deployment team which is composed of managers and executives of the various functions. This team would provide the primary mechanisms for the management of the Lean efforts, and they are to ensure that Lean techniques and values are displayed and supported in each functional department.

Lastly, Krichbaum (2007:7) comments that continuous improvement workshops are the most often practiced methodology for the implementation of Lean Manufacturing and that Lean success comes from how one thinks about the business and how one acts when improvement opportunities arise. Many kaizen workshops conclude with action items undone, bringing about the notion that nothing has really changed. It is important that people see that the Lean philosophy has changed operational practices. In order to increase the success of Lean deployment, the following four follow-up rules are recommended:

success depends upon on-going, two way communication with the operators;
operators are the customers of the Lean projects;
follow-up on action items immediately following projects is how culture change is effected; and
follow-up builds confidence towards Lean deployment.

Shulka (2005:2) indicates that in the quest to attain “flow” with “zero” waste, organisations are falling short on the people management aspect of Lean implementation. The people who are actually responsible for sustaining Lean programs are relegated to the background, not well managed and that their importance in the Lean journey to success is ignored and misunderstood. The author indicates that this often leads to variable and unpredictable process improvements and business results that can’t be maintained. Focusing on the people issues helps organisations solve the Lean puzzle.

Shulka (2005:3) continues and highlights that Lean projects typically focus on one or more concerns regarding customer service, flexibility, cost, cycle time, and quality. The ultimate concern may be to improve business profitability and this can be accomplished by improving the performance of the processes that constitute an organisation’s activities. Since people work within an organisation’s processes, one needs to improve the performance of both processes and people to gain any substantial and sustainable advantage.

Taken from the literature above and summarised in the Table 1 below are the key elements that define the requirements for successful Lean Manufacturing implementation. These elements have been divided into six main principles, namely, Engagement/Commitment, Ideas/Suggestions, Communication, Training and Leadership. These principles have been chosen as such because it best summarises the information as detailed in the literature. Listed within each of these principles are the key elements that assist in further describing them.
<table>
<thead>
<tr>
<th>Principles</th>
<th>Key elements</th>
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| Engagement/commitment | – Have the right people involved in the implementation process.  
– Leaders must understand and be committed to the idea and methods of the TPS and Lean;  
– In order to improve commitment by others, follow up must be done on Lean implementation after the project is completed;  
– Leadership must display persistence in the face of adversity;  
– Leadership must reinforce the Lean culture;  
– People must see that the Lean philosophy has changed operational practices;  
– Everyone must continuously be tuned into the upcoming efforts of the Lean journey; and  
– To improve Lean implementation, focus on the people pieces. |
| Ideas/suggestions | – Leaders must listen to the ideas that come from workers involved in the workshop;  
– Leaders must listen to the ideas of those working in the respective process;  
– Leadership must practice active listening as a valued work habit rather a conscious ‘to do’; and  
– Leaders must take time to listen and truly discuss the issues with employees because only then will gains be quickly made, trust built and relationships formed. |
| Communication | – Leaders must be able to communicate and make possible their steadfastness to Lean;  
– Leaders must get everyone tuned into the reasons why the Lean journey is being taken;  
– Leaders maintain two way communications with the operators;  
– Leaders must have good oversight of the Lean efforts;  
– Leaders must ensure that Lean techniques and values are displayed and supported in each functional department; and  
– Lean success comes from how we think about our business and how we act when improvement opportunities are confronted. |
- Implementation of Lean is not just a set of tools and simply implementing them one by one will not achieve full implementation;
- Although individual components or building blocks of Lean may be tactical and narrowly focussed, one can only achieve maximum effectiveness by using them together and applying them cross-functionally through the system;
- It is important to note that the sequence of implementation affects the overall impact of the Lean workshop;
- Leaders and employees has to have a total understanding of all Lean processes in order to successfully implement the program;
- For long-term results, Lean implementation should not be rushed;
- For long-term results, organisations should invest in long-term training;
- It is important that Leaders must first know what’s going on in the company by first-hand observations and involvement on the shop floor (Genchi Genbutsu);
- For Lean deployment, implementing tools represents at most 20 percent of the effort in Lean transformations and that the other 80 percent of the effort is expended on changing leaders’ practices and behaviours, and ultimately their mind-set;
- For expert guidance, find someone who has been through Lean deployments before; and
- To improve or achieve sustainability, incrementally change the culture of the organisation.

<table>
<thead>
<tr>
<th>Training</th>
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<tbody>
<tr>
<td>- Form a Lean implementation team to build a Lean culture;</td>
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<tr>
<td>- Establish a Lean Deployment Team (Steering Committee);</td>
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<tr>
<td>- Move some decision making and activity to the production floor; and</td>
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<tr>
<td>- To effect culture change and to build confidence towards Lean deployment, follow-up on action items immediately following projects.</td>
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</table>
Leadership must drive positive behavioural change throughout the organisation;
- Leadership must learn from mistakes and take into account social issues;
- To achieve quality improvements, leadership must implement comprehensive change management programs such as Total Quality Management (TQM) that address both social and technical aspects of quality management;
- Leadership has an essential role in establishing conditions that enable that 80 percent of the effort to succeed;
- Leadership must be able to bridge the gap between Lean tools and Lean thinking;
- Leadership must note that even brilliant use of tools without changes in culture rarely produces lasting change, or even lasting improvement;
- Leadership must note that successful sustained Lean conversions often involve changes in culture;
- Lean requires a change in leadership behaviours and practices and implies a change in what leaders reinforce; and
- Lean efforts will fail if there is no commitment from top management.

<table>
<thead>
<tr>
<th>Leadership</th>
<th>Elements required for Lean Manufacturing implementation</th>
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<tr>
<td></td>
<td>2.3.4. Barriers to successful implementation</td>
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<td></td>
<td>Lathin and Mitchell (2001:40) indicate that the biggest barriers hindering the adoption of Lean Manufacturing are the beliefs, norms and values that comprise the mass production mind-set. The authors maintain that this can sabotage the right-sizing of technology required to become a Lean producer and that without careful consideration of the existing social system, barriers may arise that slow or hinder various aspects of Lean production implementation. The author's stress that some social factors will be obvious to the casual observer, but many will not be and that they will surface at critical points in the implementation process, causing added and unexpected chaos during and already demanding roll-out. Latin and Mitchell (2001:42) continue by highlighting that the trick is to anticipate the social barriers</td>
</tr>
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before they arise and plan for managing them during the technical system design. The following are potential obstacles to Lean implementation, according to Lathin and Mitchell (2001:43):

- a mass production mind-set;
- people’s need for autonomy;
- a lack of real-time information for shop floor production and inventory management;
- sales bonuses that create spikes in end of month demand for goods;
- piece rate pay systems;
- feelings of high status among technical specialists that make them resist cooperation with factory floor personnel;
- a bigger is better “mind-set” applied to technology;
- a full utilisation mind-set or belief that machines and people must always be busy; and
- barriers, such as individualism, individual reward systems, lack of a competitive spirit and multiple job classifications.

Melton (2005:663) stresses that the two biggest problems with the application of Lean to business processes are the perceived lack of tangible benefits and the view that many business processes are already efficient. These perceptions are the following:

- there are many tangible benefits associated with Lean business processes. A Lean business process will be faster and as most business processes are linked to organisational supply chains, this can deliver significant financial benefits to a company.
- many business processes may appear very efficient. The application of Lean Thinking however forces one to review the whole supply chain in which the business process sits, and this frequently reveals bottlenecks and pockets of inefficiency.

Melton (2005:664) continues by indicating that although the principles and tools associated with Lean thinking may appear at face value an easy concept to use within an apparently willing industry, they present huge ‘change’ challenges to any business truly wishing to become Lean. The author further states that perhaps the biggest resisting force for the process industries will be the huge inertia that must be overcome, namely, the resistance to change.
Figure 2 below illustrates a force field diagram that shows some of the drivers and resistors within the manufacturing sector of the process industries.

![Force Field Diagram]

In Figure 2 above, the author elaborates on the specific driving forces as well as the resisting forces to Lean Manufacturing. These driving forces are represented by the “Forces supporting Lean” as displayed on the left-hand-side of the figure whereas the resisting forces are represented by the “Forces resisting Lean” displayed on the right-hand-side. When the forces termed “Forces supporting Lean“ are greater than the forces termed “Forces resisting Lean”, will positive change towards being a Lean organisation occur.

Regarding barriers to successful implementation, Kilpatrick (2003:4) identified several difficulties that companies experience. These difficulties include:

- failure to tie improvements made to financial statements that would represent a monetary value or measure;
– implementation of building blocks in the wrong sequence which in the end creates the perception that Lean implementation is not meant for the organisation;
– choosing a difficult or low-impact project on the first attempt which perhaps is not as successful and results in a decline in future support;
– overlooking administrative areas with the mind-set that Lean implementation will have little impact on these areas;
– the perception that the organisation spends too much money on training and not on doing or implementing what has been learnt;
– due to Lean’s dependence on JIT delivery, failure to expand Lean initiatives to the supply chain will greatly diminish the benefits of Lean initiatives or make them seem non-existent;
– due to the impact that Lean has on every function within the organisation, it causes discomfort and many companies are not able to cope with the magnitude of change;
– due to the turn-over of managers and decision makers in organisations and taking into account the time frame that is associated with fully understanding and implementing Lean, change in management many times result in the program being scrapped; and
– the concepts being taught in Lean are different to those that managers, accountants and decision makers were taught resulting in disagreements and mistrust.

Smalley (2005:1) indicates that insufficient leadership and resources and a lack of commitment are a few of the most common reasons for the lack of progress in Lean implementation efforts but most profoundly, that stability in manufacturing operations is found to be more transpiring in industry. Smalley (2005:2) regards stability as being the general predictability and consistent availability of manpower, machines, materials, and methods (4M’s) and to achieve basic stability, one must concentrate on these four key elements.

Krichbaum (2003:2) stresses that motivation for success in Lean implementation must come from the top, because in most cases middle managers do not have the influence to change the culture. The author continues by indicating that most of the Lean concepts aren’t difficult to grasp and that the obstacles to Lean are cultural and not intellectual or technical. This means that training needs to be delivered in short
bursts immediately followed by a workshop in order to let the event become the training or learning means.

