AN EVALUATION OF THE IMPLEMENTATION OF MERCEDES BENZ PRODUCTION SYSTEM (MPS) AND THE EMPLOYEE CHANGE READINESS AT MERCEDES BENZ COMMERCIAL VEHICLES SOUTH AFRICA:

A half thesis submitted in partial fulfilment of

the requirements for the degree of

MASTER OF BUSINESS ADMINISTRATION

in the

RHODES BUSINESS SCHOOL

By

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July 2014

Integrative Summary

The research paper comprises of three distinct sections;
1. An evaluation report,
2. A literature review section and
3. A research methodology section.

The evaluation report section describes the evaluation of the implementation of Mercedes Benz Production System (MPS) at Mercedes Benz Commercial Vehicles, which is a division of Mercedes Benz South Africa's manufacturing plant situated in East London.
The section evaluates the changes the implementation of MPS brought to the Key Performance Indicators (KPI'S) of the division and evaluates the change readiness of the employees in the division prior to the change.
The change implementation was initiated by the management of MBCV as a strategic organisational change to bring about continuous improvement to the KPI's of the organisation. These KPI's are Safety, Quality, Delivery, Cost and Morale (SQDCM). The reason behind the change at the time was deemed critical to MBCV in order to meet the annual KPI targets and remain cost competitive and sustainable.
The evaluation report further describes the results of the change with regards to the organisational KPI's and the level of employee change readiness which was conducted through a questionnaire survey.
A brief literature review is included in the Evaluation Report under section one describing key concepts about Production Systems, Lean Manufacturing and Change Management. The evaluation section includes recommendations based on the results of the research findings and ends with a conclusion.

The literature review section explores the literature that supports production systems, lean manufacturing and change management concepts, its definitions, importance and benefits. The literature review describes and critiques key concepts of the research such as productions systems, MPS in particular, lean manufacturing concepts and related change management topics relevant to the research. The literature review defines production systems and the concepts of lean manufacturing,

highlighting the benefits of the concepts to enhance organisations' manufacturing capabilities. An integrated part of lean manufacturing is people and the implementation of lean manufacturing into an organisation requires change management theories therefore key understanding in this particular research was to discuss change management concepts, in particular, employee change readiness. The literature will discuss different tools to assess employee change readiness and from this develop an employee change readiness tool. The change management concepts evaluated change readiness and the consequences if organisations are not ready for change.

The research methodology section describes how that the research was conducted in two phases, one to evaluate the implementation of MPS with regards to the organisational KPI's (SQDCM). This was assessed through reports from projects and presentations made by the project teams on improvements of the organisational KPI's. The second phase evaluated the change readiness of the employees prior to the implementation of MPS. This phase of the research was intended to retrieve quantitative data with an adapted questionnaire which was distributed to employees. To evaluate the change readiness, a change model known as ADKAR was used as an evaluation instrument.
The modified ADKAR questionnaire was distributed to employees in hard copies and completed during a weekly team meeting. The results were summarised and descriptive statistics were used to analyse the final results. Microsoft Excel (2010 version) was used to illustrate and display the graphs. Section three discussed the research methodology in more detail.

The study shows that although there were some positive changes that came from the implementation of MPS in MBCV, especially to the following KPI's (Safety, Quality, Delivery and Cost), real consideration should be given to employee morale and the level of change readiness of MBCV employees.

Acknowledgements

I wish to express my sincere gratitude to the following individuals and institutions for the support and guidance. I am immeasurably indebted to them all:

I would like to thank my wife, Rutanya - this dissertation would not have been possible without your support and understanding during this time, my daughter, Roya, for needing to forfeit Saturdays, best for spending time with me, because I needed to work on my dissertation. My dedication to this project was not only for the advancement of my studies and self, but for that of our family. To my parents and mother-in–law for affording me the time to work by giving generously of their time to babysit and entertain Roya – for this I thank you.

I would like to thank my brother–in-law, Cyril, for his support and efforts to assist me and for taking the time to read MBA work again - thank you for your inputs.
Thanks also to my siblings – whose encouragement has meant a great deal to me.
My mentor and friend, Desi Naidoo, his ability to see the potential in me has changed my world forever. Also Mr. Samuel Meintjies, who played an instrumental role in setting me on this path, to these two men I extend my thanks.

Mercedes Benz South Africa for providing me with an ideal opportunity to develop myself, thank you for the financial aid and infrastructure to complete my studies.
To the entire Commercial Vehicles' staff - thank you for your support. To the two Divisional Managers, Tom Cawood and Goodhope Ncapo, who supported me through reading the MBA, thank you.

To the MBA 2012 class, especially the Eastern Cape group, thank for your friendship and support. Thank you to my supervisor, Kevin Rafferty, for his knowledge sharing, patience, understanding and guidance. Without your academic assistance this surely would have not been possible.

Last, but certainly never least, I would like to acknowledge and give thanks to God for the blessings, wisdom and strength he has gifted me to complete my studies.
Thank you, God.

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Acronyms

ADKAR – Acronym for Awareness, Desire, Knowledge, Ability, Reinforcement
BOS – Bus Operating System
CI – Continuous Improvement
CKD – Complete Knock Down
COO – Coordinator
CV – Commercial Vehicles
GBSC – Global Balance Score Card
GE – General Electric
GDP – Gross Domestic Product
GSP – Global Services and Parts
JES – Job Element Sheet
JIS – Just in Sequence
JIT – Just in Time
KPI – Key Performance Indicator
MBCV – Mercedes Benz Commercial Vehicles
MBSA – Mercedes Benz South Africa
MPS – Mercedes Benz Production System
NAAMSA – National Association of Automobile Manufacturers of South Africa
NIST – National Institute for Standards and Technology
NVA – Non Value Add
POS – Parts Operating System
SWI – Standard Work Instruction
SQDCM – Acronym for Safety, Quality, Delivery, Cost and Morale
OTD – On Time Delivery
TM – Team Manager
TOS – Truck Operating System
TPM – Total Productive Maintenance
TPS – Toyota Production System
5s – Acronym for Sort, Straighten, Shine, Standardise and Sustain

SECTION 1: EVALUATION REPORT

1.1 Context

At the beginning of 2013, the management of Mercedes Benz Commercial Vehicles (MBCV) South Africa assembly focused strategically on improving the annual efficiency targets together with developing standardised processes. To achieve these objectives a decision was taken to roll out the Mercedes Benz Production System (MPS) within MBCV.

MBCV wanted the implementation of MPS to enhance their KPI's. In addition to this the researcher's aim was to evaluate the implementation of Mercedes Benz Production System (MPS) at Mercedes Benz Commercial Vehicles (MBCV) with regards to the changes of the organisational KPI's (SQDCM) and to evaluate the change readiness of the employees, prior to implementation. The MPS project started in July 2013 and this research paper evaluated the project up until the end of June 2014. The objectives of the research paper were:

- Evaluate the changes to the organisational KPI's (Safety, Quality, Delivery, Cost, and Morale) that emerged from the implementation of MPS through each phase of the project and at the overall completion of the project.
- Evaluate the level and stage of readiness in areas where the change had not been implemented using the ADKAR change readiness instrument, prior to MPS implementation.
- Provide an evaluation report and recommendations on how the implementation of MPS has affected changes to the organisational KPI's and report on the change readiness of the shop-floor, with the implementation of MPS.

MPS has been implemented throughout the Daimler organisation, but never before in an environment of this nature with its huge model range and manual processes.

1.2 Introduction

The first section of the research paper is the evaluation report. This section describes the setting of the study and why the researcher feels the study is important

to the body of knowledge. A second objective of this section is to highlight to the organisation (MBCV) the findings of the strategic decision taken to implement MPS. The findings of each KPI (SQDCM) are discussed and descriptive statistics are utilised to describe the level of change readiness of the employees. A brief literature review is provided within the evaluation report, together with a short description of the research methodology. The ADKAR change model instrument was used to evaluate the level of change readiness of the MBCV shop floor workers. These results are displayed using bar charts. The evaluation report was followed up with recommendations based on the research findings and ends with a conclusion.

1.2.1 Setting of the Study

The automotive industry accounts for about 6% of South Africa's gross domestic product (GDP) and is of utmost importance to the economy of South Africa in terms of facilitating job creation (Rodin, 2014: 1).

According to Furlonger (2014: 1), unstable labour environment, low volumes and a volatile currency are some of the struggles South Africa's automotive industry faces. The integration into the global manufacturing environment by the South African automotive industry has been characterised by a relentless focus on *cost containment, cost reduction, efficiency improvements* and *quality* (Lamprecht, 2014: 1). Nico Vermeulen (2014: 1), director of the National Association of Automobile Manufacturers of South Africa (NAAMSA), states "It is not going to be an easy ride, because you are up against the very best in the world." (Lamprecht, 2014: 1). Therefore, it is imperative for any automotive manufacturer, especially in South Africa, to find methods of competing against the world's best and becoming more productive.

According to Vincent (2013: 1), cost and availability of labour and materials are ranked as the biggest driver of competiveness in South Africa. The labour costs in South Africa have increased at a faster rate than that of their global peers, yet productivity has not proportionated to the same effect (Vincent, 2013: 1). The manufacturing sector of South Africa was historically built on the basis of relatively cheap labour and therefore labour cost is considered to be ranked number one in

South Africa, above ‘Talent-driven innovation’ and ‘Economic financial trade and tax system’ which are ranked number one and two globally (Vincent, 2013: 1).

The local market attractiveness of South Africa’s manufacturing sector is in survival mode due to factors such as the threat of cheap imports, a small domestic market, policy, uncertainty, high input cost and minimal skills base labour (Vincent, 2013: 1).

Mohr *et al.* (2012: 1) explains that manufacturers can create new value, minimise cost and improve operational stability by focusing on four key areas: production, product design, value recovery and supply chain management. Mohr *et al.* (2012) state that manufacturers can make tremendous gains by implementing programs to improve labour and capital productivity, with programs such as lean manufacturing which is a key initiative in improving an organisation productivity.

A highly competitive global economy which is coupled with companies that provide their customers with high quality products at prices that are competitive and have fast delivery times to their customers is the competitive edge in business today (MPS, 2009: 9). High quality products to customers, at a low cost and manufactured faster than the competition are essential for corporations that want to enjoy long term success and sustainability (MPS, 2009: 9).

A fundamental focus of MPS is on the people of the organisation, utilising them to their full potential and expertise while empowering them through training and development interventions to achieve long term growth and survival of the organisation (MPS, 2009: 9). If people are the key fundamental element of MPS, it brings about tension or contradiction to early statements made by Vincent that labour issues are the biggest driver to competitiveness in South Africa. Another view would be that MPS is correct to focus on people which supports Vincent’s statement that labour issues are a concern in the South African automotive industry and therefore focusing on the labour developments could in fact be a competitive edge to an organisation.

Therefore the research seeks to evaluate the implementation of MPS at Mercedes Benz Commercial Vehicles (MBCV) with regards to the changes of the organisational KPI’s (Safety, Quality, Delivery, Cost and Morale) and to evaluate the change readiness of the employees, where MPS has not yet been implemented.

1.2.2 The Manufacturing Company

Mercedes Benz Commercial Vehicles (MBCV) founded in 1962, assembles a unique product brand in comparison to any other assembly plant of commercial vehicles (MBCV plant presentation, 2013a). It is unique within the entire Daimler group of companies as it assembles the Mercedes Benz truck brands (Atego, Actros and Axor), Mitsubishi trucks, Freightliner trucks and Mercedes Benz bus chassis (Bentz, 2013a). The assembly operation is a Complete Knock Down (CKD) operation where parts are supplied from Germany, United States, Japan and Brazil in kits (MBCV plant presentation, 2013a). The commercial vehicle plant is situated in the Eastern Cape Province and is a division of Mercedes Benz South Africa which is a wholly-owned subsidiary of the global motor manufacturer, Daimler AG. MBCV employs over 300 people who are made up of monthly and hourly paid staffs who perform several of activities in the following fields: engineering, logistics, production and quality (MBCV plant presentation, 2013a).

1.3 Literature Review

1.3.1 Production Systems

According to Schuh *et al.* (2012:910), “A production system can be defined as an integrated framework of defined aims, principles and methods that guide the design and operation of manufacturing processes, taking into account economic, strategic, organisational and social aspects of the company’s environment.”

The Japanese car manufacturer, Toyota, has successfully implemented lean management with the aid of a production system and can be seen as the pioneers of production systems (Jens, 2014: Online). According to Jens (2014: Online) this production system is known as Toyota Production System (TPS) and a larger number of automotive manufacturers have modelled their own production systems based on TPS including Daimler AG.

1.3.2 Toyota Production System (TPS)

According to Art of Lean Inc. (2014: Online) TPS dates back to 1902 by its original founder Sakichi Toyoda. The production system of Toyota comprises of two fundamental pillars (Just-In-Time and Jidoka), Just-In-Time - making only what is

needed, when it is needed, and in the amount needed, delivered just as they are needed and Jidoka – highlighting problems immediately in order to address them (Art of Lean Inc., 2014: Online).

According to Art of Lean Inc. (2014: Online) TPS has four basic aims that are in line with Toyota's organisational values, these four basic aims are:

- Providing world class quality and service to customers.
- Developing each employee's potential based on respect, trust and cooperation.
- Reducing cost through eliminating waste and maximising profits.
- Developing flexible production standards based on market demands.

Rusli *et al.* (2012:179), explains that, predominately, TPS is aimed at reducing cost, by thoroughly eliminating wastes or muda as it is phrased in Japanese.

Holweg (2007: 421) believes that the story of TPS is fuelled as one of the greatest corporate success stories; the way Toyota has improved their manufacturing technique to gain a competitive advantage. According to Holweg (2007:421) view TPS lead to other automotive manufacturers adapting or modifying their concepts based on TPS. This includes the MPS.

1.3.3 Mercedes Benz Production System (MPS)

"The Mercedes Benz Production System is an integrated model of how processes should be designed, implemented and sustained within Daimler manufacturing. The Production System describes how we will produce automobiles and parts, and how we will run the day-to-day business" (MPS: 2009).

In the Daimler organisation the management system is commonly known as Mercedes Benz Production System, but although the management system is almost identical; other divisions term the management system differently like Daimler Buses use Bus Operating System (BOS), Global Services and Parts (GSP), Parts Operating System (POS), Truck Operating System (TOS) and Human Resources term it as 'Lean Admin' (Jens, 2014).

According to MBSA (2013: Online), the system is seen as a competitive tool to provide high quality products to their customers' desire, quickly and at a lower cost

than their competitors. MPS tools are fundamentally based on 'Best Practice Operations and Principles' of leading automobile manufacturers around the globe and has a direct bearing on **S**afety, **Q**uality, **D**elivery, **C**ost and **P**eople (MBSA 2013: Online).

The five subsystems of MPS according to Clarke (2005: 159-160) are:

1 Human Infrastructure (Leadership, Clarity of task and roles, Employee Involvement and Developments, Work group organisational structure and Safe work practice together with environmental awareness).
2 Standardisation (standardise methods and work procedures, visual Techniques/5S).
3 Quality Focus and Robust Processes and Products (Quick Issue detection and correction), Robust Processes, (products and preventative quality assurance, Customer focus internal and external)
4 Just-In-Time (JIT) (Production smoothing, Pull production, Continuous flow processing, Customer demand rate.
5 Continuous Improvements (Waste elimination).

The entire organisation is involved in the nature of change and the implementation of MPS and the focus is mainly on the shop floor, but has a natural effect on supporting environments as all concepts of MPS are fundamentally applicable to all areas of the business within the organisation (MBSA 2013: Online).

1.3.4 Lean Manufacturing

According to Kilpatrick (2003: 1) "Lean" operating principles are known by a variety of synonyms such Lean Manufacturing, Lean Production, Toyota Production System etc. that began in manufacturing environments. The common understanding is that TPS started in Japan by Toyota, but Henry Ford had been using parts of Lean as early as the 1920's (Kilpatrick, 2003).