Regarding resistance to change, Krichbaum (2003:5) maintains that workers on the shop floor feel threatened by the changes brought about by Lean and that as waste and bureaucracy are eliminated, some will find that little of what they have been doing is adding value. To address this and to make sure the individuals on the shop floor understand the seriousness and permanence of Lean changes, it is recommended that one makes sure they understand that their negative views on Lean are viewed as their desire to cease employment at the firm.

In summary, the following are the key issues mostly stressed by the various authors above as being barriers to successful implementation of Lean Manufacturing initiatives:

- the perception or mind-set that the mass production approach to production is the best;
- the need for autonomy amongst the workforce and technical specialist who normally resist to cooperate or work with others;
- the belief by management that people and machines must be working and busy all the time;
- the notion by management and supervision that all business processes are already efficient and that one should not tamper with what works;
- the normal resistance and/or difficulty to adapt to change that comes about with Lean deployment;
- failure by workshop individuals and management to link improvements made to financial gains for the organisation;
- failure to achieve good results due to the building blocks being implemented in the incorrect sequence during workshops or that the incorrect project is chosen which results in low support from management;
- the perception that too much money is spent on training related to Lean Manufacturing rather than performing work to achieve savings;
- failure to expand Lean initiatives to the supply chain which results in diminishing the benefits of Lean initiatives implemented in the organisation;
- motivation for success in Lean implementation must come from the top; and
- attempting to implement Lean initiatives while the current process is not stable.
2.3.5. Requirements for successful implementation

Roper (2002:1) states that anyone who has been involved with Lean Manufacturing for any period of time has probably concluded three things:

- once demonstrated, Lean concepts are relatively easy to understand;
- with support, Lean concepts and tools are relatively easy to apply; and
- no matter what, Lean concepts and tools are difficult to sustain and expand once implemented.

According to Roper (2002:1), Lean success is often defined as the existence of a "kaizen culture" in which Lean tools are effectively applied by enthusiastic employees to eliminate waste. This level of Lean success requires incredible focus and discipline over an extended period of time (50 years for Toyota), extraordinary management leadership, vision and commitment, and enlightened corporate leadership. Unfortunately, most organisations lack charismatic and committed leadership capable of driving such a change by force of personality alone. Such organisations need a more structured process for achieving the discipline and focus necessary for Lean success.

Alukal (2003:33) states that proper planning, implementation management, good change management practices and integration of Lean into the overall business strategy are the keys to obtaining enduring success with Lean deployment. The author further states that senior managers should take an active role and place focus on the following points for Lean implementation to be successful:

- undertaking a planned approach to Lean implementation rather than single point solutions;
- providing needed resources;
- appointing Lean champions;
- empowering and involving employees and emphasizing teamwork and cooperation;
- having good communication channels – both top-down and bottom up;
- managing expectations, such as fear of loss of jobs;
- making sure everyone understands the need for change, as well as their new roles as change is implemented;
creating an atmosphere of experimentation, a risk taking environment and a safety net for trial and error;

- offering good rewards and recognition programs, suggestions systems and gain sharing;

- introducing a performance measurement system based on meeting company goals;

- analysing and sharing of cost versus benefit information; and

- emphasizing everyone’s accountability.

Mann (2009:24) highlights that one must not expect a Lean process conversion to be complete once implemented. The author indicates that the urge to revert back to old habits, conflicting priorities and practices elsewhere in the organisation, and the deliberate sensitivity to faults designed into Lean processes, make a Lean conversion an exercise that should be continuously checked and reviewed. Mann (2009:24) continues by stating that Lean designs require attention to the faults, their root causes, and root cause corrective action. Temporary patches will transform into permanent fixtures, the design degrades, and practices revert to the way things have always been done.

Mann (2009:25) stresses that Lean conversions require a consistent Lean management approach and to sustain Lean success, the organisation requires a change in mind-set and behaviour among leadership, and then gradually throughout the organisation. The author continues by indicating that Lean success occurs when senior leaders put appropriate structures and processes in place and get personally involved in sustaining the Lean conversions, learning Lean, and developing other Lean thinking leaders throughout the enterprise.

According to Shuker (2000:110), managers should encourage their employees to identify ways to eliminate waste, reduce cost and enhance job security. Investment in the form of communication, on-going training, involvement and motivation are important because unmotivated employees will ultimately fail.

In conclusion and based on the literature above, the following issues are necessary requirements for successful Lean implementation:

- a strong focus and drive on discipline by management over an extended period of time;
− good communication channels both from the top-down and bottom up;
− making sure everyone understands the need for this type of change within the organisation and the competitive reasons for and benefits of Lean for the organisation as well as for themselves;
− emphasizing to those involved and affected by the new roles and everyone’s accountability as change is implemented;
− teamwork, cooperation, empowerment and involvement of employees in improvement initiatives;
− Lean champions with extraordinary management leadership, vision, commitment, and enlightened corporate leadership should be appointed;
− making everybody understand the competitive reasons for and benefits of Lean for the organisation as well as for themselves;
− proper planning, implementation management, good change management practices and integration of Lean into the overall business strategy are the keys to obtaining enduring success with Lean deployment;
− creating an atmosphere of experimentation within the organisation in order to let individuals feel free to take calculated risks but ensure a safety net for trial and error;
− establishing programs such as rewards, recognition and suggestions programs systems, performance management and gain sharing for employees;
− in order to sustain Lean success, the organisation requires a change in mind-set and behaviour among leadership, and then gradually throughout the organisation.
− to be effective over the long run, discipline is essential;
− managers must encourage employees to identify ways to eliminate waste, reduce cost and increase profit; and
− managers must enhance job security and investment in the form of communication, on-going training, involvement and motivation.

2.3.6. The sustainability of Lean initiatives

Mann (2009:16) maintains that for an enterprise-wide Lean initiative to be sustained, leaders at three organisational levels must play complementary roles. In Figure 3 below, the author shows the three levels of management and how the areas of primary contribution and tasks are given.
As shown in the Figure 3 above, the author suggests that effective Lean leadership comes from the top as well as from lower levels in the organisation. In Figure 3, each row represents the leaders at the respective organisational level as well as their contributions. The columns on the other hand provide detail on the three levels of management as well as the contribution and tasks at each management level. Mann (2009:17) explains that post-mortem discussions of unsuccessful Lean implementations often blame the initiative’s collapse on a failure to adhere to the Lean design at lower levels.

Mann (2009:17) explains that critiques of tools indicate that even the brilliant use of tools without changes in the culture of the organisation rarely produces lasting change, or even lasting improvement. The author continues by indicating that in an organisation, the most important source of reinforcement is leadership and that successfully sustained Lean conversions often involve changes in culture and a change in leadership behaviours and practices. Furthermore, most Lean conversions fail to deliver the promised benefits or hold initial gains and this mainly results from the mistaken belief that Lean is a cost reduction system, and once implemented, brings permanent improvement (Mann, 2009:25).

Alukal (2003:34) is of the opinion that many managers have found that the three essential ingredients for successful Lean sustainability are:

- sustained, hands-on, long-term commitment from senior management;
- training for all employees in the Lean building blocks; and
– good cultural change-management during the transformation from the traditional push to the Lean pull mentality.

Concluded from the literature above, the following points are seen as necessary requirements for the sustainability of Lean initiatives:

– leaders at the different levels within the organisation should assist each other and their roles should overlap in order to assist and complement each other;
– regarding leadership, a change in culture and leadership behaviour and practices is required to ensure successful and sustained Lean initiatives;
– sustained, hands-on and long-term commitment towards Lean initiatives is required from senior management; and
– continuous training for all employees in the Lean Manufacturing principles, building blocks and tools.

2.4. Summary

The chapter above focussed on the various aspects of Lean Manufacturing. The aim of the section was to provide the reader with an understanding of the importance of Lean for organisations, why Lean Manufacturing is required and how proper implementation and sustainability of initiatives can bring about improvements in the various operations of the organisation. Furthermore, it should set the tone for the chapters that follow in the sense that the research topic will now be better understood and that the intent of the research will be viewed more clearly.

Sections in the chapter were concluded with a summary of the key elements raised by the authors. These key elements will be grouped together and used in the chapters that follow.
3. CHAPTER 3 – HYPOTHESESIZED MODEL

3.1. Background

In this chapter the primary and secondary objectives of the study will be clarified. This will be followed by an explanation on how these objectives will be achieved and how information obtained will be used to provide management with constructive feedback on how to improve their current operations. The conceptual framework and theoretical model of the study will be explained and the statements of the study will be declared.

3.2. Primary objective

Given the manner in which continuous improvement initiatives are being implemented, and not necessarily sustained thereafter in the OEM paint shop environment, the primary objective of this study was to show management the main principles that affect the sustainability of continuous improvement initiatives. The identification of these principles was the first step towards addressing the dependent variable for this study which is the sustainability of continuous improvement initiatives in an OEM paint shop environment.

This objective was achieved through consulting various literature sources which were concerned with continuous improvement initiatives regarding Lean Manufacturing. Information obtained was then summarised and filtered from it was the principles that need to be focussed on in order to ensure the sustainability of continuous improvement initiatives.

3.3. Secondary objectives

Given the primary objective, the secondary objectives for the study are to:

- measure the performance or extent to which each of these principles were present and functional within the organisation; and
- identify and provide management with key elements on which to focus in order to improve the current situation with respect to the sustainability of continuous improvement initiatives.
In order to measure the presence and functionality of these key principles within the organisation, measuring instruments were constructed. These instruments were handed to various individuals as indicated in the envisaged sample. The results were analysed and used to draw conclusions and make recommendations for management in order to improve their operations with respect to the sustainability of continuous improvement initiatives.

3.4. Conceptual framework/model

The conceptual framework of the study followed the thinking process that the sustainability of continuous improvement initiatives in an OEM paint shop environment can be improved through placing focus on principles that are present. Views from authors listed in the literature study were summarised and grouped into six main principles.

Filtered from the literature, the principles which are seen to be important to the successful implementation and sustainability of continuous improvement initiatives are as listed below:

- engagement or buy-in of all parties affected;
- suggestions and ideas from all parties affected;
- communication prior, during, and after implementation;
- training of all parties affected;
- teamwork initiatives; and
- leadership requirements.

These principles represent a summary of the important points as raised by the various authors given in the literature and for the purpose of the study, is considered the benchmark to ensure the successful implementation and sustainability of continuous improvement initiatives.

3.5. Theoretical model

The objective of the research is to provide to senior management the principles on which to focus on in order to improve the current situation with respect to the sustainability of continuous improvement initiatives. This is theorised to be improved by focussing on the six main principles which have been filtered from the literature.
Therefore, it is indicated that the main principles which are seen to be important for the successful implementation and sustainability of continuous improvement initiatives are as listed below:

– engagement/commitment or buy-in of all parties affected;
– suggestions and ideas from all parties affected;
– communication prior, during and after implementation;
– training of all parties affected;
– teamwork initiatives; and
– leadership requirements.

As previously stated, the aim of the study was to determine the effect that the independent variables have on the dependent variable. This entails then that the aim of the study would be to determine the effect that the six main principles as detailed above have on the sustainability of continuous improvement initiatives.

The following were the statements of this study that had to be confirmed.

S1: The engagement/commitment or buy-in of all parties affected by continuous improvement initiatives has an effect on the sustainability thereof.

S2: The consideration and use of suggestions/ideas from all parties affected, especially shop floor workers, has an effect on the sustainability of continuous improvement initiatives.

S3: Providing detailed communication prior, during, and after continuous improvement initiatives to all parties affected has an effect on the implementation and sustainability thereof.

S4: Providing proper training and information to all parties affected by continuous improvement initiatives has an effect on the implementation and sustainability thereof.

S5: Positive teamwork initiatives and culture prior, during and after continuous improvement initiatives have an effect on the sustainability thereof.

S6: Ensuring that the proper type of leadership is involved in the continuous improvement initiatives has an effect on the sustainability thereof.

The theoretical model for the sustainability of continuous improvement initiatives in and OEM paint shop environment is summarised in Figure 4.
Figure 4. Theoretical model for the sustainability of continuous improvement initiatives in an OEM Paint Shop environment

As illustrated in Figure 4 above, the main principles that affect the sustainability of continuous improvement initiatives (dependant variable) are the independent variables.

The independent variables for the study represent both the primary and secondary objectives. As indicated in Figure 4 above, the primary objective was to identify the main principles that affect sustainability of continuous improvement initiatives. The secondary objectives were therefore to measure the performance or extent to which

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Secondary objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1: Engagement/commitment</td>
<td>Measure presence and functionality of these principles within the organisation</td>
</tr>
<tr>
<td>S2: Ideas / Suggestions</td>
<td>Identify key elements to improve the sustainability of continuous improvement initiatives</td>
</tr>
<tr>
<td>S3: Communication</td>
<td></td>
</tr>
<tr>
<td>S4: Training</td>
<td></td>
</tr>
<tr>
<td>S5: Teamwork</td>
<td></td>
</tr>
<tr>
<td>S6: Leadership</td>
<td></td>
</tr>
</tbody>
</table>

Sustainability of continuous improvement initiatives in an original equipment manufacturer (OEM) paint shop environment

Feedback to management in order to improve operations

Measuring Instruments

Draw conclusions and make recommendations based on findings

How?
these principles are present and functional within the organisation as well as to identify elements to improve the sustainability of continuous improvement initiatives.

Measuring instruments in the form of questionnaires and personal interviews were used to measure the presence and functionality of these principles within the organisation (independent variables). Based on the findings, conclusions and recommendations were made. As shown in Figure 4 above, recommendations made was then handed to management in order to improve operations.

3.6. Summary

In this Chapter, the researcher broadly discussed the research topic, clarified the dependent variable and funnelled the discussion to the independent variables. This was followed by an explanation of the impact the independent variables have on the dependent variable. Lastly, the relationship between the dependent and independent variables were explained and the statements for the study listed.

The chapter that follows introduces the reader to the paradigm chosen for the study, the envisaged sample considered as well as a discussion of the two measuring instruments used to gather information from participants.
4. CHAPTER 4 – RESEARCH METHOD

4.1. Background

In this chapter, the researcher explains the steps followed to assess the extent to which continuous improvement initiatives are sustainable within the paint shop. This was achieved through the use of two different measuring instruments, namely a self-constructed questionnaire and personal interviews.

Questions detailed in the questionnaire focussed on various principles and elements that were highlighted in this study by the researcher as being important. Interviews were also held with production group leaders and supervisors. Questions asked were focussed on the principles as detailed in the questionnaire and the responses brought about additional information that was combined with the information obtained from the questionnaires.

In the sections that follow, a discussion is given on the research paradigm, sample size and why it was specifically selected, how the measuring instrument was constructed as well as how information obtained was used in order to provide constructive feedback to management. The discussion of the results and conclusion and recommendations are included in chapter 6.

4.2. Research paradigms

The paradigm chosen for this study was both quantitative and qualitative. Firstly, through the use of a questionnaire, the researcher was able to obtain information from the various participants in the paint shop that are affected by the implementation of continuous improvement initiatives. Concurrent to this, the researcher conducted personal interviews with different individuals at selected management levels in the paint shop. The principles focussed on in the questionnaire and interviews are the principles as listed in the theoretical model.

The principles were formulated through summarising the key elements as raised by the various authors as detailed in the literature. Being considered the benchmark to ensure the successful implementation and sustainability of continuous improvement
initiatives, these key elements were then grouped into the six main principles that are required to ensure the successful sustainability of continuous improvement initiatives.

These key elements raised by the various authors in the literature study were restructured to formulate the research questions. These questions were then grouped into the six main principles and used in the questionnaire to determine the extent to which each of these principles were present. For the personal interviews, open-ended questions were formulated to each address the six main principles identified.

The researcher works in the same production unit of the organisation being researched. To avoid the risk of bias, questionnaires were handed to individuals at different management levels, different departments as well as different shifts within the business unit being studied. As will be discussed in the section below, the management levels include senior management, line supervision and group leaders of the business unit being studied.

4.3. The sample

The sample included senior management, line supervision and group leaders within the respective business unit. All individuals included in the sample are involved in the manufacturing process and are affected by continuous improvement initiatives implemented or workshops being held.

The production unit in question has three shifts and includes senior management, line supervision and group leaders.
<table>
<thead>
<tr>
<th>Participants</th>
<th>Management Level</th>
<th>Department</th>
<th>Quant.</th>
<th>Shift</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Senior</td>
<td>Line Supervision</td>
<td>Group leader</td>
<td></td>
</tr>
<tr>
<td>Unit Head</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Managers</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Managers</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supervisors</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group leaders</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Manager</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supervisors</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manager</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supervisors</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2.  Production unit management composition

In the table as shown above, a total of fifty eight (58) participants, spread across different levels and departments, were considered to form part of the sample. From the table, departments included in the sample are production, maintenance, process and the quality department (displayed in column five of table). All these departments are affected by continuous improvement initiatives because changes made to the production processes require input from all in order to successfully standardise and complete implementation and improve operations.

Forty six (46) participants are on a shift basis and responsible for keeping the production lines running (refer second last column of table). These participants are from the production and maintenance departments. The twelve participants that are on straight shift include the Production Unit head, two Production Managers, one Process Manager, three Process Supervisors, the Maintenance Manager, the Quality Manager and three Quality Supervisors (refer last column of table).
It is important to note that no shop floor employees have been included in the sample. This sample has been chosen because even though shop floor employees are important and affected by continuous improvement initiatives, they do not have the authority to implement and enforce actions that would influence the sustainability of continuous improvement initiatives.

Detailed below is an organogram of the production unit being studied. It should be noted that there are two different production areas, namely, Paint shop 2 and the Check Point 8 Paint repair (CP8). These production departments report to the same business unit head but are not located in the same facility.

Figure 5. Production unit management structure
Figure 5 above shows the structure of the various leadership levels that report to the business unit head responsible for the production unit being studied. All production, maintenance and process managers report to the same business unit head. The supervisors in the respective departments report to their direct manager and only supervisors in the production department have group leaders that report to them.

It will be noted that apart from the Quality Manager and Supervisors, all other participants included in the sample are represented in the organogram and report to the same business unit head. Even though the Quality manager and supervisors do not report to the same business unit head, they are still included in the sample as they are affected by the outcome of continuous improvement initiatives.

4.4. The measuring instruments

4.4.1. The questionnaire

According to Collis and Hussey (2003:17), the process of collecting data in a quantitative study is an attempt by the researcher to measure variables or count occurrences of a phenomenon. For the purpose of this research, a Five-point Likert scale questionnaire was used as a tool to collect data from participants as listed in the research sample. This Likert scale has a five point rating scale, consisting of the following descriptive measurements, namely, strongly disagree, disagree, neutral, agree and strongly agree.

The questionnaire consisted of six questions for each of the six main principles that affect the sustainability of continuous improvement initiatives. The questions were aimed at determining the extent to which each of the six principles had an effect on the sustainability of continuous improvement initiatives (Refer to Appendix B for the self-constructed questionnaire that was used).

The questions were aimed at determining the extent to which the six main principles were present and functional within the organisation. By scoring each of these questions, the researcher was able to analyse the information, summarise them and determine the extent to which these main principles were present and functional within the organisation. From this, conclusions and recommendations were made on how to improve the operations of the business unit.
4.4.2. The interview

Each interview question was constructed to focus on one of the six main principles as filtered from the literature (Refer Appendix C for the self-constructed interview to be used to obtain information from participants). The questions were developed to determine the extent to which these principles were present and functional within the business unit. Responses obtained from these interviews were summarised and compared with the results obtained from analysing the results of the questionnaires.

The reasoning behind obtaining information through using both questionnaires and interview was to improve the reliability and validity of the results. Through using two different measuring instruments to obtain information related to the same issue, the quality of the information becomes more reliable. This in the end complemented the validity of results as well as added substance to the conclusions and recommendations.