Holweg (2007: 422) supports this and mentions that Toyota's production system adopted various elements of the Ford system selectively and in unbundled forms and hybridized them into their own ingenious system coupled with the own original ideas.

According to Kilpatrick (2003: 1) who defines 'lean Manufacturing' as "A systematic approach to identify and eliminate waste through continuous improvements, which flows the product at the pull of the customer in pursuit of perfection."

Kilpatrick (2003:3) explains that in a survey, done by NIST Manufacturing Extension Partnership, of forty of their clients who implemented Lean Manufacturing reported the following improvements:

- A 90% reduction in Lead Time (Cycle Time).
- The productivity increased by 50%.
- The Work-in-Progress Inventory reduced by 80%.
- The space used decreased by 75%.

Organisations that have adopted lean manufacturing are able to be more responsive to market trends and deliver products and services faster with less expenses (Kilpatrick 2003: 5). The concept of Lean crosses all industry boundaries from the supply chain to the customers and addresses all organisational functions and impacts on the entire organisation (Kilpatrick 2003: 5).

1.3.5 Change Management

According to Todnem (2005: 369), change management has been defined as 'a process of continually renewing an organisation's direction, structure and capabilities to serve the ever changing needs of customers'. Todnem (2005: 369) believes change management should be a feature of both and operational and strategic level of an organisation. Thus there should be no hesitation regarding the importance of organisations having the ability to identify their future requirements and how to manage the change requirements (Todnem, 2005: 369).

Nordin *et al.* (2010:2) explain that lean manufacturing principles, as adopted by production systems like MPS, represent a holistic approach to change, with multiple initiatives undertaken to foster a culture of continuous improvements. This creates the foundation for lean manufacturing to take control of a significant organisational and cultural change within organisations.

1.3.5.1 Change Readiness

Holt *et al*. (2007:235) define readiness for change as an all-inclusive attitude that is concurrently influenced by the content (i.e., what is being changed), the process (i.e., how the change is being implemented), the context (i.e., circumstances under which the change is occurring), and the individual involved with the change (i.e., characteristics of those being asked to change). Holt *et al*. (2007:235) state that, furthermore, readiness collectively reflects if individuals are cognitively and emotionally motivated to accept, embrace and adopt to alter the current status quo and to what extent. Drezensky *et al.* (2012:95) and Armenakis *et al*. (1993) argue that readiness which is similar to Lewin's (1951) concept of unfreezing is displayed in organisational member's beliefs, attitudes and intentions regarding the degree to which the changes are needed and capacity of the organisation to successfully implement the changes. Readiness for change is mainly incorporated into two facets, (1) the need for change and (2) the individual, together with the collective efficacy (i.e. the perceived ability to change) of groups affected by the changes (Drezensky *et al.*, 2012:95). According to Drezensky *et al.* (2012:95) many authors are of the opinion that readiness for change is one of the most important constructs for assessing employees' responses to change as it determines if employees support the change project or not and interpret the readiness for change rather than the resistance of that change. In this particular research the change project is the implementation of MPS within MBCV and determining the level of readiness of the employee to the change project.

Successful organisational change is possible when organisations are ready for that change (Smith, 2007). Organisations that fail to focus on the readiness of employees before a massive change in the organisation are organisations that assume employees are ready for the change. Focusing on the change readiness can be a key element in implementing the change project successfully.

1.3.5.2 Resistance to Change

According to Drezensky *et al.* (2012:95), the failure of the change is mostly attributed to the so called soft factors such as 'resistance to change'.

According to Palmer and Dunford (2008: 26) resistance is a sign that not everyone is ready for the change and that resistance needs to be overcome in order to progress.

Resistance to change occurs due to a difference of interest within the organisation and some interests may be undermined by the proposed change (Palmer and Dunford, 2008: 26). Palmer and Dunford (2008: 26) explain that resistance to change is not always overcome, but efforts should be put in to achieve as much as possible.

Armenakis *et al.* (1993) state that the terms 'resistance to change' and 'change readiness', are sometimes used as synonyms.

According to Oreg (2006:73), the term 'resistance to change' is used frequently in the research and literature on organisational change and therefore resistance to change is used as an explanation why efforts for introducing huge changes in production methods (like MPS), technology, management practices or compensation systems fail or do not meet the expectations. Recent studies have revealed that resistance to change is attributed to the relationship between a change in work conditions and work related outcomes (Oreg, 2006:82).

1.3.5.3 Change Management Process Models

There are many different change models that exist in literature that can guide and instruct the implementation of major change in organisations (Mento *et al.*, 2002: 45). Egan (2005) and Mento *et al.* (2002) state that there are three models of change in literature that stand out more than any others and these models are:

- Kotter's eight-step model of transforming,
- Jick's ten-step model for implementing change and,
- General Electric's (GE) seven-step model for accelerating change.

The above mentioned change models are popular in academic literature but there is a change model first published by Prosci Research in 1998 which is deemed very popular in the corporate environment for benchmarking and empirical studies (Prosci Research, 2007). This change management model is known as the ADKAR model.

Section 2 of this research paper describes these models and assesses the similarities and short-comings of these models, and others, to determine which model will be the most suitable model to assess the readiness of the employees.

In this evaluation research paper the researcher selected a model that is fit for purpose and applicable to the context of the change.

The selection of a model required is to be people focused and focused on the readiness of the individual. The model needed to take into consideration factors such as the capabilities of resources within the organisation. This would have incorporated elements of infrastructure, technology and staffing and the need to evaluate a more holistic statement of change readiness.

Therefore the ADKAR model was selected for evaluating the employee readiness at Mercedes Benz Commercial Vehicles (MBCV).

ADKAR is an acronym for five phases of what an individual goes through in order to achieve successful change (Hiatt, 2006).

1.3.5.4 The ADKAR model (Hiatt, 2006)

According to Suganthalakshmi and Muthuvelayutham (2011: 80) ADKAR is a goal–oriented change management model; this lets the change management team focus their activities on specific organisational results. It was initially a model utilised as a tool to determine whether change management activities like communications and training were producing the desired results during organisational change (Suganthalakshmi and Muthuvelayutham, 2011: 81).

The ADKAR model was first published in 1998 by Prosci Research who had been doing research for over ten years and researched approximately 900 organisations (Hiatt, 2006). According to Bedser (2012: 11) the ADKAR model focuses on the early stages of change while the other complementary change models tend to focus on the entire change process. For example - Lewin's (1951) "unfreeze – change – re-freeze" model, Kotter's (2007) eight-step model of transforming and Jick's ten-step model implementing change.

The five phases of the ADKAR change model are;

A – Awareness of the need for change

According to Prosci Research (2006) the first phase is about the individual's awareness of the change in terms of what the nature of the change is, why the change is happening, what are the risks of not changing and what are the benefits of the change. The awareness for the change deals with the strategic direction of the organisation when considering all factors that drives the change such as technology, competitiveness or market demands.

D – Desire to support the change

The desire to change revolves around personal motivation of the individuals and also the organisational drivers to support the change (Prosci Research, 2006).

K – Knowledge on how to change

The knowledge, skills and behaviours required during and after the change. It is also the understanding of how to change. According to Hiatt (2006) knowledge is split into two subcategories, the how to change (i.e., what is required in the transition) and how to perform when the change is implemented.

In this third phase the individual is aware of the change and either has the desire to change or not, but still obtaining the know-how to change.

A - Ability to implement the new skills

The fourth phase is about demonstrating the ability to implement the change and identify the barriers that may inhabit implementing the change (Prosci Research, 2006).

R - Reinforcement to sustain the skills

The final phase is about sustaining the change and having the mechanisms in place to maintain the change, together with realising the rewards, incentives, successes and recognition of the change.

The simplicity and application of the model is an advantage in comparison to other complicated change readiness assessment tools (Hiatt, 2006). Prosci Research (2006) describes the ADKAR model as a link between individual performance, organisational change management and business results. The ADKAR model primarily focuses on the individual, individual readiness and the early phases of the change (Bedser, 2012: 58).

The ADKAR model is very adaptable for numerous changes and can be applied in the public or private sectors and in an individual's personal life (Suganthalakshmi and Muthuvelayutham, 2011).

The researcher utilised the ADKAR model, but the questionnaire was adapted for the study of evaluating the level of change readiness of employees at MBCV before the implementation of MPS.

1.4 Research Method

The research paper is an Evaluation Research Paper which refers to a research purpose rather than a specific research method (Babbie, 2011: 361).

The research method is comprised of two phases:

Phase one analysed the data from various documents to evaluate the change of the organisational key performance indicators after the implementation of the Mercedes Benz Production System (MPS). These documents constituted from project presentations, reports, time and motion study documents as well as the organisation's Global Balance Scorecard (GBSC).

Phase two included a questionnaire survey to evaluate the change readiness of employees prior to the implementation of MPS. The questionnaire consisted of twenty statements adapted to ADKAR factors. The questionnaire was in the form of a 5 point scale. A rating level from 1 – 5, where 1 is strongly disagreeing and 5 strongly agreeing to the twenty statements. The questionnaire was distributed to a total population of 86 employees in departments where the implementation of MPS had not yet been implemented.

The questionnaire was distributed to the entire population of 86 employees which constituted of employees from three departments, prior to the change of the implementation of MPS. The response rate received of the 86 employees was a 78% response rate.

The questionnaire was distributed to employees during the weekly meetings where the purpose of the questionnaire was explained to the employees. The questionnaire took approximately 10 – 15 minutes to complete. The questionnaire is contained in (Appendix B).

Population in this research comprised of the departments, where the introduction of MPS had not yet been introduced and the entire population was included in the research.

The raw data from questionnaires based on the response to the research statement, which was to evaluate the level of change readiness of employees prior to the change. After the collection of data derived from questionnaires, it was analysed in order to establish the level of change readiness of the employees.

1.5 Results

The following section presents the results of the study. The results answered the research question and the results are present separately in two sections, the evaluation of the changes to the organisational key performance indicators after the implementation of MPS in the division. The results for this were derived from document analysis of various documents such as project reports and presentations. The second aim that the research was to evaluate the employee change readiness which was derived from data in the form of a questionnaire survey. Data from the questionnaire survey was transferred into Microsoft Excel (2010 version) in order to perform descriptive statistics. The statistical analysis of this evaluation research paper was to determine the level of employee change readiness using the adapted ADKAR questionnaire.

Phase One

The aim of the organisation was to implement the Mercedes Benz Production systems into the various departments and enhance the organisational KPI's for better efficiencies.

There were six sub-projects in total, each with their own aims and objectives or targets. The objectives or targets of the six sub-projects revolved around the organisational KPI's. The main objectives were:

1. Safety and Ergonomics – To improve safety and minimise risks of unsafe incidents. And secondly, was to enhance processes and facilities to improve ergonomics which will allow employees to perform in a more comfortable working environment.
2. Quality – The quality (of MBCV products) the time of these projects was not in disastrous state, as the division was achieving the quality targets or just slightly not achieving them. The quality results are documented on the organisational Global Balance Score Card (GBSC) and reviewed monthly in management meetings. However, the MPS projects seek to enhance the process capabilities allowing for more consistent quality achievements.

3. Delivery – The off-line delivery and on-time (OTD) targets in the division before the projects and during the implementation of the projects were sound and were achieved. Again, the consistency of achieving these targets, especially off-line targets, was in question. The MPS projects seek to provide more consistencies by standardising processes and reducing waste.
4. Cost – MBCV is continuously under pressure to show annual improvements with regards to cost. Overhead cost reduction is the main driver. According to Naoshekpam (2014), a lean manufacturing consultant, there is a need for good manufacturing techniques to make high quality and profitable products at a lower cost than the competitors and for becoming a consistent supplier to customers. Operational cost improvements can be improved in three particular ways (Naoshekpam, 2014):

   One is to increase sales pricing; however this could mean a loss of the market due to high increases in sales prices and this option would not suit the division's strategy as the division is in the manufacturing element of the value chain.

   The second possibility is to reduce cost – this is within the division's domain to reduce the manufacturing cost by implementing good manufacturing techniques such as lean manufacturing or production systems.

   The third option is to reduce both cost and sales prices, this could lead to high sales of products, but this would depend on a cooperative effort from all competitors which is highly unlikely as everyone is in a race for better results than its competitors.

Therefore the objective of the implementation of MPS would be to improve manufacturing cost and this could be achieved by eliminating waste. All companies share the same costs (material cost, purchased parts cost, labour cost, energy cost and equipment depreciation cost), the key element is in the manufacturing technique of a company (Naoshekpam, 2014). This manufacturing technique needs to eliminate waste in all aspects, saving on material cost by preventing defects with safe, proven processes, reduce purchase cost by streamline logistics cost and supplier (JIT/JIS), reduce labour cost by eliminating waste and reducing non-value activities, reduce energy cost by implementing alternative energy and enhancing

processes that require less energy and improve equipment capability affording the best efficiencies out of equipment by methods such as Total Productive Maintenance (TPM).

5. Morale – To address staff issues and to develop employees with the proper training and skills development.

1.5.1 The Results of the Implementation of MPS

The results of the implementation of MPS within MBCV had both quantitative and qualitative targets. The results of each project were presented to a steering committee in the form of presentations and a visit to the factory floor. The presentations are available on the organisational server, but not available publicly. In this research paper a high level view will be taken to explain these results.

The costing of the MPS implementation projects.

The project started in June 2013 and was completed in June 2014. During this time there were two Lean consultants from India contracted to assist with training and implementation of MPS within commercial vehicles. Both Assembly consultants spent four to six months in the division.

The cost of the consultants was a straight forward cost together with materials ordered such as signs, labelling, steel for jigs, fixtures and paints to enhance appearances. Other cost involved overtime payments to employees for implementing some of the continuous improvements. The cost was for Saturday's work at a rate of 1.5 per hour compared to the normal rate.

There were plenty of cost savings in the projects such as utilising obsolete equipment from Mercedes Benz Passenger Cars division and refurbishing all the obsolete equipment to suit a new purpose within the MBCV division.

With the use of our data systems and considering what the other additional costs were such as overtime and materials, the total project amounted to a cost of approximately R1.6 million for the division to implement MPS in MBCV.

The benefits of the implementation of MPS within MBCV

The benefits of each project was presented and displayed to CV management and the steering committee.

In total there were six projects in various departments where MPS was implemented and depending on the business of each department there were different objectives or targets to achieve. In Logistics, for example, the MPS team focused on improving part supply to the production lines more efficiently as compared to production where the focus was on eliminating the waste of the current processes, standardising the processes, reducing safety and ergonomic concerns and increasing the number of continuous improvements. The benefits of the MPS implementation are discussed below under each KPI's.

The opinion of Art of Lean Inc., (2014: Online) is that the driving force of production systems which includes (MPS) is to eliminate waste and with an aim of improving quality, cost, productivity, safety and morale. This will lead to satisfied customers, happier employees and delighted investors.

- **Safety & Ergonomics**

According to Art of Lean Inc. (2014: Online) improving workplace safety is ongoing and needs to be continually improved and should never be sacrificed in the name of productivity.

The overall results show a good improvement in the safety and ergonomic challenges. There were a total of 35 unsafe/ergonomic issues observed during the different phases of the project, 26 of those concerns have since been closed. Thus the MPS implementation project in MBCV brought about an improvement factor of 74% with regards to safety concerns.

Production systems should place a lot of emphasis on safety with the aid of productions system tools like standardised work and [1]5s housekeeping, this should reduce the safety risk in the workplace (Liker, 2004 and Art of Lean Inc., 2014: Online).

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[1] The 5s terminology originates from Japan and this strategy simply set the principles for reducing waste (Pycraft *et al.,* 2010:438 - 439).

Clarke (2005: 214) concludes, in her case study of MPS implementation, that the employees' perceptions indicate that safety was achieved through MPS for the various processes. In Appendix 3 under MPS subsystem 'Human infrastructure' there is an operating principle - 'Safe Work Practices and Environmental Awareness' which utilises the various tools to reduce safety risks and environmental threats.

- **Quality**

According to Kilpatrick (2003: 5), organisations with superior quality products enter new markets easier and command higher prices for the products and services than companies with inferior quality. Production systems or Lean manufacturing principles can improve quality by 80% (Kilpatrick, 2003: 3).

Quality in this regard can be measured by the number of continuous improvements made. All these enhancements to the process would lead to improving the product quality. The main quality measurement in the plant is the quality achievement from a customer perspective quality audit. The process of measuring quality is done by a random selection from an unbiased auditor and measured by detecting the number of faults that would be seen by all customers, against a set target. For example 8 faults in total per vehicle and these faults are categorised into minor and major faults that have a different weighting. A minor fault constitutes of minor faults such as dirt on parts and major faults has to do with functionality of the vehicle and safety concerns.

A total of 73 continuous improvement ideas (CI's) were implemented. All of these CI's will lead to improving the existing process and thus provide a better possibility to achieving higher quality products. The MPS tools to improve and maintain quality were implemented during the project to ensure that there was a systematic method to control quality in the division. See Appendix 3 under MPS subsystem 'Quality Focus and Robust Processes and Products'.

- **Delivery**

According to Art of Lean Inc. (2014: Online), true efficiency is only achieved by producing sales quantities with the shortest labour hours possible, this contributes to substantial reductions in cost. The reduction of labour hours was decreased during the project by eliminating waste in terms of non-value added time spent on the

assembling processes. The assembly processes were enhanced through various activities such as facility upgrades, tooling and material placing, this lead to a reduction in cycle times and workloads were evenly distributed. The reduction of cycle times meant that some employees were under-loaded with work and their work could be distributed to other employees and this lead to a headcount saving of a total of eight employees which lead to a reduction of labour hours. The eight workers were place in different area of the plant where needed and some were not replace due to natural attrition.

Kilpatrick (2003: 3), states that the adaption of production systems could lead to a 50% improvement of productivity and a reduction of up to 90% of cycle times.

Delivery, as an organisational KPI target, is normally measured as On–Time Delivery (OTD) to the end customer. OTD is the percentage of orders which is achieved on-time from the customer perspective. The delivery was measured by the standardisation of processes that lead to reduced cycle times, thus eliminating waste and allowing a more consistent delivery of products to customers.

All projects combined achieved on average a 23.5 % reduction of cycle times. The reduction of cycle time means that the time required to assemble one complete vehicle has been reduced thus improving the customer's expectation time. Various tools like the Kanban system, enhanced tugger routes for material flow were improved to enhance productivity.

- **Cost**

In order to maintain margins and profits companies must continuously eliminate waste and to reduce cost (Art of Lean Inc., 2014: Online). The principle of cost reduction which is formulated as "Profit = [Sales Price – Cost]", whereby the cost element is made up of material cost, labour and other expenses. Although the cost element is required for production, companies need to find opportunities to reduce material and labour cost in order for them to remain competitive (Art of Lean Inc., 2014: Online). According to Liker (2005: 114) TPS seeks to maximise the entire system in reducing cost via waste reduction.

The six projects all showed different potential saving in terms of cost. The cost at the time of the projects was determined through the continuous improvements that allowed for reduced cycle times, which eventually amounted to headcount reduction

of shop floor employees. Combined, the six projects reduced the headcount figures by eight which amounts to a 3% headcount efficiency improvement.

Other initiatives of cost reduction also came out of the MPS implementation project such as better utilisation of trolleys that transport parts and more efficient usage of hysters. The improved utilisation of the part trolleys made the issue of availability of trolleys a non-issue and saved on the purchasing of additional trolleys. Better routes and improved delivery scheduling of parts to the production line improved the usage of hysters, meaning less travelling of hysters which brings a saving of fuel and maintenance cost. Additionally, the improved routes and delivery scheduling display that the current amount of hysters are sufficient and no urgent purchasing is required for additional hysters.

- **Morale**

The fundamental principle of MPS is employee morale, this is the first subsystem of MPS (see Appendix 3) and it revolves around employee morale.

The basic training and awareness has provided a morale boost to MBCV employees and there were numerous improvements made to improve the working conditions of the employees on the shop floor. Some of these enhancements were items such as improving the lights in their work stations, providing better jigs, tools, improved workloads and improved processes. High morale can lead to consistent achievement of objectives (Liker, 2005: 222).

In the long term the implementation of MPS can be seen by many shop floor employees as a morale boost. However it must also be highlighted that the perception regarding MPS is seen from the shop floor as a headcount reduction exercise. This became more evident in the weekly meeting discussions and where the realignment and distribution of workloads became a concern for the production team manager. The managers had to deal with shop floor employees' concerns of not coping with workloads.

The research of Clarke (2005: 189) MPS goal 'morale' or improving motivation is the least likely goal employees suggested MPS achieved. According to Clarke (2005: 189) this was an interesting finding as standardisation of processes is a key function of providing economically efficient solutions. In the questionnaire distributed to

evaluate the change readiness of the employees the response to the statements indicate that there is a huge concern regarding the morale of employees.

The evaluation results of MPS on the divisional KPI's suggest that there were worthwhile achievements the MPS project brought to the division, but the cost of implementing MPS was initially high in comparison to the immediate achievements the project accomplished. Ideally the long term benefit will be that the training and development of the MBCV employees will allow them to continue the culture of continually improving the organisational KPI's to remain sustainable.

Out of the MPS goals the 'morale' goal has become a concern as employees where not entirely happy with the headcount reduction and receiving additional workloads without the MPS team doing full evaluation of the various model mixes. As mentioned in the introduction the MBCV environment is unique as there is a huge model mix and models are built according to customer request.

The challenging part of the operation is that the essence of MPS is standardisation and yet the operational environment has huge variants built on one production line making standardisation a very challenging dimension. Therefore after the completion of the project realignment of new time studies had to be done to realise the initial potential savings that came out of the project.

The research paper has provided the findings and discussions on the evaluation of the implementation of MPS in MBCV and how the system has brought changes to the divisions' KPI's.

Phase two

The second phase of the research paper is the results and discussions on the evaluation of the shop floor employee's level of change readiness to the implementation of MPS in MBCV.

1.5.2. Biographical Results

Table 1.5.2.1, below, illustrates the biographic data of the sample population. Babbie (2011: 261) states that the overall response rate is a guide to the representativeness of the sample of respondents. A high response rate means less chance of significant

non-response bias than that of a low rate. In comparison a low response rate is a sign of danger as non-respondents are most likely to differ to respondents in other ways such as resistance to change (Babbie, 2011: 261).The response rate was high, which meant that there was good participation from the sample selected and reduce the threat of nonresponse bias.

Table 1.5.2.1 – Biographical Results

Department	Questionnaires Sent	Percentage of Total
Vehicle Preparation Centre (VPC)	30	34.88%
Freightliner/Fuso Logistics	24	27.91%
Freightliner/Fuso Production Line 2	32	37.21%
Total	**86**	**100%**
Responses	**Percentage of Total**	**Response Rate**
Vehicle Preparation Centre (VPC) (21 responses)	31.34%	70%
Freightliner/Fuso Logistics (15 responses)	22.39%	62.5%
Freightliner/Fuso Production Line 2 (31 responses)	46.27%	96.88%
Total (67 responses)	**100%**	**77.91%**
Age Profile	**Responses**	**Percentage of Total**
20 - 30	13	21.31%
31 – 40	31	50.82%
41 – 50	10	16.39%
51 - 65	7	11.48%
Other	0	0%
Total	**61**	**100%**
Years' Experience	**Responses**	**Percentage of Total**
0 – 10	42	73.68%
11 – 20	12	21.05%
21 – 30	0	0%
31 – 40	3	5.26%
Other	0	0%
Total	**57**	**100%**
Gender Profile	**Responses**	**Percentage of Total**
Male	47	85.45%
Female	8	14.55%
Total	**55**	**100%**
Job Grade	**Responses**	**Percentage of Total**
Level 1	7	12.28%
Level 2	4	7.02%
Level 3	5	8.77%
Level 4	40	70.18%
Level 5	1	1.75%
Total	**57**	**100%**

There were a total of 67 responses from 86 questionnaires sent out. The biographical results for categories Age profile, Years' experience and Job grade came back with figures less than the total number of responses due to some of these categories being left blank on the questionnaires.

1.5.3. Questionnaire Summary

Table 1.5.3 (A – E) below provides a summary of the overall questionnaire and how the different statements were respondent to according the ADKAR categories. Each ADKAR category is indicated by a different colour; Awareness is indicated in yellow, Desire is indicated in dark blue, Knowledge in olive green, Ability in red and Reinforcement in orange.

Table 1.5.3.A – Summary scores for Awareness Statements

ADKAR Category	Nr.	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
AWARENESS	1	I am aware of the implementation project of MPS within MBCV.	20.9%	7.46%	11.94%	43.28%	16.42%
	2	I understand the reasons why MPS is being implemented in MBCV.	23.53%	16.18%	17.63%	30.88%	11.76%
	3	I understand the reasons why MPS is being implemented in my department.	24.59%	18.03%	16.39%	34.43%	6.56%
	4	I understand the goals and objectives for the implementation of MPS.	26.98%	15.87%	20.63%	28.57%	7.94%
	5	I am aware of the challenge/risk the implementation of MPS will bring about.	23.73%	18.64%	25.42%	22.03%	10.17%
	6	MPS is relevant to all employees.	29.69%	10.94%	12.50%	28.13%	18.75%

Table 1.5.3.B – Summary scores for Desires statements

ADKAR Category	Nr.	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
DESIRE	7	I am interested in being part of the implementation project of MPS.	31.15%	9.84%	9.84%	32.79%	16.39%
	8	MPS implementation will present opportunities for me in the workplace.	32.76%	13.79%	17.24%	25.86%	10.34%
	9	I will support the implementation of MPS in my department.	17.74%	17.74%	16.13%	30.65%	17.74%
	10	I personally foresee benefiting from the implementation of MPS.	24.59%	24.59%	26.23%	18.03%	6.56%

Table 1.5.3.C – Summary scores for Knowledge statements

ADKAR Category	Nr.	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
KNOWLEDGE	11	I understand what MPS is about.	27.87%	9.84%	17.75%	32.79%	14.75%
	12	I am aware that MPS is in existence in MBSA Passenger cars division.	20.63%	19.05%	17.46%	31.75%	11.11%
	13	I understand how the implementation of MPS will change my work.	21.31%	13.11%	31.15%	21.31%	13.11%
	14	I have the necessary knowledge/information of MPS to cope with the change.	24.19%	24.19%	27.42%	19.36%	4.84%

Table 1.5.3.D – Summary scores for Ability statements

ADKAR Category	Nr.	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
ABILITY	15	I can positively contribute to the change MPS brings about.	20.97%	11.29%	29.03%	25.81%	12.90%
	16	My ability for continuous improvement ideas will be better.	21.67%	6.67%	16.67%	41.67%	13.33%
	17	The implementation of MPS will allow me to perform better at my job function.	22.58%	8.06%	24.19%	32.26%	12.90%

Table 1.5.3.E – Summary scores for Reinforcement statements

ADKAR Category	Nr.	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
REINFORCEMENT	18	The team will support the implementation of MPS.	19.67%	6.56%	27.87%	34.43%	11.48%
	19	My manager will support the change.	19.35%	9.68%	25.81%	27.42%	17.74%
	20	My personal development will improve due to the change.	24.19%	9.68%	25.81%	30.65%	9.68%

1.5.4. Graphical display of each question rating.

Awareness

The response rate for statements 1 to 6 was to evaluate the awareness of the employees with regards to the implementation of a change.

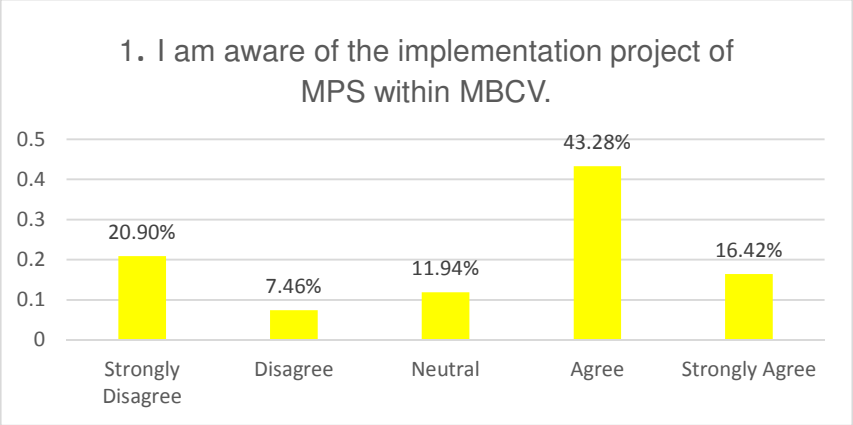


Figure 1.5.4.1 – Awareness 1

Statement 1 is put as a direct statement to understand the level of awareness of employees with regard to the implementation of MPS. A high percentage of 60% combine either agrees or strongly agrees that they are aware of the implementation of MPS. Close to 30% indicated that they are not aware of the change. This is a considerably a high percentage of employees, which the division would need to address.

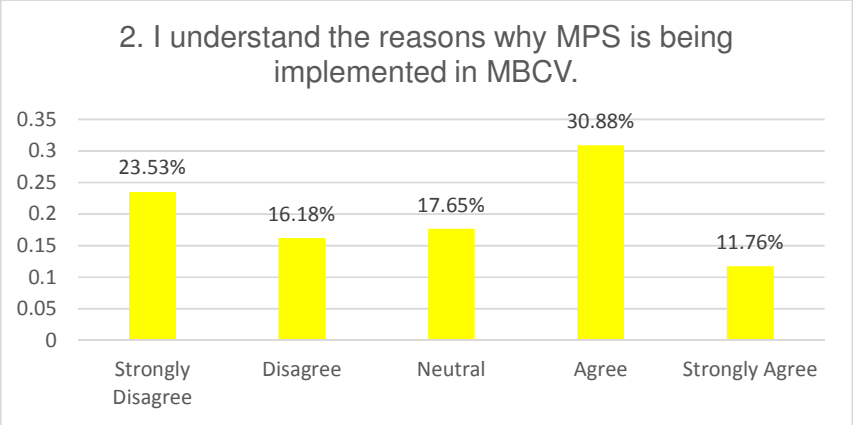


Figure 1.5.4.2 – Awareness 2

Statement 2 of evaluating employee awareness has a 42% agreeing and 40% of respondents disagreeing, with a 17.65% of employees neutral on this statement.

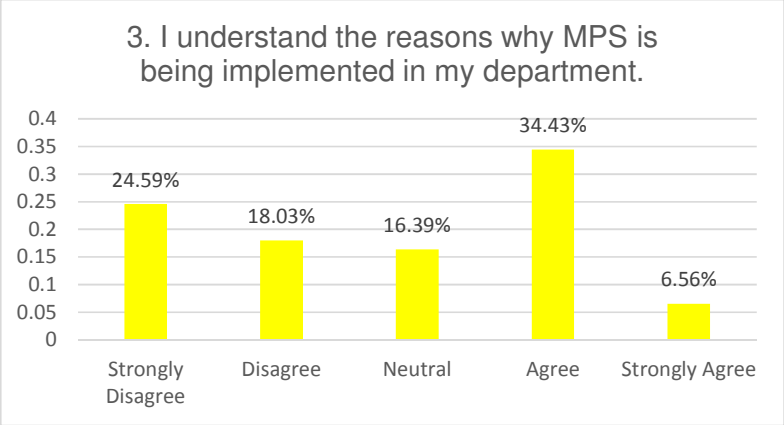


Figure 1.5.4.3 – Awareness 3

Statement 3 is phrased similar to statement two, the only difference between the two is one is asking the understanding for the entire division and statement 3 is for the employee's specific department where the individual is working. The results here are more in favour of disagreement with combined scores of strongly disagree and disagree that totals to 42.62% compare to 40.99% for agree and strongly agree. The scores for statement 2 is more in favour of agreement than that of statement 3 and the reason for this could be that statement 3 has more personal effect on the respondents.