4.5. Summary

In this chapter the paradigm of the study and why it was chosen were discussed. The sample for the study was explained and detail was given on the different leadership levels of the business unit and departments that were included in the sample.

This was followed by an explanation of how the two measuring instruments were constructed and utilised as well as how information obtained was used to identify the principles that affect the sustainability of continuous improvement initiatives.

The chapter that follows focusses on the empirical study and on how information obtained from the measuring instruments were used and structured for analyses and make recommendations for management.
5. CHAPTER 5 - EMPIRICAL STUDY

5.1. Data analysis

The section below is a brief discussion of how information obtained from the two measuring instruments have been structured and compared with one another.

5.1.1. The questionnaire

In order to capture the responses from the participants, a database was created. To differentiate questionnaire information from each other and to categorise participants, the position and department section of the participants as listed in the heading of the questionnaire was used. By differentiating the data in this manner, it allowed the researcher to group information into leadership level and department in order to form relationships between the information obtained.

Furthermore, the five point rating scale as displayed in the questionnaire was converted from being descriptive to numerical. This conversion of participant opinion from descriptive to numerical was performed so that information obtained could be graphically plotted and displayed for better interpretation and analyses.

The Rating scale was changed as follows:

<table>
<thead>
<tr>
<th>Descriptive</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numerical</td>
<td>-2</td>
<td>-1</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 3. Five point rating scale converted from descriptive to numerical

As can be seen from the above, a numerical number was allocated to each descriptive answer. Zero (0) was allocated to Neutral whereas decisions made to strongly agree and disagree would positively or negatively display the opinion of the participant. Therefore the rating scale ranges from strongly disagree being negative two (-2) to strongly agree being positive two (+2). Responses from participants were therefore changed from descriptive to numerical in this manner.
5.1.2. The interview

Interviews were held with individuals from two of the leadership levels, namely line supervision and group leaders. This was done to get a more detailed or descriptive opinion on what their views were on the existence of the six main principles that affect the sustainability of continuous improvement initiatives. During continuous improvement initiative implementation, line supervisors and group leaders are expected to implement and maintain actions that have been identified to bring about improvements whereas management is more concerned with ensuring that implementation occurs. Therefore they are directly involved and affected by the implementation and sustainability of these initiatives.

Data from the interviews were collated, analysed and summarised. Information from the interviews was compared with the results obtained from questionnaires. This was done to highlight similarities and differences in the responses from the two different instruments.

5.2. Reliability and validity of results

In order to increase the reliability and validity of the results obtained from the research, feedback obtained from analysing the questionnaires as well as information obtained from interviews held with several individuals were compared and used to formulate the conclusions and make recommendations.

5.3. Relationships among variables/groups

When analysing the information obtained from the questionnaire in Appendix B and interview in Appendix C, it will be noted that the questions have been grouped into categories that represent the six main principles that affect the sustainability of continuous improvement initiatives. Each principle has six questions related to it. These questions represent the key elements required to measure the presence and functionality of the six main principles that affect the sustainability of continuous improvement initiatives.

The relationship among data is discussed below:
• Average overall score per department – Overall scoring obtained by each department was compared with one another in order to highlight each department’s opinion with respect to the sustainability of continuous improvement initiatives in the paint shop.

• Principle scoring per department – Scoring obtained in each of the six main principles by the various departments was compared with one another in order to highlight each department’s view with respect to the specific principle. This provided valuable insight into the extent to which each of these principles was present and functional within the specific department. The information also highlighted the strengths and short-comings that the various departments have with respect to the six main principles that affect the sustainability of continuous improvement initiatives.

• Principle scoring per leadership level - Scoring obtained in each of the six main principles was compared with one another in order to highlight each leadership level’s view with respect to the specific principle. This provided valuable insight into the extent to which each of these six main principles was present and functional in each of the leadership levels. It also highlighted differences within the leadership levels and through this, identified key areas for improvement.

• Principle scoring per department supervisor - Scoring obtained in each of the six main principles was compared with one another in order to highlight each department supervisor’s view with respect to the specific principle. This provided valuable insight into the extent to which each departments supervisor ensured that these principles were present and functional within the department.

• Principle scoring per production department - Scoring obtained in each of the six main principles was compared with one another in order to highlight each production department’s view with respect to the specific principle. This provided valuable insight into the extent to which each of these principles was present and functional in the two different production departments.

• Scoring per question – Scoring obtained per question highlighted which questions in each of these six main principles needed to be focussed on in order to improve
the current state of continuous improvement initiatives with respect to sustainability. Each low scoring question could be translated into recommendations on how to improve the sustainability of continuous improvement initiatives in the paint shop.

5.4. Summary

This chapter describes how the information obtained from the different measuring instruments were used and captured in order to formulate charts that will be used to make conclusions and recommendations.

A description of the different charts constructed has been given. This was done to clarify the intended outcome thereof so that the reader has a better understanding of why it was required and how the information obtained from it will be used.
6. CHAPTER 6 - FINDINGS

6.1. Discussion of results

This section provides the results of the study. Several charts are provided summarising the key findings. The following are the key elements:

- the differences that exist between the various departments within the paint shop with respect to the sustainability of continuous improvement initiatives;
- the differences that exist between the various leadership levels within the paint shop with respect to the sustainability of continuous improvement initiatives;
- the differences that exist within specific leadership levels within different departments within the paint shop with respect to the sustainability of continuous improvement initiatives; and
- the differences that exist within a specific leadership level within the same department but at different production facilities of the shop with respect to the sustainability of continuous improvement initiatives.

In the sub-sections that follow, each of these charts are discussed and relationships and/or similarities are drawn between the information being displayed. Furthermore, to delve deeper into determining the reason for the low scoring by a department or per main principle, the main questions contributing to the low score are identified and listed.

Concerning the interviews, the views obtained have been summarised per leadership level for each main principle and results discussed. For each main principle, the opinions of the different leadership levels that were chosen are listed.

6.1.1. Average overall score per department

The scores detailed in this section represent the respective department’s overall view on the sustainability of continuous improvement initiatives. Displayed in the chart below (Figure 6), scores achieved by each department represent the average total achieved for all the main principles that affect the sustainability of continuous improvement initiatives. As previously mentioned, these six main principles are Engagement/Commitment, Ideas/Suggestions, Communication, Training, Teamwork,
and Leadership and the variables refer to production, process maintenance and quality.

![Average overall score per department](image)

**Figure 6.** Average overall score per department

As seen from chart above, the Quality Department achieved the highest average overall score of 0.9. The Process Department achieved a score of 0.4 which is the lowest for all four departments being researched. Production and Maintenance Departments both achieved an average overall score of 0.8. Scores achieved by the Production, Maintenance and Quality Departments are relatively positive as they are closest to a score of 1.

As taken from the questionnaire and according to the rating scale, these scores indicate that these departments “agree” that continuous improvement initiatives in the paint shop are sustainable. The score of the Process department on the other hand is closer to 0 (zero), indicating that the department is “neutral” regarding the sustainability of continuous improvement initiatives.
When considering these overall scores, ample room for improvement exist for all departments to get the scores of each main principle above one (1) and closer to a score of two (2) which would indicate that the various departments “strongly agree” that continuous improvement initiatives in the paint shop are sustainable.

To achieve this, however, further analysis needs to be performed to identify and to determine what is required to take the paint shop from its current state to a state where participants “strongly agree” that continuous improvement initiatives are sustainable. It is for this reason that the sections that follow focus more on the scoring per main principle by the various departments and leadership levels.

6.1.2. Principle scoring per department

The scores obtained represent each department’s view with respect to the respective six main principles. Taking into account all participants under each department and grouping them together, the average score achieved for each department is plotted for each main principle and can therefore be compared with one another. The chart below displays this comparison.
In the sub sections that follow, the results of each of the departments as shown on the chart are discussed. A brief will be given on the principles that were scored the lowest by each department. This will be followed by the identification of the questions which contributed to this low score. Lastly, a summary will be given of the low scored questions which re-occurred amongst the various departments.

6.1.2.1. All participants (overall)

Overall scoring for all participants reveals that each main principle was present and functional to an “agreeable” state. This is represented by the actual scoring for each of the principles being 0.7 for Engagement/Commitment and Communication, 0.8 for Ideas/Suggestions, Training and Leadership and 0.9 for Teamwork. All these scores are close to 1, indicating that they are being practiced to and “agreeable” state. It, however, raised concerns and highlights a large gap for improvement for each main principle in order to ensure and improve the sustainability of continuous improvement initiatives.
Apart from Communication, the Production Department has scored higher in each main principle than for “All participants (overall)”. Production, however, is the department with the highest number of participants in the research sample and it is expected that it follows the “All participants (overall)” trend. The two principles which were scored the lowest are Engagement/commitment (0.7) and Communication (0.7).

Upon further analyses of the questions which were scored the lowest in the principles, the two listed below were identified.

Under Engagement/commitment, the following questions were scored the lowest:
- Once projects are completed, follow-ups are done on Lean implementation.
- Employees ensure that the Lean philosophy has changed operational practice.
- All processes are already seen as being efficient and that one should not tamper with what works.

Under Communication, the following questions were scored the lowest:
- Leaders get everyone tuned into the reasons why the Lean journey is being pursued.
- Public Recognition is given to good team performance.
- Good communication channels exist both from the top-down and bottom up.

When comparing the scores achieved with those of the other departments, the Process department achieved the lowest score for each of the main principles. Training was scored 0.1 by the process department, which is 0.7 points lower than the “All participants (overall)” measurement. Furthermore Engagement/commitment, Ideas/suggestions and Teamwork achieved a score of 0.4 and Leadership achieved a score of 0.5. Due to the low scores achieved by the Process department in all of the main principles, the lowest scored questions in each of these principles were identified.

The questions which were scored the lowest in each main principle are listed below.
Under Engagement/commitment, the following questions were scored the lowest:
- Once projects are completed, follow-ups are done on Lean implementation.
- Employees ensure that the Lean philosophy has changed operational practice.
- All processes are already seen as being efficient and that one should not tamper with what works.

Under Ideas/suggestions, the following questions were scored the lowest:
- Leaders take time to truly discuss the issues with employees.
- Leaders practice active listening and provide feedback when ideas are assessed.
- Leaders have created an environment within the organisation of experimentation.