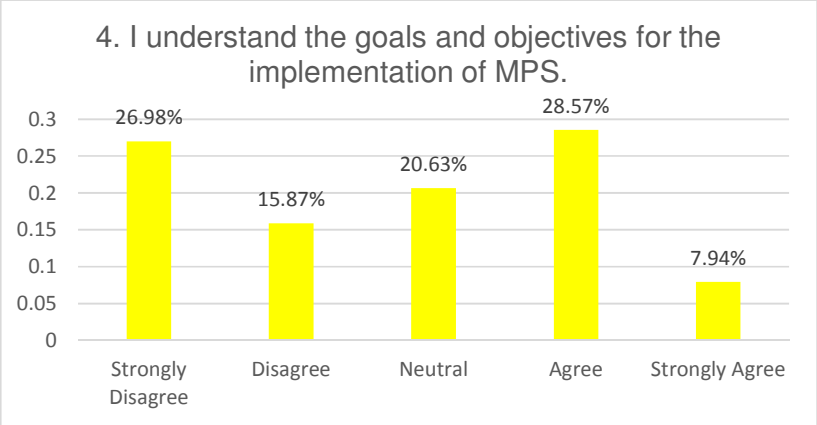


Figure 1.5.4.4 – Awareness 4

Statement 4 challenges the awareness of understanding the goals and objectives of the change. The results are not positive as combined scores of disagreement are higher in comparison to the combined agreement scores. The scores are 42.85% for disagreement compare to 36.51% of respondents agreeing to understand the objectives and goals of the change. Their scores are leaning to the left hand side of

the bar chart with 21% of employees neutral to the statement. This is evident that employees are not aware of the objectives and goals of the change.

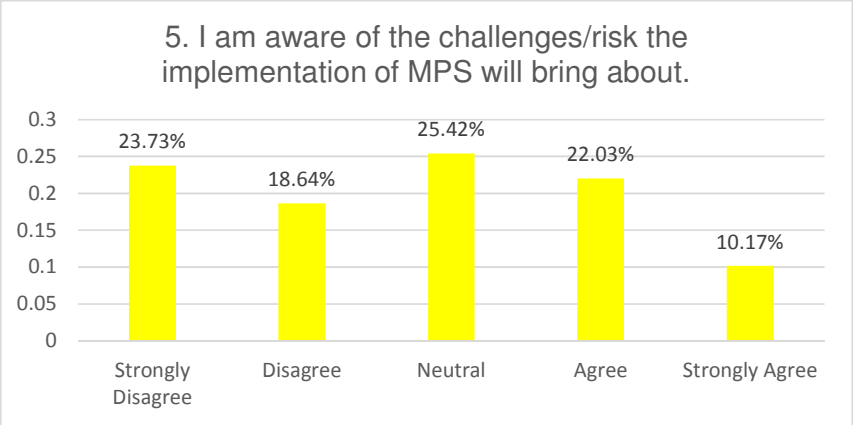


Figure 1.5.4.5 – Awareness 5

The awareness of challenges and risks of the change is considerably low with 40% of respondents either strongly disagreeing or disagreeing that they are aware of the challenges and risks. This is a high percentage of 25.42% are neutral on statement 5, this could be interpreted as respondents who are not sure if they aware of the challenges or risk. Respondents that are neutral do not provide confidence for successful change and requires attention (Hiatt and Creasey, 2003).

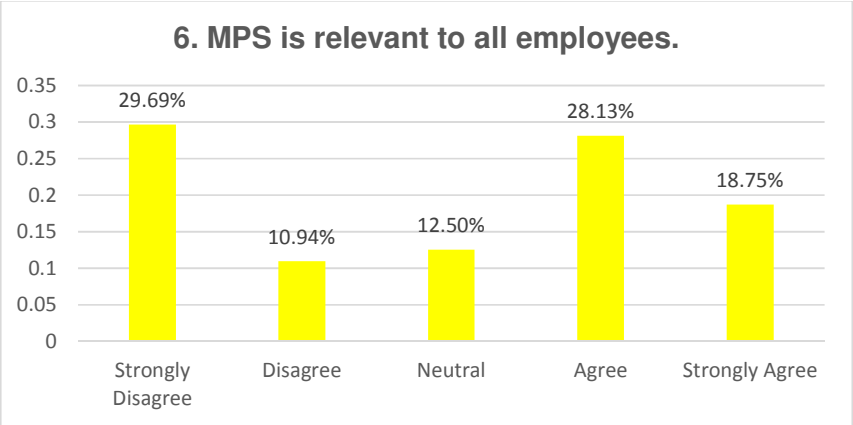


Figure 1.5.4.6 – Awareness 6

Statement 6 indicates that a majority of respondents are in an agreement that the MPS is relevant with 46.88%. There is 29.69% that strongly disagree about the relevance of MPS; this could be that there was not much awareness regarding the relevance of MPS for employees.

The six statements above were adapted to evaluate the level of awareness of employees. The graph below summarised the response from respondents on questions 1 to 6.

Figure 1.5.4.6.A describes the summary of scores of the Awareness statements.

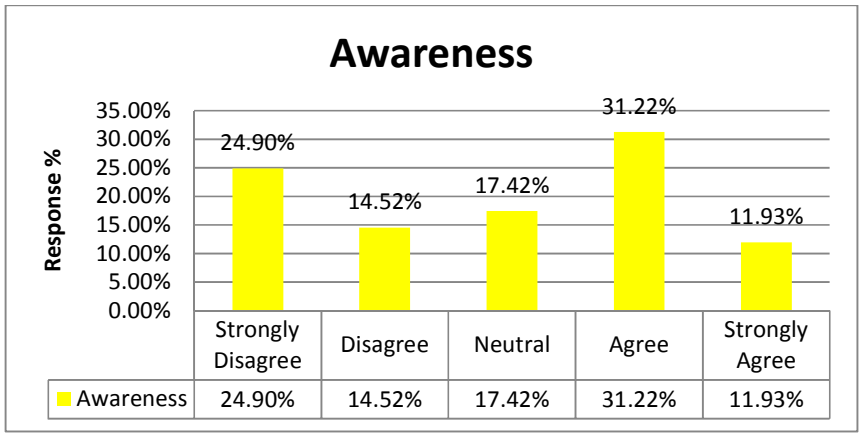


Figure 1.5.4.6.A – Summary of Awareness statements

Awareness – Respondents' overall rating indicates that 31.22% of the respondents agree that they are aware of the change. There are more respondents that agree to being aware of the change than there are respondents that are unaware. The rating of the respondents stating that they are unaware is considerably higher and could affect a successful change. These respondents can be resisting the change due to a lack of awareness Hiatt and Creasey (2003: 130).

According to Hiatt and Creasey (2003: 49) if awareness is identified to score low than the focus should be on awareness, as it will be pointless to work on Desire, Knowledge or Skill as this will not facilitate the change. More than 40% of respondents are agreeing to be aware of the change, 17.42% are neutral and 39.42% of respondents indicated not to be aware of the change. There should be a strong focus given to drive more awareness.

Desire

Statements 7 to 10 deal with evaluating the desire of the employees towards the change that will take place.

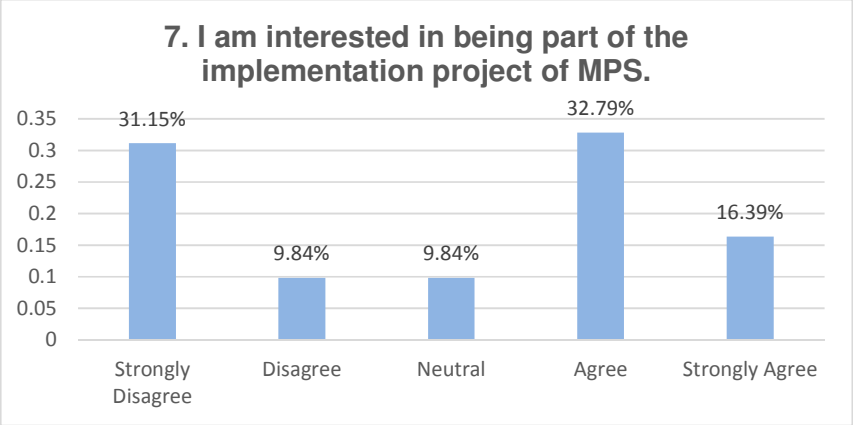


Figure 1.5.4.7 – Desire 1

Statement 7 describes a strong disagreement with 31.15% of the respondents not being interested in the change project. However a combined score of agreeing and strongly agreeing describes that 49.18 % of the respondents are interested in the change project.

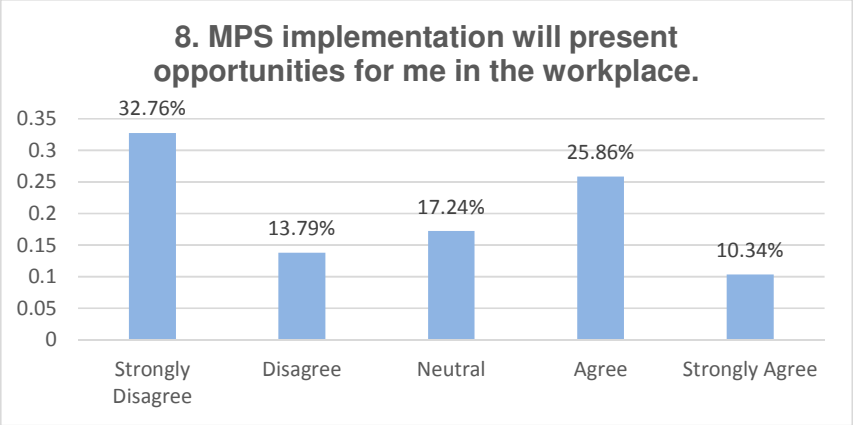


Figure 1.5.4.8 – Desire 2

Statement 8 in particular is an area of concern as respondents strongly disagree that the implementation of MPS will present any opportunities for them. The desire for change in particular with statement 8 indicates that 46.55% of respondents do not show a desire for the change. Hiatt and Creasey (2003) state that once individuals see the opportunities for themselves in a change the level of desire increases dramatically.

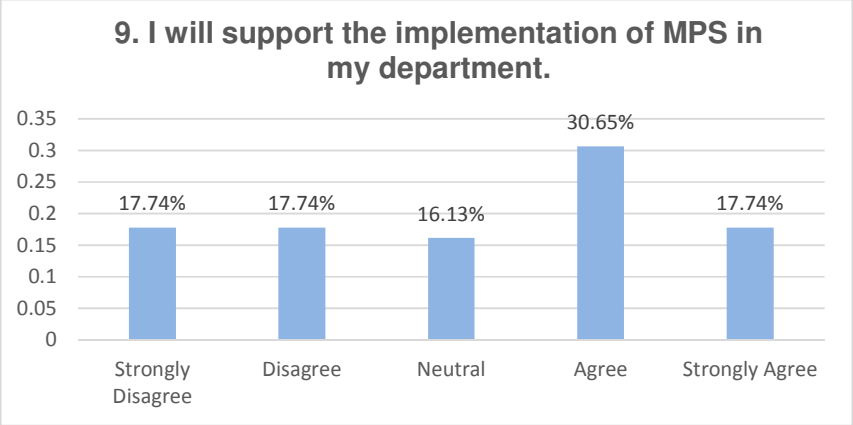


Figure 1.5.4.9 – Desire 3

There is definitely strong support towards the project with 30.65% agreeing and 17.74% strongly agreeing. Respondents are very supportive of implementing MPS in their departments with over 48% in support of the project and over 35% not in favour to support the project. The 35% that are not in favour of supporting the project needs to be engaged in order to address their concerns for not supporting the implementation. These respondents could influence the respondents that will support the project, especially when trying to sustain the change.

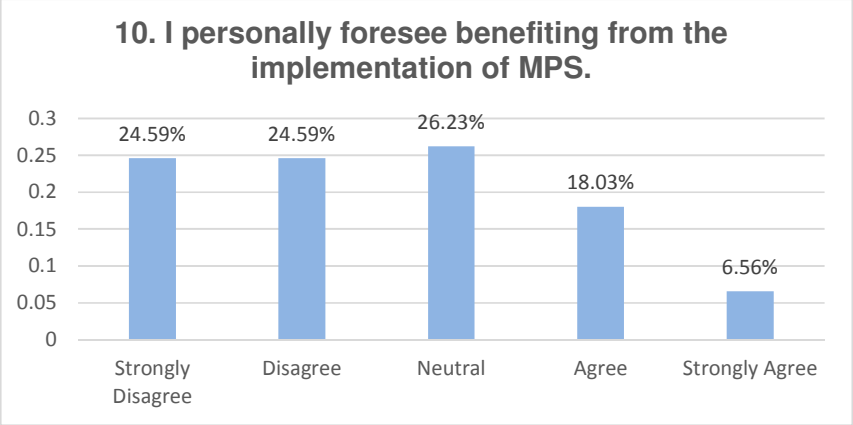


Figure 1.5.4.10 – Desire 4

Once again statement 10 strongly indicates that respondents certainly do not think that they would benefit from the change project. A combine score of strongly disagreeing and disagreeing of 49.18% do not see themselves from benefiting from the implementation of MPS. A huge percentage of respondents are neutral on statement 10.

Figure 1.5.10.D describes the summary of scores of the Desire statements.

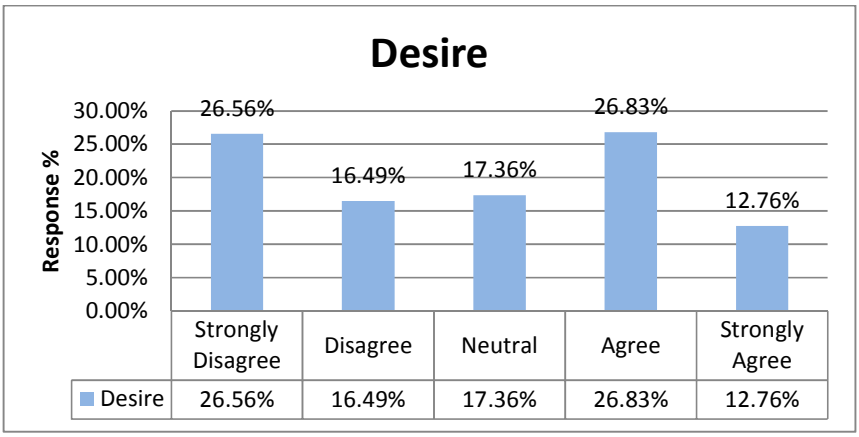


Figure 1.5.10.4.D – Summary of Desire statements

Desire – The desire rating from respondents is a concerning factor as the ratings indicate that more respondents showed that they do not have the desire for the change with combine scores of 43.05% not in favour for the change compare to 39.59% had the desire to change.

According to Hiatt and Creasey (2003: 50) desire can originate from either negative or positive consequences and the negative consequences have to be great enough to overcome their personal threshold to resist change.

Knowledge

Statements 11 to 14 evaluates the level of knowledge respondents have about the change, in order to successfully implement the change.

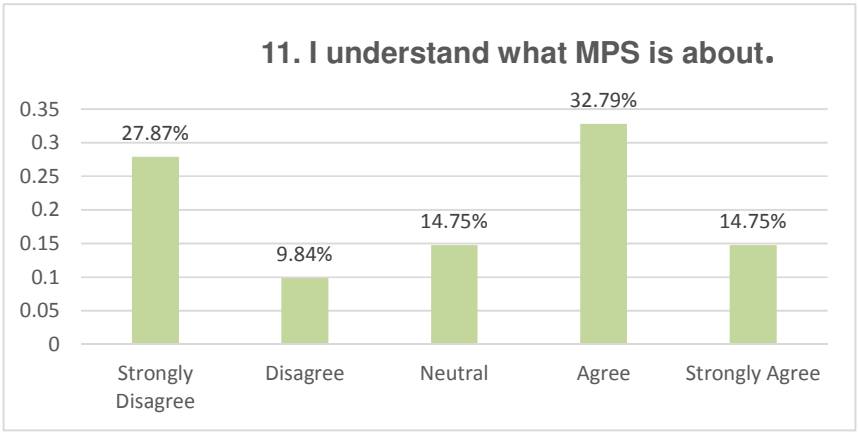


Figure 1.5.4.11 – Knowledge 1

Respondents indicate good understanding of MPS with 32.79% rated that they agree to understand what MPS is about. However 27.87% strongly disagree to understand

what MPS is about. There are a high percentage of respondents that do not understand what MPS is about. This is a basic lack of knowledge that could affect the support for the change (Hiatt and Creasey, 2003).

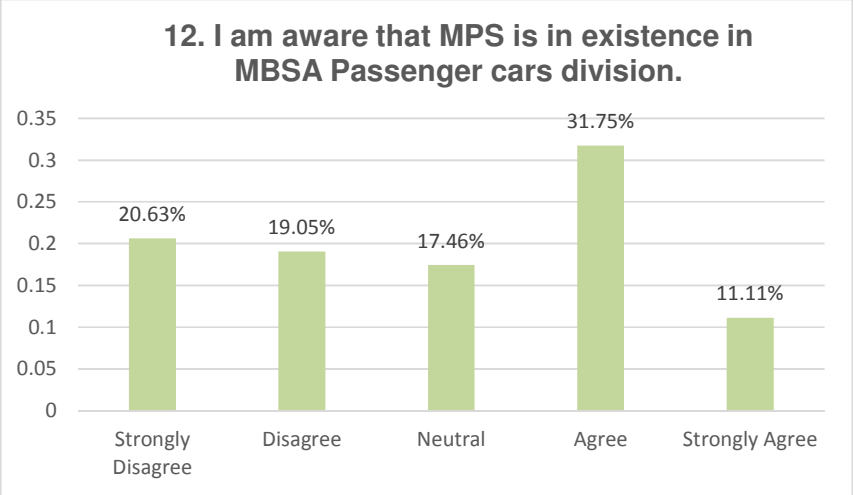


Figure 1.5.4.12 – Knowledge 2

Although over 40% of the respondents indicate that they are knowledgeable about MPS, there are 39.68% of respondents that are not knowledgeable about the existences of MPS within MBSA passenger car's division.

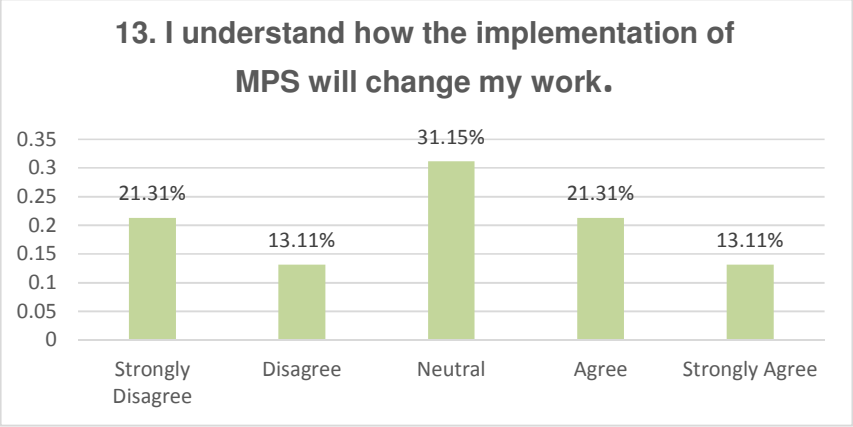


Figure 1.5.4.13 – Knowledge 3

Statement 13 indicates a rate of 31.15% of respondents as neutral. Clearly employees are not convinced that they understand how MPS would change the work. There is a strong indication that the knowledge and information regarding MPS to cope with the change is not sufficient

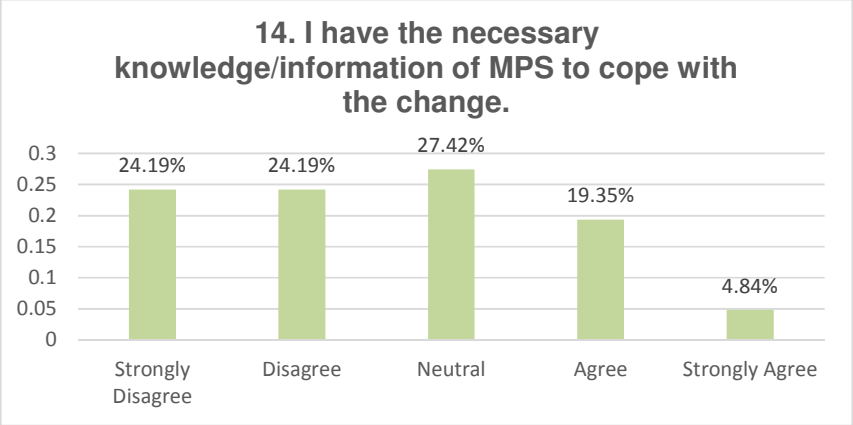


Figure 1.5.4.14 – Knowledge 4

Statement 14 is a clear indication that employees do not have the knowledge or information to cope with the change. There is a very high rating from neutral to strongly disagree and less towards agreeing and even less that are strongly agreeing. A combine score of 48.38% of respondents do not agree that they have the necessary information or knowledge for the change.

Figure 1.5.4.14.K summarised the knowledge statement scores.

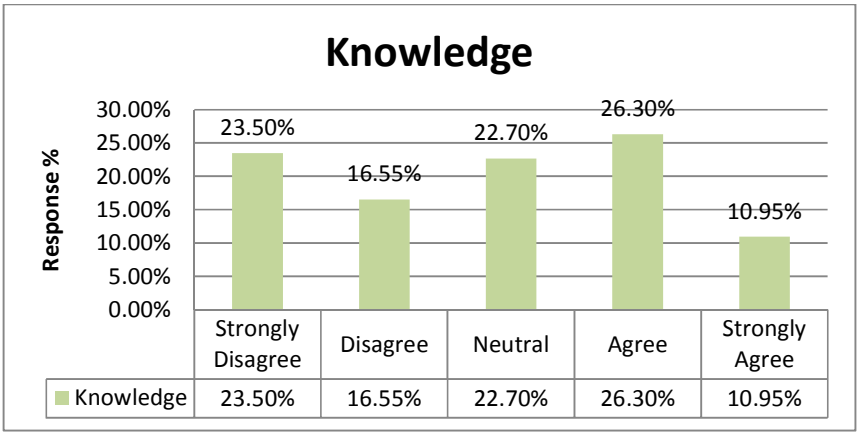


Figure 1.5.4.14.K – Summary of Knowledge statements

Knowledge – Respondents' ratings indicate that the respondents are fairly knowledgeable about the change, but there are also a significant number of respondents that lack knowledge about the change and therefore could affect the change due to a lack of knowledge. Over 40% of respondents feel that they do not have the knowledge for the change. The statistics describes that Knowledge, definitely stands out as an area of concern.

Ability

Statements15 to 17 evaluates the employees' ability to implement the change.

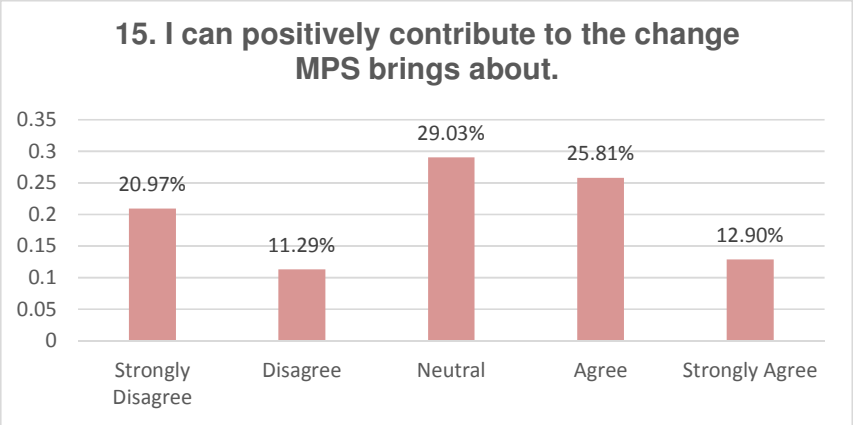


Figure 1.5.4.15 – Ability 1

Statement 15 describes that over 38% of respondents agree that they can positively contribute to the change and a combined score of 32.26% state that they disagree that they can positively contribute to the change. A high percentage of 29.03% of respondents indicate neutral to the statement that they can positively contribute to the change.

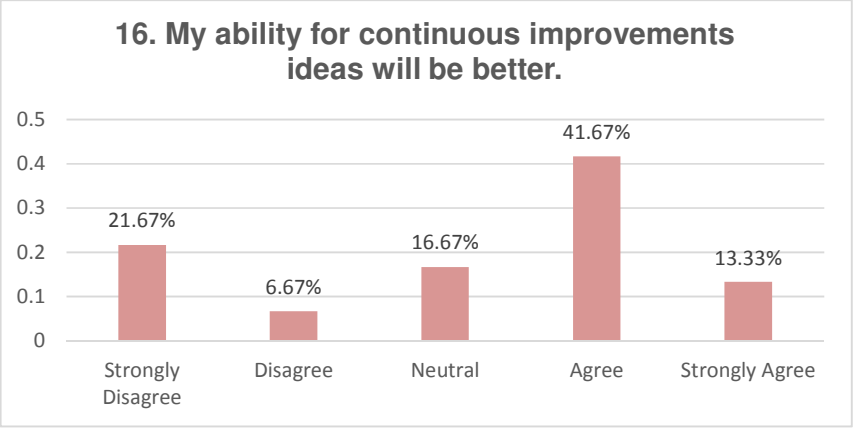


Figure 1.5.4.16 – Ability 2

The response to statement 16 illustrate that respondents agree by 41.67% that their ability for continuous improvement ideas will be better.

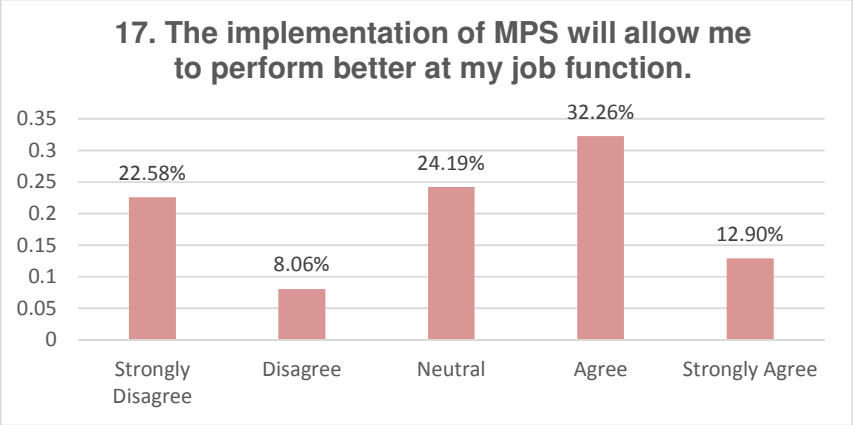


Figure 1.5.4.17 – Ability 3

Statement 17 shows that respondents agree with the statement that the change will allow them to improve their performances. A combined score of 45.16% agree that the change will allow them to perform better. These results are evident as so few people know anything about the change project.

Figure 1.5.4.17.AB summarised the Ability statement scores.

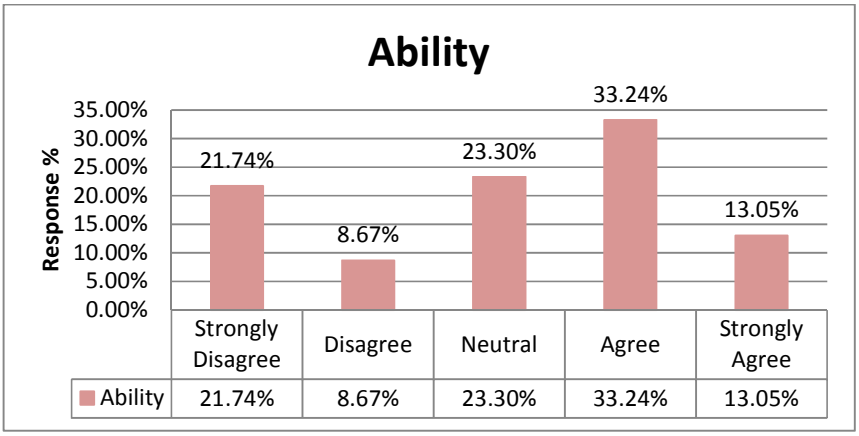


Figure 1.5.4.17.AB –Summary of Ability statements

The contrasting statistics between evaluating the knowledge and the ability of the employees is that employees seem to think that they have the ability to implement the change, but lack the knowledge regarding the change.

Ability – Respondents clearly think that they have the ability to implement the change and contribute positively to the implementation of MPS. There are 33.24% of respondents that agree to have the ability and 13.05% of respondents strongly agreed that they are able to implement the change.

Reinforcement

Statements 18 to 20 are to evaluate if the change will be sustainable.

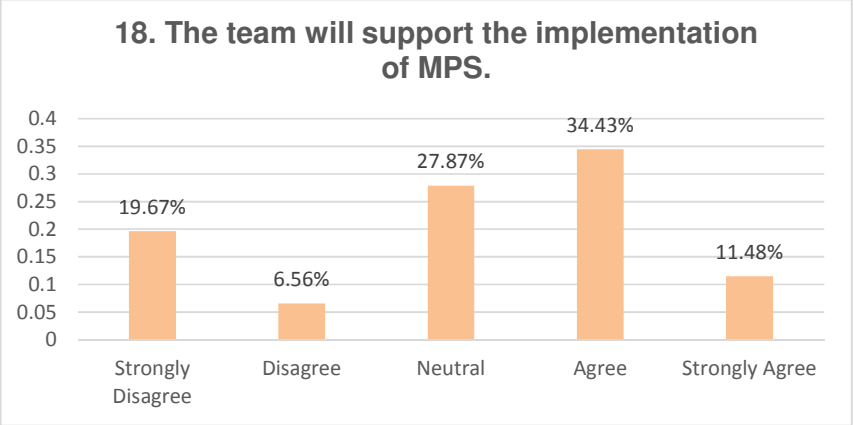


Figure 1.5.4.18 – Reinforcement 1

Statement 18 indicates that 34.43% of respondents agree that the change will be supported by their respective teams. Over 25% of respondents are of a different opinion that their teams will not support the change and 27.87% of respondents were neutral on this statement.

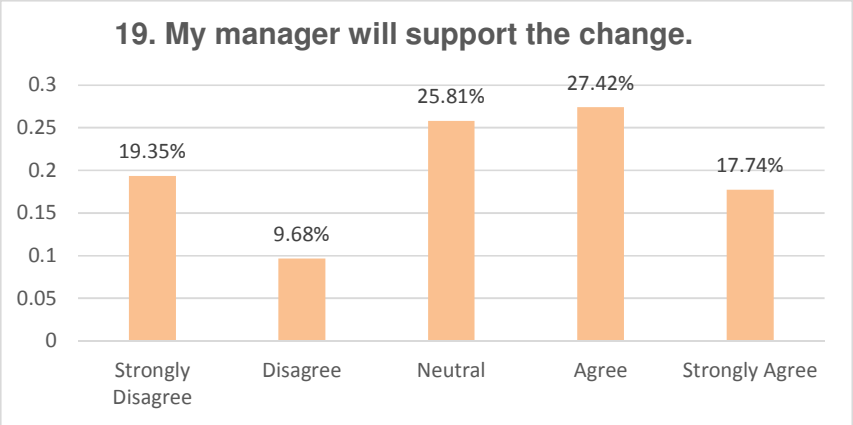


Figure 1.5.4.19 – Reinforcement 2

Respondents are of the opinion that their respective managers will support the change. Over 45% of respondents support statement 19, that their managers will support the change, while 29.03% do not agree that their respective managers will support the change.