Under Communication, the following questions were scored the lowest:
- Leaders regularly communicate and demonstrate their commitment to Lean.
- Leaders get everyone tuned into the reasons why the Lean journey is being pursued.
- Good communication channels exist both from the top-down and bottom up.

Under Training, the following questions were scored the lowest:
- Leaders have a total understanding of all Lean processes.
- Middle management received detailed training on Lean implementation tools.
- Continuous training is provided for all employees in the Lean Manufacturing principles, building blocks and tools.

Under Teamwork, the following questions were scored the lowest:
- Follow-ups are done on action items immediately after projects have been completed.
- Technical specialists cooperate and work together with others during meetings.
- Rewards are based on team performance.

Under Leadership, the following questions were scored the lowest:
- Leaders learn from previous mistakes and take into account social issues.
- Leaders are committed and enthusiastic about Lean.
- Leaders are accessible and participate in Lean activities.
6.1.2.4. Maintenance

The Maintenance department scored Training (1), Teamwork (0.9) and Leadership (0.9) the highest, whereas Engagement/commitment (0.5), Ideas/suggestions (0.7) and Communication (0.8) were scored the lowest.

Upon further analyses of the actual questions which were scored lowest in Engagement/commitment, Ideas/suggestions and Communication, the issues listed below were identified.

Under Engagement/commitment, the following questions were scored the lowest:
- Employees ensure that the Lean philosophy has changed operational practice.
- We are continuously informed and reminded about the need for Lean.
- All processes are already seen as being efficient and that one should not tamper with what works.

Under Ideas/suggestions, the following questions were scored the lowest:
- Leaders take time to truly discuss the issues with employees.
- Leaders practice active listening and provide feedback when ideas are assessed.
- Leaders have created an environment within the organisation of experimentation.

Under Communication, the following questions were scored the lowest:
- Leaders regularly communicate and demonstrate their commitment to Lean.
- Lean initiatives and successes are made public to the organisation’s employees after implementation.
- Good communication channels exist both from the top-down and bottom up.

6.1.2.5. Quality

The Quality department scored Communication (1.1), Training (1.2) and Teamwork (1.3), higher than all the other departments, whereas Engagement/commitment (0.6), Ideas/suggestions (0.6) and Leadership (0.8) were scored similar as by the other departments.

The principles, Engagement/commitment and Ideas/suggestions, scoring 0.6 each, were analysed and the actual questions which were scored lowest were as below.
Under Engagement/commitment, the following questions were scored the lowest:
- Once projects are completed, follow-ups are done on Lean implementation.
- Employees ensure that the Lean philosophy has changed operational practice.
- All processes are already seen as being efficient and that one should not tamper with what works.

Under Ideas/suggestions, the following questions were scored the lowest:
- Leaders take time to truly discuss the issues with employees.
- Leaders practice active listening and provide feedback when ideas are assessed.
- Leaders have created an environment within the organisation of experimentation.

6.1.2.6. Chart summary

Principles which were scored the lowest as compared to the “All participants (overall)” series were Engagement/commitment, Ideas/suggestions and Communication. Even though the Quality Department scored Communication at 1.1, the principle is still scored low and a concern for the other departments and therefore needs to be highlighted.

Taking into account the questions which were scored the lowest in each main principle by the relevant departments, re-occurrences were identified. Summarised in the table below are the questions which re-occurred and caused the low scores in each of these principles.

<table>
<thead>
<tr>
<th>Engagement/commitment</th>
<th>Once projects are completed, follow-ups are done on Lean implementation.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Employees ensure that the Lean philosophy has changed operational practice.</td>
</tr>
<tr>
<td></td>
<td>All processes are already seen as being efficient and that one should not tamper with what works.</td>
</tr>
</tbody>
</table>
Ideas/suggestions

– Leaders take time to truly discuss the issues with employees.
– Leaders practice active listening and provide feedback when ideas are assessed.
– Leaders have created an environment within the organisation of experimentation.

Communication

– Leaders get everyone tuned into the reasons why the Lean journey is being pursued.
– Good communication channels exist both from the top-down and bottom up.

Table 4. Summary of the lowest scored principles with key questions per the various departments

6.1.3. Principle scoring per leadership level

In the chart as displayed below, managers, supervisors and group leaders from the various departments have been grouped in order to formulate views per leadership level on the Sustainability of Continuous improvement initiatives in the paint shop. It is important to note that the scores shown in this section represent the respective leadership level’s views with respect to the six main principles.
6.1.3.1. All participants (overall)

The “All participants (overall)” scoring reveals that all principles are viewed to be present and functional to an “agreeable” state which is represented by a score of 1. This is represented by the actual scoring for each element being between 0.7 and 0.9. Engagement/Commitment and Communication both achieved a score of 0.7 whereas Ideas/suggestions, Training and Leadership were scored 0.8 and Teamwork 0.9 respectively.

6.1.3.2. Managers

Managers in the paint shop scored Communication (1.1), Training (1.2), Teamwork (1.4) and Leadership (1.2), higher than all other leadership levels. Each of these principles, on average, scored 0.4 points higher that the “All participants (overall)” trend. This indicates that, compared to other leadership levels, managers have the perception that these principles are present and functional to a much greater extent.
Engagement/commitment (0.8) and Ideas/suggestions (0.7) have however been scored relatively on par with that of the other leadership levels.

When considering the three lowest scored principles, namely, Engagement/commitment, Ideas/suggestions and Communication, the following questions listed below were identified as being scored lowest.

Under Engagement/commitment, the following questions were scored the lowest:
- Once projects are completed, follow-ups are done on Lean implementation.
- Employees ensure that the Lean philosophy has changed operational practice.
- All processes are already seen as being efficient and that one should not tamper with what works.

Under Ideas/suggestions, the following questions were scored the lowest:
- Leaders take time to truly discuss the issues with employees.
- Leaders practice active listening and provide feedback when ideas are assessed.
- Leaders have created an environment within the organisation of experimentation.

Under Communication, the following questions were scored the lowest:
- Leaders regularly communicate and demonstrate their commitment to Lean.
- Leaders get everyone tuned into the reasons why the Lean journey is being pursued.
- Good communication channels exist both from the top-down and bottom up.

6.1.3.3. Supervisors

Not necessarily representing the biggest portion of the research sample, scores of supervisors in the paint shop were similar to those of “All participants (overall)”. Scores achieved for each main principle ranged between 0.6 and 0.9, with the lowest being Engagement/commitment (0.6), Communication (0.8) and Training (0.8). It is important to note that the principles Communication and Training, being scored low by supervisors, have been scored amongst the highest by managers.

For Engagement/commitment, Communication and Training, the questions listed below were identified as being scored the lowest:
Under Engagement/commitment, the following questions were scored the lowest:
- Once projects are completed, follow-ups are done on Lean implementation.
- Employees ensure that the Lean philosophy has changed operational practice.
- All processes are already seen as being efficient and that one should not tamper with what works.

Under Communication, the following questions were scored the lowest:
- Leaders regularly communicate and demonstrate their commitment to Lean.
- Leaders get everyone tuned into the reasons why the Lean journey is being pursued.
- Good communication channels exist both from the top-down and bottom up.

Under Training, the following questions were scored the lowest:
- Shop floor staff understand the need for and practices of Lean Manufacturing.
- Middle management received detailed training on Lean implementation tools.
- Continuous training is provided for all employees in the Lean Manufacturing principles, building blocks and tools.

6.1.3.4. Group leaders

Apart from Engagement/commitment and Ideas/suggestions, group leaders have scored the other principles lower than Management and Supervision. The lowest scored principles are Communication (0.5), Training (0.7), Teamwork (0.7) and Leadership (0.6). Apart from Training, which is similar in scoring to the supervisory level, the principles Communication, Teamwork and Leadership were scored the lowest by group leaders as compared to other leadership levels. This indicates that the perception of group leaders with respect to the presence and functionality of these principles are lower as compared to supervisors and managers.

The questions that have been scored the lowest in Communication, Training, Teamwork and Leadership are listed below.

Under Communication, the following questions were scored the lowest:
- Leaders get everyone tuned into the reasons why the Lean journey is being pursued.
- Public Recognition is given to good team performance.
- Good communication channels exist both from the top-down and bottom up.
Under Training, the following questions were scored the lowest:
- Leaders have a total understanding of all Lean processes.
- Shop floor staff understand the need for and practices of Lean Manufacturing.
- Continuous training is provided for all employees in the Lean Manufacturing principles, building blocks and tools.

Under Teamwork, the following questions were scored the lowest:
- Follow-ups are done on action items immediately after projects have been completed.
- Technical specialists cooperate and work together with others during meetings.
- Rewards are based on team performance.

Under Leadership, the following questions were scored the lowest:
- Leaders learn from previous mistakes and take into account social issues.
- Leaders are committed and enthusiastic about Lean.
- Leaders are well informed about the actual situation on the factory floor.

6.1.3.5. Chart summary

Principles which were scored the lowest compared to the “All participants (overall)” series were Engagement/commitment, Communication and Training. Taking into account the questions which were scored the lowest in each main principle by the different leadership levels, reoccurrences were identified. Summarised in the table below are the questions which re-occurred and caused the low scores in each of these principles.

| Engagement/commitment | – Once projects are completed, follow-ups are done on Lean implementation.  
| – Employees ensure that the Lean philosophy has changed operational practice.  
| – All processes are already seen as being efficient and that one should not tamper with what works. |
Communication

- Leaders regularly communicate and demonstrate their commitment to Lean.
- Leaders get everyone tuned into the reasons why the Lean journey is being pursued.
- Good communication channels exist both from the top-down and bottom up.

Training

- Shop floor staff understand the need for and practices of Lean Manufacturing.
- Continuous training is provided for all employees in the Lean Manufacturing principles, building blocks and tools.

Table 5. Summary of the lowest scored principles with key questions by the various leadership levels

A concern that should be highlighted from this section is the difference in scoring by the various leadership levels with respect to Communication, Training and Teamwork. This difference in scoring indicates that the perception within the leadership levels regarding the presence and functionality of these principles are contradicting.