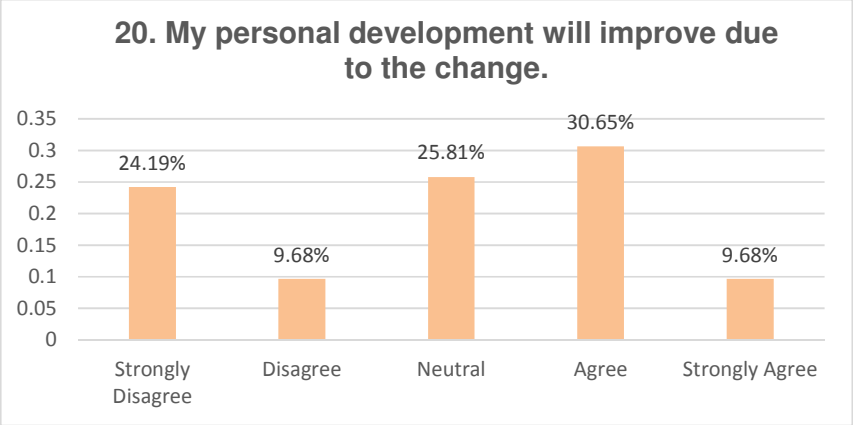


Figure 1.5.4.20 – Reinforcement 3

Statement 20 respondents are much higher in favour of agreeing with the statement; however there is a large percentage that feels that their personal development will not improve due to the change. A percentage of 40.33% of respondents are agreeing that their personal development will improve due to the change however 33.87% disagree that their personal development will improve.

Figure 1.5.4.20.R represents the summary of reinforcement statements.

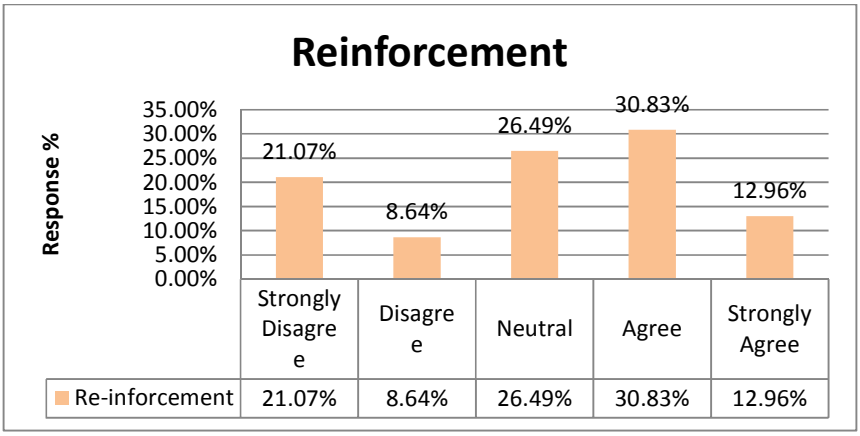
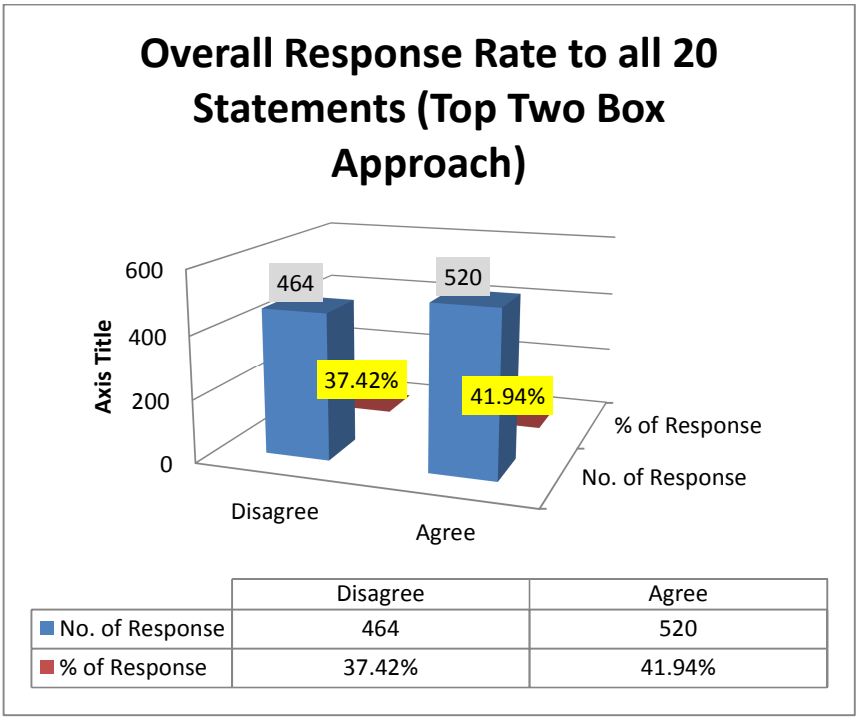


Figure 1.5.4.20.R Summary of Reinforcement statements

Reinforcement – The majority of the respondents feel that the change can be sustained and supported. A 30.83% of respondents agree that the change will be reinforced, while 21.07% strongly disagree.

Figure 1.5.5.2, represents the total of responses combined of all 20 statements, where the ratings were combined into the following, disagreement to the 20 statements or agreement with the 20 statements in the questionnaire.



	Disagree	Agree
No. of Response	464	520
% of Response	37.42%	41.94%

Figure 1.5.5.2 – Overall response rate to all 20 statements (Top two box approach)

The results based on this methodology represents that the level of readiness to the implementation of MPS in MBCV based on the five categories of (Hiatt, 2006) model. Over 40 % of respondents are positive about the change while a considerable amount is in disagreement. There are 20% of employees that are neutral to the change, meaning that they either somewhat agree or somewhat disagree with the change. A percentage of 37.42% of respondents was negative or in disagreement to the change and therefore such a higher percentage of respondents means strong resistance to the change project.

1.6 Discussions and Recommendations

The results of the MPS project in MBCV represent both qualitative and quantitative value.

The decision taken to enhance or bring about change within the division can be seen as positive by many individuals, but there are also some that would be critical about this. Change in any organisation is inevitable; as one cannot produce different results by doing the same things. Therefore, change at some stage needs to be a driver for better results. The key in any organisation is how to implement that change successfully.

Positive contribution from the MPS projects within the MBCV division.

- The project brought about new insights to the divisions and a much needed drive for change.
- The MPS team which comprised of individuals from the department of MPS and some of MBCV employees showed commitment, drive and determination to bring about positive change in the division.
- There were open discussions with management and from the onset targets were agreed upon.
- The MPS projects provided training and development to the MBCV staff.

Recommendations

1. Better communication and involvement of all role players can be enhanced. Many key individuals were only brought up to speed about the changes at a later stage and certain individuals conducted changes without involving the entire team.
2. Shop floor employees should be involved from the start of the project through communication, awareness, participation and given a sense of ownership.
3. Management can prepare their teams better to support future projects of this nature. More discussions and awareness from different departmental managers could have informed supervisors with sufficient knowledge and drive to support the project.
4. The process of PLAN, DO, CHECK and ACT (PDCA) should be emphasised more in order for all to be on the same path before the final presentations and the further steps required to realise the potential benefits to be made clear in order maintain stability.
5. The planning of improvement work could be better organised as there are no additional employees available to purely focus on the MPS improvement projects.
6. Time frames of the projects were tense and projects were at times under pressure to be completed, this limited the MPS team to do more work and show better results than the results produced at the end of the projects. Therefore better time frames should be considered in accordance of the scope of the project. This will allow more accurate work.

7. Before projects of this nature are initiated there should be an introduction meeting, where discussions around an MPS overview, its purpose, and benefits are discussed and emphasised in order to have the full buy in of management. Once the full support of the entire management team is given the motivation and drive can cascade down to the shop floor to also support projects of this nature.

The second part of the discussions and recommendations section revolves around the evaluation of employee change readiness prior to the implementation of MPS in the departments.

According to Hiatt and Creasey (2003: 8) executives want change to happen as soon as possible with the focus of the change is purely on financial performances. The change project benefitted short term financial performances but could have long term consequence on individuals of the organisation because the primary interest of executives differ to the primary interest of front line employees (Hiatt and Creasey, 2003).

A key objective of this research paper was to evaluate the level of readiness of the employees in MBCV to the change of implementing MPS within the division.

The results above indicate an overall readiness between *neutral and agree* on the scale of the questionnaire. Although most statements indicated that more respondents were either neutral or agreed to the prescribed change compared to the respondents that disagreed with the statements; the percentage of respondents disagreeing with the change is considerably high. The statistics described two focus phases of the ADKAR model where respondents indicate more disagreement than agreement to be Desire and Knowledge

Recommendations on the each ADKAR factor;

- Awareness – Score from respondents indicate that 39.22% of respondents are not aware of the change, 17.42% of respondents rated a neutral response and 43.15% of respondents replied that they are aware of the change. Yorkshire and Humber (Online: 2014) state that ‘Awareness’ involves information sharing that a change is happening and answering the ‘why’ question. According to Yorkshire and Humber (Online: 2014) there are resisting factors at this stage which include being comfortable with the status

quo, the credibility of the manager or change agent, debate or denial that the change is needed and rumour machines and misinformation. The resistance factors can be minimised by communication with all stakeholders, providing access to information, having an event or general meeting or by creating an observable condition or need (Yorkshire and Humble, 2014). Hiatt (2006) states that communication around awareness should place emphasis on the benefits and business reasons for the change.

Based on the survey there are many respondents that are not aware of the change, therefore communication should be improved by the division to involve all stakeholders.

To improve awareness, employees need to understand what the benefits of the change will be and understand the consequences if the change does not happen. The division could have communicated this to all stakeholders and explained the importance behind the change to ensure that the main strategy is to remain sustainable by finding and improving the manufacturing techniques and reducing operational cost with the aid of a productions system called MPS. The creation of awareness regarding the implementation of MPS within MBCV could have been communicated more frequently with all the required information and illustrations to all stakeholders, especially the shop floor staff.

According to Hiatt and Creasey (2003: 49) if awareness is identified as an area of concern, the focus should be on communicating the reasons for the change. The division should consider better communication for future change projects.

- Desire – “For successful change all individuals need to make a personal decision to support and participate in the change” (Yorkshire and Humble, Online: 2014).

  The rating from respondents for desire indicate that the desire of respondents is a concerning factor. Respondents indicated with combined rating scores of 43.05% of them not agreeing with having the desire for the change. There were 17.36% of respondents neutral and 39.59% of respondents indicated that they do have the desire for the change project.

According to Yorkshire and Humber (Online: 2014) 'Desire' can be considered the most difficult stage as it involves a personal decision and not so much the change agent. Yorkshire and Humber (Online: 2014) indicate that this stage can be strengthened by offering incentives, reduce the fear of employees, creating an atmosphere of belonging, providing face to face communication and generating awareness as to why the change is important for both organisation and the individual.

Therefore emphasis on individual gain and how the project would improve working conditions this would produce the desired rating. To create the desire for change repeating the reasons for change may not be enough more should be done to create the desire for the change. The division's management should investigate the key issues as to why 43.05% of respondents lack the desire to change and try to correct these issues, through continuous dialogue with employees.

- Knowledge – Respondents' ratings indicate that they are fairly knowledgeable about the change, but there are also a significant number of respondents that lack knowledge about the change and therefore could affect the change due to lack of knowledge.

  Respondents rating scores indicate that 40.05% disagree that they have the knowledge about the change, while 22.70% responded with a neutral score and 37.25% of response indicated that they do have knowledge about the change. If knowledge is identified has an area of concern, then caution should be taken not to discourage employees on dwelling on motivating factors rather provide education and training for the skills and behaviour required for the change (Hiatt and Creasey, 2003: 50).

  Yorkshire and Humber (Online: 2014) explain that knowledge is only effective when individuals have awareness and desire. According to Hiatt (2006) if employees lack the education or training to successfully contribute, irrespective if they have the awareness and desire, these employees will not demonstrate the readiness for change. Both, skills and behaviours are required to support the change once it occurs (Yorkshire and Humber, Online: 2014).

Training was provided during the implementation of the various projects, however the division could have offered basic training of MPS to employees before the commencement of the implementation of MPS, with this knowledge the projects could have been supported and more positively been contributed to by the shop floor employees.

- Ability – A number of the shop floor respondents indicated that they have the ability to implement the change.
  The score of respondents regarding the ability to conduct or carry out the change indicate the following scores; 30.41% replied that they do not have the ability to carry out the change, 23.30% were neutral on their ability to conduct the change and 46.29% stated that they have the ability to perform the change.
  According to Yorkshire and Humber (Online: 2014), ability should not be confused with knowledge, this is the gap between theory and practice. The ability to implement the change can be improved by ongoing practise, coaching, time, access to required resources and feedback (Yorkshire and Humber, Online: 2014) There should have been more practice time provided for the MBCV staff to ensure that their abilities were improved for future projects of this nature. Projects had strict and short time frames and this impacted on employees to adapt to the change. More time should be given to employees to adapt and improve their ability to perform the necessary change.

- Reinforcement – Majority of the respondents feel that the change can be sustained and supported. A total of 29.71% of respondents were of the opinion that the change will not be sustainable and that employees will revert to their old behaviours. There were 26.49% of respondents that replied neutral to the statements on reinforcement of the change and 43.79% agreed that the change will be sustained.
  “It is a natural tendency to resort to what we know. It takes concerted and ongoing effort to make change stick” (Yorkshire and Humber, Online: 2014). This will be the biggest challenge for the division to sustain the changes made

during the implementation of MPS and maintaining a culture of continuous improvements.

Lewin (1951), Kotter (2007) together with Hiatt (2006) agree that the final stages of any change should focus on sustaining that change.

Yorkshire and Humber (Online: 2014) recommend that the following be taken into perspective in sustaining the change that was implemented: ongoing celebrations of the change, ongoing rewards or recognitions, constant feedback, maintaining accountability, maintaining measuring of the change and providing the resources to sustain the change.

1.7 Conclusion

The key element of MPS fundamentally is to rationalise processes, causing processes to become more controlled, thus reducing cycles and improving quality. This eventually leads to cost reduction and better efficiency. The lowering of cost in the initial stages is not great, but over a longer term, given that the principles of MPS are followed thoroughly, it would reduce cost sufficiently. The changes to the organisational KPI's were evident in the research paper and projects. All KPI's achieved good results and impressed both senior and executive management.

However, the one KPI that is at the centre of MPS and a concerning factor to efficiency threats in South Africa's automotive industry are people or labour and their morale and motivation. The standardisation and cost reduction efforts are seen as a potential threat of job cuts by the shop floor employees. Distribution of workloads without proper consultation and awareness demotivates and demoralises the shop floor employees.

Yet, through proper communication and awareness the shop floor employees seem to understand that a common goal is required for sustainability of the organisation.

The ADKAR model evaluates the change readiness of individuals and future studies can be conducted to evaluate the readiness of the entire organisations, incorporating aspects of staffing, facilities, technology and infrastructure.

It can also be concluded by the level of readiness of the employees in the division that there will be a need for management to focus on futuristic organisational change proposals in order to be successful.

The unsatisfactory results on morale and the level of readiness of employees, indicates that MBCV needs to act on the recommendations made in the evaluation report to improve the morale of employees and achieve successful change for future change proposals.

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SECTION 2: LITERATURE REVIEW

2.1 Introduction

In today's competitive environment manufacturing organisations are under tremendous pressure to remain competitive by being more productive and offer better quality while reducing cost (Chauhan and Singh, 2012: 57). Unprecedented competition, coupled with a significant resource crisis, especially of energy and materials, has made lean manufacturing a key concept in the industrial environment (Chauhan and Singh, 2012: 58).