6.1.4. Principle scoring per department supervisors

The scores as detailed in the section below are the scores achieved by the supervisors in the different departments. It represents their views on each main principle and highlights the differences that exist in the various departments at the specific leadership level. The reason why only this leadership level (Supervisors) is being analysed in this manner is because the structures in the other levels do not allow for this type of investigation. When considering the Management level, it has too few participants per department and for group leaders, they are only found in the production department.
Figure 9. Principle scoring per department supervisors

6.1.4.1. Production

Scoring achieved by Production Supervisors range from 0.6 for Engagement/commitment to 0.9 for Ideas/suggestions and Teamwork. The three principles that were scored the lowest by the Production department supervisors are Engagement/commitment (0.6), Communication (0.7) and Training (0.8).

The questions that have been identified as being scored the lowest by these supervisors are listed below.

Under Engagement/commitment, the following questions were scored the lowest:
- Once projects are completed, follow-ups are done on Lean implementation.
- Employees ensure that the Lean philosophy has changed operational practice.
- We are continuously informed and reminded about the need for Lean.

Under Communication, the following questions were scored the lowest:
– Leaders get everyone tuned into the reasons why the Lean journey is being pursued.
– Public Recognition is given to good team performance.
– Good communication channels exist both from the top-down and bottom up.

Under Training, the following questions were scored the lowest:
– Leaders have a total understanding of all Lean processes.
– Middle management received detailed training on Lean implementation tools.
– Continuous training is provided for all employees in the Lean Manufacturing principles, building blocks and tools.

6.1.4.2. Process

Supervisors in the process department have scored each main principle lower than supervisors from other departments. Scores achieved range from 0.3 for Teamwork and Leadership to 0.5 for Communication and Training. Considering this score range, which is closer to 0 (zero) than to 1, it can be said that the process department supervisors feel “neutral” regarding the presence and functionality of the principles that affect the sustainability of continuous improvement initiatives.

Due to the low scores achieved by the Process Department in all of the six main principles, the lowest scored questions in each of the main principles are highlighted. The questions which were scored lowest in each main principle are listed below.

Under Engagement/commitment, the following questions were scored the lowest:
– Once projects are completed, follow-ups are done on Lean implementation.
– Employees ensure that the Lean philosophy has changed operational practice.
– All processes are already seen as being efficient and that one should not tamper with what works.

Under Ideas/suggestions, the following questions were scored the lowest:
– Leaders take time to truly discuss the issues with employees.
– Leaders practice active listening and provide feedback when ideas are assessed.
– Leaders have created an environment within the organisation of experimentation.

Under Communication, the following questions were scored the lowest:
– Leaders regularly communicate and demonstrate their commitment to Lean.
– Leaders get everyone tuned into the reasons why the Lean journey is being pursued.
– Good communication channels exist both from the top-down and bottom up.

Under Training, the following questions were scored the lowest:
– Leaders have a total understanding of all Lean processes.
– Middle management received detailed training on Lean implementation tools.
– Continuous training is provided for all employees in the Lean Manufacturing principles, building blocks and tools.

Under Teamwork, the following questions were scored the lowest:
– Follow-ups are done on action items immediately after projects have been completed.
– Technical specialists cooperate and work together with others during meetings.
– Rewards are based on team performance.

Under Leadership, the following questions were scored the lowest:
– Leaders learn from previous mistakes and take into account social issues.
– Motivation and demand for success of Lean efforts come from top management.
– Leaders are accessible and participate in Lean activities.

6.1.4.3. Maintenance

Scores by the maintenance supervisors range from 0.6 for Engagement/commitment and Leadership to 0.9 for Training. Principles which have been scored the lowest are Engagement/commitment (0.6), Leadership (0.6) and Communication (0.7).

The questions which were scored lowest in each of the principles are listed below.

Under Engagement/commitment, the following questions were scored the lowest:
– Employees ensure that the Lean philosophy has changed operational practice.
– We are continuously informed and reminded about the need for Lean.
– All processes are already seen as being efficient and that one should not tamper with what works.
Under Communication, the following questions were scored the lowest:
- Leaders regularly communicate and demonstrate their commitment to Lean.
- Lean initiatives and successes are made public to the organisation’s employees after implementation.
- Good communication channels exist both from the top-down and bottom up.

Under Leadership, the following questions were scored the lowest:
- Leaders learn from previous mistakes and take into account social issues.
- Leaders are well informed about the actual situation on the factory floor.
- Leaders are accessible and participate in Lean activities.

6.1.4.4. Quality

Supervisors in the Quality department have scored all of the six main principles higher than supervisors from other departments. Scores achieved range from 0.8 for Engagement/commitment to 1.3 for Communication and Teamwork. Principles which have been scored the lowest are Engagement/commitment (0.8), Ideas/suggestions (1) and Leadership (1.1).

The questions that scored the lowest in each of these principles as mentioned above are listed below.

Under Engagement/commitment, the following questions were scored the lowest:
- Once projects are completed, follow-ups are done on Lean implementation.
- Employees ensure that the Lean philosophy has changed operational practice.
- All processes are already seen as being efficient and that one should not tamper with what works.

Under Ideas/suggestions, the following questions were scored the lowest:
- Leaders take time to truly discuss the issues with employees.
- Leaders practice active listening and provide feedback when ideas are assessed.
- Leaders have created an environment within the organisation of experimentation.

Under Leadership, the following questions were scored the lowest:
- Leaders drive positive behavioural change throughout the organisation.
- Leaders learn from previous mistakes and take into account social issues.
Leaders are committed and enthusiastic about Lean.

6.1.4.5. Chart summary

The principles scored the lowest on average are Engagement/commitment, Ideas/suggestions and Leadership. Taking into account the questions that scored the lowest in each main principle by the different department supervisors, re-occurrences were identified.

Summarised in the table below are the questions which caused the low scores in each of these principles.

<table>
<thead>
<tr>
<th>Principle</th>
<th>Key Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engagement/commitment</td>
<td>− Once projects are completed, follow-ups are done on Lean implementation.</td>
</tr>
<tr>
<td></td>
<td>− Employees ensure that the Lean philosophy has changed operational practice.</td>
</tr>
<tr>
<td></td>
<td>− All processes are already seen as being efficient and that one should not tamper with what works.</td>
</tr>
<tr>
<td>Ideas/suggestions</td>
<td>− Leaders take time to truly discuss the issues with employees.</td>
</tr>
<tr>
<td></td>
<td>− Leaders practice active listening and provide feedback when ideas are assessed.</td>
</tr>
<tr>
<td></td>
<td>− Leaders have created an environment within the organisation of experimentation.</td>
</tr>
<tr>
<td>Leadership</td>
<td>− Leaders learn from previous mistakes and take into account social issues.</td>
</tr>
<tr>
<td></td>
<td>− Leaders are accessible and participate in Lean activities.</td>
</tr>
</tbody>
</table>

Table 6. Summary of the lowest scored principles with key questions by the various department supervisors


6.1.5. Principle scoring per production department supervisors

The chart below displays the scores by production supervisors that belong to two different production sections that fall under the paint shop or the business unit being researched.

**Figure 10.** Principle scoring per production department supervisors

The one production section is Paint shop 2, whereas the other section is Check Point 8 (CP8) Paint Repair. Paint shop 2 has three production managers, each managing a shift, whereas the CP8 Paint Repair area only has one Manager that manages three shifts.

Each production manager has his own supervisors and for the purpose of this analysis, all supervisors in Paint shop 2 will be grouped and their views on the six main principles will be compared to that of the supervisors in CP8. This brings about a different aspect in the sense that in Paint shop 2, the views of supervisors being managed by three different managers will be compared to the views of supervisors being managed by one manager.
6.1.5.1. Production supervisors (Paint shop 2)

Production supervisors in the paint shop have scored all the principles lower than supervisors in CP8 Paint repair. This indicates that their view with respect to the presence and functionality of the principles that affect the sustainability of continuous improvement initiatives in the paint shop is not viewed as positive as in CP8 Paint repair. Principles which were scored the lowest are Engagement/commitment (0.6), Communication (0.6) and Training (0.8).

The questions which were scored lowest in each of these principles as mentioned above are listed below.

Under Engagement/commitment, the following questions were scored the lowest:
- Once projects are completed, follow-ups are done on Lean implementation.
- We are continuously informed and reminded about the need for Lean.
- All processes are already seen as being efficient and that one should not tamper with what works.

Under Communication, the following questions were scored the lowest:
- Leaders get everyone tuned into the reasons why the Lean journey is being pursued.
- Public Recognition is given to good team performance.
- Good communication channels exist both from the top-down and bottom up.

Under Training, the following questions were scored the lowest:
- Leaders have a total understanding of all Lean processes.
- Middle management received detailed training on Lean implementation tools.
- Continuous training is provided for all employees in the Lean Manufacturing principles, building blocks and tools.

6.1.5.2. Production supervisors (CP8 Paint Repair)

Production supervisors in the CP8 have scored all the principles higher than supervisors in Paint shop 2. This indicates that their view with respect to the presence and functionality of the principles that affect the sustainability of continuous
improvement initiatives are more positive than that of the Paint shop 2 supervisors. Principles which were scored the lowest are Engagement/commitment (0.8), Training (0.9) and Teamwork (1).

The questions which were scored lowest in each of these principles as mentioned above are detailed below.

Under Engagement/commitment, the following questions were scored the lowest:
- Once projects are completed, follow-ups are done on Lean implementation.
- Employees ensure that the Lean philosophy has changed operational practice.
- All processes are already seen as being efficient and that one should not tamper with what works.

Under Training, the following questions were scored the lowest:
- Leaders have a total understanding of all Lean processes.
- Shop floor staff understand the need for and practices of Lean Manufacturing.
- Continuous training is provided for all employees in the Lean Manufacturing principles, building blocks and tools.

Under Teamwork, the following questions were scored the lowest:
- Technical specialists cooperate and work together with others during meetings.
- Teams are provided with dedicated areas and materials for team problem solving.
- Rewards are based on team performance.

6.1.5.3. Chart summary

The principles which were scored the lowest were Engagement/commitment and Training. Taking into account the questions which were scored the lowest in each main principle by the different department supervisors, re-occurrences were identified.

Summarised in the table below are the questions which caused the low scores in each of these principles.
Engagement/commitment

- Once projects are completed, follow-ups are done on Lean implementation.
- All processes are already seen as being efficient and that one should not tamper with what works.

Training

- Leaders have a total understanding of all Lean processes.
- Continuous training is provided for all employees in the Lean Manufacturing principles, building blocks and tools.

**Table 7.** Summary of the lowest scored principles with key questions by the different production department supervisors

**6.1.6. Overall scoring per question**

The chart below displays the question scoring per main principle by all participants that took part in the study.
In the sub sections below, the three questions being scored the lowest in each main principle are listed. Within this section, however, all participants are being taken into account and the opinion of the whole research sample is reflected in the scoring.

6.1.6.1. Engagement/commitment

Under Engagement /Commitment, the following questions were scored the lowest:

– Once projects are completed, follow-ups are done on Lean implementation.
– Employees ensure that the Lean philosophy has changed operational practice.
– All processes are already seen as being efficient and that one should not tamper with what works.

6.1.6.2. Ideas/suggestions

Under Ideas/suggestions, the following questions were scored the lowest:

– Leaders take time to truly discuss the issues with employees.
– Leaders practice active listening and provide feedback when ideas are assessed.
– Leaders have created an environment within the organisation of experimentation.
6.1.6.3. Communication

Under Communication, the following questions were scored the lowest:

- Leaders regularly communicate and demonstrate their commitment to Lean.
- Leaders get everyone tuned into the reasons why the Lean journey is being pursued.
- Good communication channels exist both from the top-down and bottom up.

6.1.6.4. Training

Under Training, the following questions were scored the lowest:

- Shop floor staff understand the need for and practices of Lean Manufacturing.
- Middle management received detailed training on Lean implementation tools.
- Continuous training is provided for all employees in the Lean Manufacturing principles, building blocks and tools.

6.1.6.5. Teamwork

Under Teamwork, the following questions were scored the lowest:

- Follow-ups are done on action items immediately after projects have been completed.
- Technical specialists cooperate and work together with others during meetings.
- Rewards are based on team performance.

6.1.6.6. Leadership

Under Leadership, the following questions were scored the lowest:

- Leaders learn from previous mistakes and take into account social issues.
- Leaders are committed and enthusiastic about Lean.
- Leaders are accessible and participate in Lean activities.

6.1.7. Interview summary

Listed below are summaries of feedback from interviews. Each main principle lists the viewpoint of supervisors and group leaders that participated in the interviews.

For Engagement/commitment, the views raised by the two leadership levels are listed below.
– Group leaders are of the opinion that there is no real engagement/commitment because after workshops are held, there is no follow-up to ensure that actions implemented and standard set are sustained. Production staff are kept responsible for maintaining the process even if quality standard set during workshop deteriorates and become unsustainable.

– Supervisors (in production) are of the opinion that engagement/commitment is present but fades away after workshops have been held and actions implemented. This directly affects the sustainability of continuous improvement initiatives because supervisors and other production staff are left responsible for maintaining the standard.

For Ideas/suggestions, the views raised by the two leadership levels are listed below.

– Group leaders are of the opinion that implementing the ideas/suggestions from members that are directly involved with the process will empower them, make them feel part of the team and that they are contributing towards improving processes. They feel that this does not happen during workshops.

– Supervisors are of the opinion that the ideas/suggestions that come from individuals directly involved with the process are important and should be considered and assessed as this will improve engagement/commitment as well as improve the sustainability of initiatives. The acceptance of ideas/suggestions does occur but when they are not used, feedback on why it was not used is not always given.

For Communication, the views raised by the two leadership levels are listed below.

– Group leaders are of the opinion that communication is present and important because it provides a better understanding of Lean initiatives as well as creating an awareness of the success of Lean initiatives. The general feeling amongst group leaders is that communication is occurring but can be improved.

– Supervisors are of the opinion that Communication, both internally and externally, is important as it keeps everyone updated, creates awareness around Lean initiatives as well as highlight improvements achieved. They feel, however, that even though communication is present, it hardly reaches or affects individuals closest to the process and that concerns raised on the shop floor are not conveyed back to management.
Under Training, the views raised by the two leadership levels are listed below.

- Group leaders are of the opinion that training plays an important role in ensuring sustainability and helps individuals forming a habit of continuous improvement. Their view on training is that it is available but not all involved in Lean initiatives get the required training that they need in order to fully understand the reasons why these initiatives are being implemented as well as the role they have to play in order to achieve sustainability.

- Supervisors are of the opinion that training is important because it broadens the skills of the people and keeps everyone aware and updated with the Lean philosophy and tools. Supervisors however feel that training is not given to all leadership levels and that all the relevant parties should undergo training so that there is a common understanding of what is required.

For Teamwork, the views raised by the two leadership levels are listed below.

- Group leaders are of the opinion that teamwork is important as improvements achieved helps everyone that is involved with the process as well as aligns everyone to a common goal. Teamwork is present during workshops but teams selected do not necessarily include all the necessary people that are required to achieve the end goal.

- Supervisors are of the opinion that teamwork is very important to increase buy-in, ensure engagement and to improve commitment to a common goal. Teamwork is present but teams, however, seldom include individuals that are closest to the process.

Under Leadership, the views raised by the two leadership levels are listed below.

- Group leaders are of the opinion that leaders should be more involved in Lean initiatives and, through auditing the “improved” process, can assist in ensuring sustainability. Leaders should lead by example, show interest and be enthusiastic about Lean initiatives. Leaders in most cases, drive implementation because it is a requirement, but they do not necessarily believe in the Lean philosophy.

- Supervisors are of the opinion that leaders should show interest, create awareness and understanding about Lean concepts and emphasize the need for improvement initiatives. They feel that even though leadership is present, they
can play a bigger role in creating an environment that encourages commitment towards Lean initiatives.

### 6.1.8. Final summary

Detailed in the table below is a summary of three questions for each main principle that should be focussed on in order to improve the current view with respect to principles that affect the sustainability of continuous improvement initiatives in an OEM paint shop environment.

| Engagement/commitment | – Once projects are completed, follow-ups are done on Lean implementation.  
| – Employees ensure that the Lean philosophy has changed operational practice.  
| – All processes are already seen as being efficient and that one should not tamper with what works. |
| Ideas/suggestions | – Leaders take time to truly discuss the issues with employees.  
| – Leaders practice active listening and provide feedback when ideas are assessed.  
| – Leaders have created an environment within the organisation of experimentation. |
| Communication | – Leaders regularly communicate and demonstrate their commitment to Lean.  
| – Leaders get everyone tuned into the reasons why the Lean journey is being pursued.  
| – Good communication channels exist both from the top-down and bottom up. |
| Training | – Shop floor staff understand the need for and practices of Lean Manufacturing.  
| – Middle management received detailed training on Lean implementation tools.  
| – Continuous training is provided for all employees in the Lean Manufacturing principles, building blocks and tools. |
Leadership

- Leaders learn from previous mistakes and take into account social issues.
- Leaders are committed and enthusiastic about Lean.
- Leaders are accessible and participate in Lean activities.

Table 8. Summary key questions per principle that affect the sustainability of continuous improvement initiatives in an OEM paint shop environment

Note that in the table above the main principle Teamwork is not included. Even though it achieved a scoring of 0.9 as detailed by the “All participants (overall)” series in Figure 9, when considering all chart summaries as detailed within the previous sections, Teamwork did not appear as a main principle that required much focus as compared to the other principles.

When consulting Figure 9, one will note that the leadership level that affected the Teamwork principle score the most was the group leaders whereas the other leadership levels scored it relatively high. This point raises concern because group leaders are the leadership level which is closest and has the most interaction with workers on the shop floor. The principles that are listed in the table above however appeared several times during the analysis and were a concern for all leadership levels.

Each of the questions detailed above reveal issues or concerns that can be improved upon in order to address the current state of principles that affect the sustainability of continuous improvement initiatives in an OEM paint shop environment.

It should be noted however that the point 6 listed under Engagement/commitment in the questionnaire is phrased in such a manner that it actually contradicts the rating scale. It is therefore scored incorrectly and not necessarily scored low. Due to this error this question will not be considered as being an area on which to place focus on.
Concerning the summaries of interviews conducted, the following points conclude the views of the participants for each of the six main principles:

- Engagement/commitment is present during the implementation phase but as soon as workshops are done, no follow-ups are performed to ensure that standards achieved and set during workshops are maintained and production staff is left responsible to maintain standards.
- Ideas/suggestions from participants are being accepted but when these ideas are not implemented, feedback is generally not given on the reasons why it rejected. This affects the morale and commitment of those involved.
- Communication is present but information being shared does not necessarily reach the shop floor. Furthermore, information shared is also not understood by all, especially by workers on the shop floor. Communication can therefore be improved by means of displaying relevant information regarding Lean initiatives on notice and bulletin boards.
- Training is available but does not involve all individuals that normally take part in Lean initiatives. Training provided should be structured in order to let all involved understand the reasons why these initiatives are being implemented as well as the role they play in order to achieve sustainability.
- Teamwork is present during workshops but the selection of the individuals that take part in the workshop does not always include the relevant individuals that are required to achieve and implement the improvements.
- Leadership are limited in their involvement in Lean initiatives. They drive implementation mostly because it is a requirement but they do not necessarily believe in the Lean philosophy.

Concerns listed in the points above complement items as listed in the Table 8. This indicates that there are similarities in the findings obtained from the questionnaires and the interviews.

6.2. Conclusion

Considering all the interview questions that were highlighted as being scored low by the various participants during the analysis performed, it brings forth the notion that there are similar issues present in the different departments and leadership levels and if addressed, it can affect the overall scoring with respect to the performance of
the main principles that affect the sustainability of continuous improvement initiatives in an OEM paint shop environment.

Through the identification of the questions that were scored the lowest as well as the points as summarised from the interviews conducted, various recommendations were made regarding issues to focus on in order to improve the presence and functionality of principles that affect the sustainability of continuous improvement initiatives within the paint shop.