Chauhan and Singh (2012: 57) described lean manufacturing as follows "Lean Manufacturing aims at the elimination of waste in every area of production, including customer relations, product design, supplier networks and factory management". The aim of lean manufacturing is to save human effort, reduce inventory, decrease the time it takes to develop products and to reduce space in order to become highly responsive to customer demand, while still producing quality products in the most efficient and economical manner (Chauhan and Singh, 2012: 57). In the current dynamic business context, lean manufacturing has undergone and is still undergoing a process of continuous evolution (Chauhan and Singh, 2012: 57).

Sánchez and Pérez (2001: 1443), reiterates that the interest of lean manufacturing is predominately based on empirical evidence that lean manufacturing will improve the company's competitive advantage.

Romano *et al.* (2010: 89), state that the literature in general agrees that lean manufacturing impacts on a number of operational performances such as efficiency, throughput times and on-time delivery.

"The lean concept is not a single-point invention, but the outcome of a dynamic learning process (Holweg, 2007). The attainment of a lean engineering organisation is the critical requirement for ensuring a return on investment in intelligent manufacturing (Chauhan and Singh, 2012: 58).

The understanding of the introduction is clear that organisations have to adapt to certain philosophies to remain competitive and the literature review will present these new developments and adaptions undertaken with Mercedes Benz Production System (MPS) to enhance manufacturing philosophies at Mercedes Benz South Africa. The literature will seek to describe, flesh out and critique key concepts of the

research such as productions systems, MPS in particular, lean manufacturing concepts and related change management topics relevant to the research. The literature review will define production systems and the concepts of lean manufacturing, highlighting the benefits of the concepts to enhance organisations' manufacturing capabilities. An integrated part of lean manufacturing is people and the implementation of lean manufacturing into an organisation requires change management theories therefore key understanding in this particular research was to discuss change management concepts, in particular, employee change readiness. The literature will discuss different tools to assess employee change readiness and from this develop an employee change readiness tool.

2.2 Production Systems

2.2.1 The history of Production systems

The end of craft production sparked a new evolution of how to produce goods, which set the way for today's sophisticated quality control tools that were initially improved by John Hall who achieved the first production based on standardised, interchangeable rifle parts (Clarke, 2005: 72).

In 1911, Frederick W. Taylor of the United States developed the concept and tools know as *Principles of Scientific Management;* which formalised time-study and work study concepts (Chase and Aquilano, 1995: 14). According to Clarke (2005: 75), Taylor's concepts were standards to define the relation between worker and work. According to Drucker (1954: 280) the essence of Taylor's Scientific Management principles are "the organised study of work, the analysis of work into its simplest elements and the systematic improvement of the worker's performance of each element".

Also in the year 1911, Frank and Lillian Gilbreth of United States conducted studies into motion studies and basic concepts of industrialised psychology line (Chase and Aquilano, 1995: 14).

Production systems were formed with Henry Ford in the year 1913 with the concept of a moving conveyor line (Chase and Aquilano, 1995: 14). Ford formulated the way for today's production systems with mass production and combining Taylor's principles with advanced technologies (Clarke, 2005: 78). The key standard with the concept of Ford had been a 'standard model (the model T)' (Clarke, 2005: 78).

From 1927 to 1933 Elton Mayo conducted studies known as the “Hawthorn studies” which study the worker’s motivation (Chase and Aquilano, 1995: 14). Clarke (2005: 71) states that the results of the study stress the importance of the human aspect of work. The significance of standardisation within production systems dates back to the Hawthorn study which acknowledges the importance of the human element (Clarke, 2005: 71).

During the 1980s the manufacturing strategy paradigm changed and manufacturing became a competitive weapon with extensive use of Just–In–Time (JIT), Total quality control (TQC) and factory automation (Chase and Aquilano, 1995: 14). The paradigm shift was brought about by the following role players: Harvard Business School, Tai-ichi Ohno of Toyota Motors of Japan, W.E. Deming and J.M. Juran of United States. These individuals and institutions were instrumental in developing the key concepts of lean manufacturing and production systems.

This paradigm shift lead to the Toyota Production System (TPS). An integrated socio-technical system which comprises of a management philosophy coupled with practices which organise manufacturing and logistics for the automobile manufacturer that includes interaction between suppliers and customers (Strategos 2013:Online). TPS is a key originator of the more generic “lean production” which was developed between 1948 to 1975 by Taiichi Ohno, Shigeo Shingo and Eiji Toyoda and was originally called “Just-In-Time” (Strategos 2013:Online).

During the 1980s and the 1990s Toyota [2]transplants played a huge role in the evolution of TPS outside Japan, this contributed to the formulation of TPS which introduced the company’s production system to Western joint-venture partners (Clarke, 2005: 94).

According to Clarke (2005: 119) the introduction of standardised production systems in recent times within the automotive industry indicates that there is a distinct trend of companies that model their own production systems from TPS. This would include the Mercedes Benz Production System (MPS).

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[2] Transplants are automotive manufacturing plants that are in a certain country but not the country of origin of the organisation

Figure 1 in Appendix 1 provides the concepts and the role players that shaped today's sophisticated production systems, this historic timeline defined the current trend of standardised production systems.

2.2.2 Definition of Production Systems

Lean production has emerged as a leading paradigm of corporations' production processes, this was due to the publication of [3]MIT's study called 'The machine that changed the world' (Schuh *et al.* (2012: 908). The past decade has brought about increasing numbers of German companies that have developed standardised production systems that were based on their own socio-technical settings (Schuh *et al.,* 2012: 908). A comparison between American and Japanese automotive plants situated both in the United States and Japan discovered that higher productivity was discovered in Japan plants due to 'Lean Production' methods because the focus was on technical principles of production control such as value stream design, flow and pull principles (Schuh *et al.,* 2012:908). These technical principles were deemed to be universally transferrable to organisations (Schuh *et al.,* 2012: 908).

According to Schuh *et al.* (2012: 910), "A production system can be defined as an integrated framework of defined aims, principles and methods that guide the design and operation of manufacturing processes, taking into account economic, strategic, organisational and social aspects of the company's environment." (Schuh *et al.,* 2012: 910). Production systems can be classified into six subsystems comprising of the following: standardisation, visual management, production control, processes, continuous improvements and employee-orientation quality of products (Schuh *et al.,* 2012: 910). Appendix 2 provides a structure of a production system with the most common principles and methods summarised in a production system.

Standardisation is the main element with a goal to reduce cost and support continuous improvements by standardising components over products and processes (Schuh *et al.,* 2012: 910). According to Schuh *et al.* (2012: 910), the

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[3] James P.Womack, Daniel T.Jones, Daniel Roos from MIT wrote a book called "The Machine that changed the world" The book forms part of the study that explains lean production concepts in the automotive industry.

element of visual management seeks to increase workplace cleanliness, transparency and stability of the processes. The subsystem called “visual management” comprises of the ‘5s’ which organises and sustains the workplace, while [4]Andon provides live tracking of key performance indicators (KPI’s) (Schuh *et al.,* 2012: 910). The quality of products and process element is focused on quality assurance, poka-yoke and jidoka (autonomation) and TPM (total productive maintenance). The production control principles comprises of JIT (Just-In-Time), one piece flow, pull and heijunka (production levelling). These control principles support the value stream design, takt time, kanban and SMED (single minute exchange of die) (Schuh *et al.,* 2012: 910). The employee-orientation principle contains principles such as leadership, individual accountability, task assignment motivation and team work. Schuh *et al.* (2012: 910), point out that the final principle of a fundamental production system is continuous improvement which is at the centre of all production principles such as problem solving, suggestion systems, root cause analysis, A3 reports and PDCA (plan-do-check-act) cycles.

Clarke (2005: 12), points out that the term ‘production system’ has no consensus as a common definition, however states a comprehensive definition. Clarke (2005: 12), acknowledged the inherent complexity of a production system and terming it to intellectual, political and corporate laws. Hence, the term ‘production system’ can be defined as a complex system concerning organisational structures with the human being at its centre (Clarke, 2005: 12).

Clarke (2005: 72) suggests that production systems were initiated through the need for standardisation of processes and work. Clarke (2005: 72) expresses the view with the introduction of Taylor’s and Ford’s work organisation, the form and function of standardisation changed and Ford’s mass production led to a decline in quality.

However, where Ford’s mass production led to a decline in quality, Toyota integrated the quality responsibility as part of the shop floor employee, to form shop floor management and combined it with a highly standardised work organisation of Taylor scientific management principles.

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[4] Andon Boards are electronic boards or screens that display information to the factory floor workers on the organisational KPI’s like On-time delivery, quality etc.

Hu *et al* (2011: 667), points out the crucial issues in advanced manufacturing systems are to improve the performance and efficiency of production processes with regards to control, evaluation and sustainability with correct systems architecture.

Spencer and Carlan (2008: 273), state, at the beginning of the 1980s, the vertical integrated Ford's production model came under criticism for being rigid and lacking flexibility in the continually changing and diverse global markets. Leading firms in lean concepts or production systems started to provide a consulting service on lean and production systems as a method of improving asset efficiency, reducing cost and increasing profits in the global competitive markets (Spencer and Carlan 2008: 273). Spencer and Carlan (2008: 273), state that the resultant production system which was displacing the older vertically integrated bureaucracy became a horizontal network of leading firms in North America such as Ford, Daimler-Chrysler and General Motors and Japanese transplants.

2.2.3 Toyota Production System (TPS)

2.2.3.1 Definitions

"The Toyota Production System empowers team members to optimise quality by constantly improving processes and eliminating unnecessary waste of natural, human and corporate resources. TPS influences every aspect of Toyota's organisation and includes a common set of values, knowledge and procedures.

It entrusts employees with well-defined responsibilities in each production step and encourages every team member to strive for overall improvement" (Toyota forklifts: 2013: Online). Listed below are the descriptions of the common terminologies used within the framework of TPS (Toyota forklifts: 2013: Online).

- Andon Board: The facility for workers to signal problems to supervisors for immediate remedy, stopping the production process if necessary. Workstations along the production line can activate a warning on an illuminated central display board, which constantly displays productivity levels.
- Asa-ichi Meeting: A meeting held every morning in Toyota plants to discuss quality deviations and eliminate their causes. An essential part of the practice of kaizen.

- Genchi Genbutsu: Going to the source to find the facts to make correct decisions build consensus and achieve goals.
- Heijunka: Levelling the production schedule in both volume and variety. A precondition for Just-In-Time and elimination of mura, muri and muda.
- Jidoka: Making problems visible so that they can be immediately addressed.
- Just-in-Time: Making only what is needed, when it is needed, and in the amount needed, delivered just as they are needed (a continuous 'pulling' flow of standardised operations).
- Kaizen: Continuous improvement. As no process can ever be declared perfect, there is always room for improvement.
- Kanban Card: An instruction in the process that parts need to be replenished for production to continue uninterrupted.
- Muda: Waste in all its forms (things that do not add value to the final product): overproduction, surplus inventory, rework/correction, motion, processing, waiting and conveyance.
- Mura: Unevenness (in workload). Heijunka eliminates mura, muri and muda.
- Muri: Overburden or strenuous work, leading to safety and quality problems – more waste.
- Poka-Yoke: Mistake-proofing – devices that make it difficult or impossible for a worker to make common errors at his or her workstation. A simple, but creative and reliable way to reduce errors and maintain quality.
- Pull-System: Items called only as they are needed, as opposed to a 'push-system' that may not take account of actual need.
- Takt Time: The rate of customer demand – producing only what the market requires, and thereby achieving the optimum duration of the work-cycle that fulfils each customer's demand

According to Khanna and Shankar (2008: 81), the two men instrumental in creating TPS were Mr Kiichiro Toyoda, founder member of Toyota Automotive Industries, and Mr Taiichi Ohno. Khanna and Shankar (2008: 81), state that TPS is a system that ensures that high quality products are delivered to customers.

The success of Toyota in the automotive industry could have been attributed to one of many factors; one in particular is their systematic company-wide problem-solving approach (Marksberry *et al.*, 2010: 837).

Toyota was introduced to the world in the 1980s, becoming renowned for the quality and efficiency as their cars lasted longer and needed fewer repairs than American cars (Liker 2004: 3).

According to Clarke (2005: 137), TPS emerged over time and has matured since the 1950s to the highly integrative system we've known since the 1980s.

Rusli *et al.* (2012: 179), explains that, predominately, TPS is aimed at reducing cost by thoroughly eliminating wastes or muda. TPS holds Just-In-Time (JIT) manufacturing as a key in achieving cost reduction through lead time reduction and by the implementation of 'pull system' in the production causing improved productivity and creating continuous flow in the production (Rusli *et al.,* 2012:179).

Liker (2004: 32) brings about an understanding and clarity by defining the "TPS House" diagram as a system and not only a set of techniques. The "TPS House" diagram in Figure 2 of Appendix 1 has become one of the more recognisable symbols in the modern manufacturing era (Liker 2004: 32). According to Liker (2004: 32-33), a house was chosen as it has a structural system consisting of a roof, supporting pillars and a foundation.

Liker (2004: 33), explains that the "TPS House" diagram starts with the goals (Best quality, lowest cost and shortest lead time) as being the roof, then continues with the two pillars Just-In-Time and *jidoka* that stipulates that the product should never move to the next station with any defects. The centre of the system comprises of people and three foundational elements which are standardisation, *heijunka* and visual management.

Chase and Aquilano (1995: 242), breaks down the definition of 'Just-In-Time' into the following:

- What is it? – It can be considered a management philosophy and 'pull' system.
- What does it do? – It attacks elements such as waste, time, inventory and scrap and achieves a streamline production.

- What does it require? – It requires employee participation, basic industrial engineering aspects, continuous improvements, total quality control and smaller lot or pack sizes.
- What does it assume? – It assumes a stable environment.

Svensson (2001: 873) is of the opinion that many recent authors describe JIT as a philosophy whereby all materials or goods arrive exactly in time when they are needed, that is neither early nor late.

Based on the above literature, TPS appears to be the forerunners of production systems and lean production concepts therefore it is an important element of the literature review to benchmark and understand the milestones achieved by other production systems, compared to MPS.

2.2.4 The emergence of the German automobile Production Systems

Pries (2003: 11) explains that during the course of the trans-nationalisation drive of German carmakers in the 1990s, 'German car manufacturers started to explore manufacturing opportunities in overseas plants and therefore these German automobile manufacturers started to focus on production systems.

During the 1980s the Japanese car manufacture companies constructed their transplants in the United States and Europe (United Kingdom mainly) and their concerns were whether these plants would replicate the so called Japanese production model of lean production and to what extent these plants would adapt themselves to the specific local setting (Pries 2003: 11). According to Pries (2003: 12), the adaption-application-debate of production systems stimulated a sequence of research projects and debates of the Groupe d'études et de recherche sur l'industrie et les salariés de l'automobile (GERPISA) network which raised the general question of what the 'best way' of building cars all over the globe was. These debates found that even car manufacturers in Japanese organisations used different production systems and in light of these debates and findings the German car manufacturers developed their production systems (Pries 2003: 12).

According to Pries (2003: 13), at the beginning of the 1990s, the German car manufacturing industry became aware of globalisation and this was evident in them restructuring the older overseas production plant with concepts of production systems. One of the German automotive organisations was Daimler–Benz and they

were seen as a successful mixture and hybridisation of German product philosophy and of Japanese, especially of Toyota's, production philosophy (Pries 2003: 12). Pries (2003: 21), explains that the traditional Daimler-Benz production system fundamentally comprised of the philosophy of craftsmanship and high production and work flexibility with a very low level of standardisation. The emerging of the new production philosophy, in particular the Daimler-Benz's case, seek to combine high flexibility in production with high standardisation in processes, this challenged the traditional Daimler-Benz production system and if not achieved could be seen as 'backward learning' (Pries 2003: 21).

2.2.5 Mercedes Benz Production System (MPS)

MPS was constructed in 1999 and implemented in 2000 because of the merger of Daimler AG and Chrysler (Clarke, 2005: 127-128).