6.3. Recommendations

Listed below are recommendations to improve the presence and functionality of the main principle that affect the sustainability of continuous improvement initiatives within the paint shop.

- When considering engagement/commitment, implementation teams should start doing follow-ups at set intervals after the workshops have been completed. These follow-ups must be focussed on assessing if all actions are still in place and if quality standard set / achieved are still the same.

- Regarding Lean as a philosophy, leaders within the organisation should live Lean and not just consider it to be the implementation of continuous improvement initiatives and use of tools to achieve improvement. Lean is more than just that and if not lived by the leaders, the positive change will not spill over to the workers. This in the end will affect the Engagement/commitment shown by others and in the end affect the sustainability of these initiatives.

- Leaders should start sharing and considering ideas and suggestions that come from the shop floor. Leaders should listen to what workers on the shop floor have to say about certain improvements that need to be implemented and should create an environment where individuals feel free to raise their opinion as well as identify areas for improvement. To make those giving ideas/suggestions feel appreciated and part of the team, constructive feedback should be given when ideas/suggestion are not used and praise when they are used.
Regular communication by leaders at all levels (top-down and bottom-up) will raise awareness within the organisation and will demonstrate their commitment to Lean initiatives. It is important that the communication reaches the shop floor or those individuals closest to the processes so that they can become familiar with the terms and benefits that these initiatives bring about. Communication, however, needs to be detailed and should be able to highlight why the Lean implementation is a necessity for the organisation.

Information regarding Lean initiatives should filter down to the shop floor in a manner that would be understandable to all. Notice and Bulletin Boards can be used as methods to improve communication. Once employees see that the leaders are living and committed to Lean, they will start to better understanding the need for its existence. Furthermore Communication from the bottom up should also be encouraged so that concerns from the shop floor can be raised and addressed.

Training of individuals at all levels within the organisation plays a big role in bringing about a better understanding of what Lean is all about and why it is important for organisations to become Lean. More than just explaining the tools, proper training needs to focus on the philosophical aspects of Lean and how a change in mind set will bring about sustainable improvement within the processes of the organisation. Employees at all levels need to know what role they play in the implementation process as well as in ensuring the sustainability of these initiatives.

Refresher training needs to be provided and during training sessions, individuals should be made aware of how and where the specific tools have been implemented and what savings have been achieved through the implementation thereof. Training provided should also be structured and specific to the relevant leadership level so that everyone knows what part or role they must play in order to ensure sustainability of continuous improvement initiatives.

It is important that Leaders in the organisation lead by example and learn from previous mistakes. This can be achieved through leaders being enthusiastic and committed to Lean and the role out of workshops. Leaders should show their interest through visiting the shop floor, interacting with shop floor workers.
regarding Lean initiatives, asking relevant questions to operators with respect to workshop held and should create awareness by continuously highlighting the need for continuous improvement. It is also important that leaders participate in Lean initiatives so that shop floor workers see that these workshops are not only for the shop floor but that the success and improvements achieved are important for all.

6.4. Limitations of the study

As the study was only performed within the paint shop, only views of the individuals within it were expressed. The study therefore does not reflect the views of the other production units such as the Press shop, Body shop and Assembly.

Also the sample size did not include any operators. This is the main limitation of the study since the shop floor workers, who are mostly affected by these initiatives and are the ones that in the end bear the brunt of initiatives which are not sustainable, are excluded.

6.5. Future research

Future studies related to the implementation of continuous improvement initiatives, several issues than can be affected come to mind. Listed below are possible topics that can be considered as future research topics.

– Impact of continuous improvement initiatives on quality system improvement.
– Impact of continuous improvement initiatives in assisting organisations to become more sustainable.
– Continuous improvement initiatives as a driver to improve employee innovation
7. **LIST OF REFERENCES**

- Alukal, G. (2003) Create a Lean, Mean Machine [online]. Quality Progress. Available from: [http://library.dip.go.th/multim2/ejournal/Quality%20Progress/Quality%20Pro2003/Scan%20%E0%B9%81%E0%B8%A2%E0%B8%81%E0%B9%80%E0%B8%9B%E0%B9%87%E0%B8%99%E0%B8%9A%E0%B8%97%E0%B8%84%E0%B8%A7%E0%B8%B2%E0%B8%A1/10148.pdf](http://library.dip.go.th/multim2/ejournal/Quality%20Progress/Quality%20Pro2003/Scan%20%E0%B9%81%E0%B8%A2%E0%B8%81%E0%B9%80%E0%B8%9B%E0%B9%87%E0%B8%99%E0%B8%9A%E0%B8%97%E0%B8%84%E0%B8%A7%E0%B8%B2%E0%B8%A1/10148.pdf). [Accessed 27 June 2012]


A. APPENDICES SECTION

a. Appendix A – 40 Building Blocks
### Appendix B – Measuring instrument - Questionnaire

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<tr>
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<tr>
<td></td>
<td>Manager</td>
<td>Group leader</td>
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<table>
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<td>Leaders understand the idea and methods of the TPS and Lean.</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>2</td>
<td>Leaders are committed to the idea and methods of the TPS and Lean.</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>3</td>
<td>Once projects are completed, follow-ups are done on Lean implementation.</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>4</td>
<td>Employees ensure that the Lean philosophy has changed operational practice.</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>5</td>
<td>We are continuously informed and reminded about the need for Lean.</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>6</td>
<td>All processes are already seen as being efficient and that one should not tamper with what works.</td>
<td>Strongly agree</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No</th>
<th>Question</th>
<th>Rating Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A committee assesses all ideas from staff involved in the workshop.</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>2</td>
<td>Structures exist for the submitting of ideas.</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>3</td>
<td>Leaders take time to truly discuss the issues with employees.</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>4</td>
<td>Leaders practice active listening and provide feedback when ideas are assessed.</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>5</td>
<td>Leaders encourage employees to show ways to eliminate waste, take out cost and increase profit.</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>6</td>
<td>Leaders have created an environment within the organisation of experimentation.</td>
<td>Strongly agree</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No</th>
<th>Question</th>
<th>Rating Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Leaders regularly communicate and demonstrate their commitment to Lean.</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>2</td>
<td>Leaders get everyone tuned into the reasons why the Lean journey is being pursued.</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>3</td>
<td>Leaders regularly visit the work floor.</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>4</td>
<td>Public Recognition is given to good team performance.</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>5</td>
<td>Lean initiatives and successes are made public to the organisation’s employees after implementation.</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>6</td>
<td>Good communication channels exist both from the top-down and bottom up.</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>Training</td>
<td>Leaders have a total understanding of all Lean processes.</td>
<td>Strongly agree</td>
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<tr>
<td></td>
<td>Shop floor staff understand the need for and practices of Lean Manufacturing.</td>
<td>Strongly agree</td>
</tr>
<tr>
<td></td>
<td>In order to ensure long-term results, our organisation has invested in long-term training.</td>
<td>Strongly agree</td>
</tr>
<tr>
<td></td>
<td>Shop floor staff is trained in teamwork and problem solving.</td>
<td>Strongly agree</td>
</tr>
<tr>
<td></td>
<td>Middle management received detailed training on Lean implementation tools.</td>
<td>Strongly agree</td>
</tr>
<tr>
<td></td>
<td>Continuous training is provided for all employees in the Lean Manufacturing principles, building blocks and tools.</td>
<td>Strongly agree</td>
</tr>
<tr>
<td>Teamwork</td>
<td>Our organisation has a Lean implementation team.</td>
<td>Strongly agree</td>
</tr>
<tr>
<td></td>
<td>Shop floor teams are empowered to solve problems and suggest ideas.</td>
<td>Strongly agree</td>
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<tr>
<td></td>
<td>Follow-ups are done on action items immediately after projects have been completed.</td>
<td>Strongly agree</td>
</tr>
<tr>
<td></td>
<td>Technical specialists cooperate and work together with others during meetings.</td>
<td>Strongly agree</td>
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<tr>
<td></td>
<td>Teams are provided with dedicated areas and materials for team problem solving.</td>
<td>Strongly agree</td>
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<tr>
<td></td>
<td>Rewards are based on team performance.</td>
<td>Strongly agree</td>
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<tr>
<td>Leadership</td>
<td>Leaders drive positive behavioural change throughout the organisation.</td>
<td>Strongly agree</td>
</tr>
<tr>
<td></td>
<td>Leaders learn from previous mistakes and take into account social issues.</td>
<td>Strongly agree</td>
</tr>
<tr>
<td></td>
<td>Leaders are committed and enthusiastic about Lean.</td>
<td>Strongly agree</td>
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<tr>
<td></td>
<td>Motivation and demand for success of Lean efforts come from top management.</td>
<td>Strongly agree</td>
</tr>
<tr>
<td></td>
<td>Leaders are well informed about the actual situation on the factory floor.</td>
<td>Strongly agree</td>
</tr>
<tr>
<td></td>
<td>Leaders are accessible and participate in Lean activities.</td>
<td>Strongly agree</td>
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c. Appendix C – Measuring instrument - Interview

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</thead>
<tbody>
<tr>
<td></td>
<td>Manager</td>
<td>Group leader</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>No</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>To what extent are those involved in Lean Implementation initiatives committed and engaged in making it sustainable after implementation?</td>
</tr>
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<td></td>
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<tr>
<td></td>
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<tr>
<td>2</td>
<td>How important are ideas and suggestions from participants in workshops towards ensuring the sustainability of Lean initiatives?</td>
</tr>
<tr>
<td></td>
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<tr>
<td>3</td>
<td>How important is communication (both internally and externally) towards ensuring the sustainability of Lean initiatives?</td>
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<td></td>
<td>Question</td>
</tr>
<tr>
<td>---</td>
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</tr>
<tr>
<td>4</td>
<td>To what extent would proper training contribute to ensuring sustainable Lean initiatives?</td>
</tr>
<tr>
<td>5</td>
<td>Why would teamwork be considered important in ensuring the sustainability of Lean initiatives?</td>
</tr>
<tr>
<td>6</td>
<td>What role would leaders have to play to ensure that the implementation of Lean initiatives is sustainable?</td>
</tr>
</tbody>
</table>