According to MBSA (2013: Online), "The Mercedes-Benz Production System (MPS) is an integrated model of how processes should be designed, implemented and sustained within Daimler manufacturing". The production systems define how the organisation will produce automobiles and how they will run their business (MBSA 2013: Online). According to MBSA (2013: Online), the system is seen as a competitive tool to provide high quality products to their customers' desire, quickly and at a lower cost than the competitors. MPS tools are fundamentally based on 'Best Practice Operations and Principles' of leading automobile manufacturers around the globe and has a direct bearing on **S**afety, **Q**uality, **D**elivery, **C**ost and **P**eople (MBSA 2013: Online). The implementation of the system requires every individual within the organisation's involvement and is mainly focused on the shop-floor, but has a natural effect on supporting environments as all concepts of MPS are fundamentally applicable to all areas of the business within the organisation (MBSA 2013: Online).

2.2.5.1 The MPS System

The five subsystems according to Clarke (2005: 159-160) are:

1. Human Infrastructure which comprises of Leadership, Clarity of task and roles, Employee Involvement and Developments, Work group organisational structure and Safe work practice together with environmental awareness.

2. Standardisation – standardise methods and work procedures, visual Techniques/5s.
3. Quality Focus and Robust Processes and Products (Quick Issue detection and correction), Robust Processes, (products and preventative quality assurance, Customer focus internal and external)
4. Just-In-Time (JIT) (Production smoothing, Pull production, Continuous flow processing, Customer demand rate).
5. Continuous Improvements (Waste elimination).

Figure 3 in Appendix 1 describes the MPS model, which is linked between the five subsystems and is described with the use of an analogy of a pulling wheel which is represented by the subsystem of Just-In-Time on a slope and assisted by the remaining four subsystems (Clarke 2005:138). The wheel is supported by standardisation which ensures that the progress made remains and does not return to what is previously was and waste is represented as obstacle for continuous improvements (MPS 2009:11).

2.2.5.2 The Subsystems of the MPS system

2.2.5.2.1 Human Infrastructure

The definition of Human Infrastructure defines the principles of roles in the organisation, the organisational structure and principles of leadership with emphasis on involvement of all employees in the deployment and achievement of the organisation's goals (MPS 2009: 13). Skills, creativity and efforts of employees are steered and supported by systems and programs based on mutual trust and respect (MPS 2009: 13). According to MPS (2009: 14) under the subsystem of Human Infrastructure, five operating principles exist under this subsystem:

1. Leadership – Involving every individual within the organisation toward achieving the organisational goals through implementation of the operating principles and the use of the employee's leadership ability.
2. Role Clarity – This principle emphasis clearly defined operation and system responsibilities for all levels of the organisation, employee involvement, development and valuing of employees.
3. Work Group Organisational Structure – It is an organised group composed of individual teams that worked together to achieve tasks.

4. Safe Work Practices and Environmental Awareness – The important operating principle is safety and all employees operate with sense of social responsibility, conserving resources and protecting the environment.

2.2.5.2.2 Standardisation

Standardisation is the fundamental philosophy and practice, this safeguards that processes are performed in a similar manner on every shift and cycle (MPS 2009: 15). MPS (2009: 15), points the reason behind standardisation is to ensure that every process contributes to the production of the organisation products in a manner that is safe, efficient and of a predictable quality that is built into the process for all activities in the organisation.

The Standardisation subsystem comprises of two operating principles:

1. Standardised Methods and Procedures – All process are standardised to ensure a safe operation, reduce process variability; quality and standardisation becomes instrumental for continuous improvements.
2. Visual Techniques - The manufacturing procedures are organised in order for all to tell by just a glance if the production processes are proceeding as per the norm, and all abnormalities are made visible. This is supported by the 5s system and process (MPS 2009: 17).

2.2.5.2.3 Quality Focus and Robust Processes and Products

Quality focus is the effort of every employee to achieve zero defect products and on their performances, whereby robust processes and products speak to the design product capability on holding tolerances and processes need to maintain predictable, stable and in-control results (MPS 2009: 19). MPS (2009: 19), the aim of this subsystem is to effectively meet the customer demand first time from all employees with the aid of Process Failure Mode Effect Analysis (PFMEA) and Total Productive Maintenance (TPM) and Quality-Stops to ensure robust processes, operating equipment and zero defects. This is maintained through a systematic implementation of a Quality Management System such as MQAS, QS 9000, ISO 9000 in the US and VDA 6, QS 9000, ISO 9000 in Germany and regular audits both internally and externally (MPS 2009: 19).

2.2.5.2.4 Just-In-Time

Just-In-Time is defined as producing what a customer wants, within the amount they want it, when they want and only using the required material, labour and space (MPS 2009: 21). Just-In-Time is an information and material flow concept (flow layout, pull concept with its aim to simplify and make processes more efficient, customer-focused manufacturer, minimum levels of stock and short lead times. MPS (2009: 21), states that this results in a lean system that contains no slack (e.g. buffer stocks, unnecessary machinery, excess staff and waste).

According to MPS (2009: 22), the JIT subsystem consists of four operation principles:

1. Production Smoothing - The production variation and volume is balanced; enabling a smooth flow of production, allowing a pull production system and efficient flow of material.
2. Pull production - All production process produces are based on the demand from the next process.
3. Continuous Flow Processing – Production process flows continuously at a constant rate from start to end.
4. Customer Demand Rate – The build rate and conveyor line speeds are based on the demand of the customer.

2.2.5.2.5 Continuous Improvements (CI)

Continuous Improvement is described as a continuous process of the company's current standards, by which employees try to improve the efficiency of the processes and work situation (MPS 2009: 24). The goal of CI is to establish and reduce or eliminate non-valued added activities, reduce lead-times, eliminate waste and enhance the working environment of every employee through ergonomic and safety improvements (MPS 2009: 24). According to MPS (2009: 24), CI is a culture, not a tool or program to be administered occasionally, with certain requirements such participation time for employees, adequate competence, skills and support.

According to MPS (2009: 26), CI consists of one operating principle:

The elimination of waste and improving on Safety, Quality, Delivery, Cost and Morale, increases organisational profits and continuously reduces manufacturing lead-times.

A breakdown of the five sub systems were described above, however, MPS contains 93 tools that support these sub systems. The 93 tools described in Appendix 3 provide detail of the various tools that can be used to support each operating principles under each sub system.

The Literature has thus far only discussed production systems, but a key element to production systems is the broader description of lean manufacturing. Production systems are, in essence, derived from lean manufacturing and were just labelled production systems to a particular organisation. Therefore, the next section of the literature is to examine lean manufacturing concepts and see how the production systems literature matches into the broader term known as lean manufacturing.

2.3 Lean Manufacturing or Lean Production

Holweg (2007: 420), points out that the term 'Lean Production' was introduced in 1990 and became a widely cited reference in Operations Management (OM) through the book titled 'The Machine that changed the World' by (Womack *et al., 1990)*. Holweg (2007: 420) argues that although this term became known during the launch of the book the concepts of Just-In-Time (JIT) and lean production came a decade prior to the book in Japan's manufacturing industries.

According to Hallgren and Olhager (2008: 978), the term 'lean production' dates back to 1988 when it was first used by Krafcik at the International Motor Vehicle Program (IMVP), however the Toyota Production System were the forerunners of lean production systems.

Knod and Schonberger (2001: 33), explains that a MIT study of worldwide automobile assembly, the system was labelled 'lean production' although many techniques were perfected first by Toyota and it was labelled as the 'Toyota Production System (TPS)'. According to Knod and Schonberger (2001: 33), citing the authors from the MIT study they described lean production as "It is lean because it uses less of everything… half the human effort in the factory, half the manufacturing space, half the investment in tools, half the engineering hours to develop a new product and half the time. Also, it requires keeping far less than half the needed inventory on site, results in many fewer defects, and produces a greater and ever growing variety of products".

The Toyota Production System is the basis for most of the 'lean production' drive in which it has been dominating manufacturing trends together with six sigma for the past ten years (Liker 2004: 7).

The theory of "Lean" has been become common to many authors and the origin of the theory, but it was only describe as lean in 1990 and the leaders of the lean concept were Henry Ford and Edward Deming long before the year 1990 (Bicheno 2006: 8).

According to Bicheno (2006: 7), in both manufacturing and service there are three principle priorities for operations consisting of Lean operations, Six Sigma quality and Supply Chain management.

Lean Thinking is a philosophy, rather than a system or a technique which focuses on simplicity, flow, visibility, partnership and value (Bicheno 2006: 7).

Figure 4 in Appendix 1 provides an inner and outer core; the inner core is a set of priorities that are interlinked and are embedded in the outer core of three related forms of thinking within the philosophy of lean production.

Hallgren and Olhager (2008: 978), state that manufacturing plant managers use various initiatives to improve the operation capabilities. Lean manufacturing and agile manufacturing are but two of these initiatives.

According to Hallgren and Olhager (2008: 978) Lean is defined as containing "little fat" and Agile as "nimble". Hallgren and Olhager (2008: 978) describe that many authors argue that lean and agile are subsets of each other.

"The definitions by Naylor *et al.* (1999) serve to contrast the concepts lean requires elimination of all forms of waste, including time, and it requires the implementation of a level schedule, while agile requires the use of market knowledge and a virtual corporation to exploit profitable opportunities in a volatile market place" (Hallgren and Olhager 2008: 978).

Hallgren and Olhager (2008: 979), point out five lean principles: value, value stream, flow, pull and perfection.

1. Value – This is defined by the end customer.

2. Value Stream – A set of processes that bring about the final product through the internal value chain.
3. Flow – Creating the value via precise steps.
4. Pull – Refers to a pull schedule, whereby production is pulled by the schedule of customer orders.
5. Perfection – Placing continuous improvements as a consistent part of the organisation.

According to Al-Aomar (2012: 299), Lean manufacturing maintains the focus on Value Added (VA) elements to manufacture products as well as the Non Value Added (NVA) (flows, delays, and mistakes), emphasizing cost effectiveness, on time delivery and coupled with high quality standards.

Boyer (1996: 48-49), is of the opinion that lean production principles can alter how people carry out duties, but will not always change their mind-set or thinking. Lean production could become more challenging and stressful for blue collar workers as the key objective of lean production is to push the responsibility down to the low structures of the organisation.

Pycraft *et al.* (2010: 438), describe the lean philosophy as doing the simple things well and gradually doing them better on the quest to eliminate all waste in every step of the way. Some argue that origins of JIT comes from Toyota's reaction to the 'oil shock' of increasing oil prices in the early 1970s and this is what spurred the need for improving manufacturing efficiencies (Pycraft *et al.,* 2010: 438).

Pycraft *et al.* (2010: 438), describes three key issues that define the lean philosophy which in turn underpins the techniques of JIT, the elimination of waste, the involvement employees and the drive for continuous improvements.

Figure 5 below in Appendix 1 provides a description of the lean philosophy and JIT methods and techniques.

2.3.1 The elimination of waste

Pycraft *et al.* (2010: 438), state that arguably the elimination of waste can be seen as the most significant part of the lean philosophy. The key concepts around this philosophy are the seven forms of waste and the 5s.

2.3.1.1 The seven forms of waste

This strategy is concerned with identifying the waste within an operation and can be applied in both service and production forming the core element of lean philosophy. (Pycraft *et al.*, 2010: 438).

1. Over-production – Producing more than what is currently required for production.
2. Waiting time – Waiting time decreases the efficiencies of both equipment and labour.
3. Transport – The movement of items around the operation, together with double and triple handling.
4. Process – The process in itself could be waste as processes could always be improved.
5. Inventory – All inventories, especially excess inventories, could mean storage cost.
6. Motion – In this case motion can be seen as a waste especially unnecessary movement within the operation adding zero value.
7. Defectives – Quality waste becomes costly and time consuming.

2.3.1.2 The 5s

The 5s terminology originates from Japan and this strategy simply set the principles for reducing waste (Pycraft *et al.,* 2010: 438 - 439).

1. Sort (Seiri) – Eliminate whatever is not needed and keep what is required.
2. Straighten (Seiton) – Place items in an orderly manner, making it easily accessible.
3. Shine (Seiso) – Keep everything neat and tidy, no dirt or refuse.
4. Standardise (Seiketsu) – Maintain order and cleanliness.
5. Sustain (Shitsuke) – Develop a commitment and pride in maintaining standards.

2.3.2 Continuous Improvements (CI) or Kaizen

Continuous Improvements is an integral part of the lean manufacturing and as it appears part of the MPS and TPS one has to view it under concept of lean manufacturing.

Chase and Aquilano (1995: 180), explains that Continuous Improvement (CI) is a philosophy undertaken by management that approaches the challenges of its products and process improvements as never ending with an element achieving minor wins. Chase and Aquilano (1995: 180), describe CI to be a continual process which seeks improvements of equipment, raw materials, labour utilisation and production methodologies through suggestions and ideas from the entire team.

The importance of CI will determine the long term sustainability of an organisation.

Pycraft *et al.* (2010: 555), defines continuous improvement as a tactic to improve performance via more and smaller incremental steps.

Murray and Chapman (2003: 273) define continuous improvement as "…. a humanistic approach because it expects everyone - indeed everyone - to participate in it. It is based on the belief that every human being can contribute to improving his workplace where he spends one-third of his life".

Pycraft *et al.* (2010: 555), defines Kaizen as an improvement, moreover it means improving one's own personal, home, social and work life. In a work environment kaizen means continuous improvements that involve everyone, both managers and workers (Pycraft *et al.,* 2010:555).

Kaizen is a Japanese phrase for on-going process of unending improvement with the aim of setting and achieving higher goals (Heizer and Render, 1996: 83).

According to Singh and Singh (2009: 51), the term is a two compounded concept Kai (change) and Zen (for the better) which originated in Japan in 1950. The word Kaizen became common in the western world and can be defined as continuous improvements. In Figure 6 in Appendix 1 'The Kaizen Umbrella' provides a breakdown of key elements that makes up the concept of Kaizen.

2.3.2.1 Kanban

According to Heizer and Render (1996: 83), Kanban is a Japanese word for card that focuses on reducing the inventory that pulls inventory through work centres.

The Kanban system is a signalling card system, where recorder quantities equal to the original number of parts held by the inventory container or equal to the amount taken from the container (Chase and Aquilano, 1995: 245).

Gupta *et al.* (1999: 2), state that the Kanban system is an element of JIT and has the attention of many researchers. The definition of Kanban is a 'visible sign' which has the following advantages, the ability to control production, simplicity in scheduling production, reduce operator burden and provide easy identification of parts.

2.3.2.2 Poka-Yoke

Knod and Schonberger (2001: 297) describe poka-yoke as, a fail-safe process that meets customer requirements; this fail-safe is known by its Japanese name as poka-yoke.

According to Heizer and Render (1996: 96), define Poka-yoke as a 'fool proof' device or technique that ensures production of good units all the time.

2.3.2.3 Total Productive Maintenance (TPM)

Pycraft *et al.* (2010: 445), expresses the view that TPM's distinct purpose is to eliminate the variability in operation processes caused by the effect of unplanned breakdowns.

It is productive maintenance carried out by all employees through minor group tasks and maintenance management recognises the importance of reliability, maintenance, and economic efficiency in plant design (Pycraft *et al.,* 2010: 555). According to Pycraft *et al.* (2010: 595), there are five goals of TPM:

1. Improve equipment effectiveness – by investigating all losses which happen.
2. Achieve autonomous maintenance – involving staff to take responsibility for some of the maintenance tasks and improvements of the maintenance performance.
3. Plan maintenance – A complete worked out approach to all maintenance activities.
4. Train staff – Both trained maintenance and operation staff, in order for all to carry out their respective task.
5. Achieve early equipment management – with maintenance prevention, that involves consideration failure causes and maintainability of equipment.

There is a fundamental element that needs to be incorporated in to lean manufacturing or production systems and that is that people are at the centre of these concepts. As people are at the centre of implementing these concepts into

organisations it requires change management concepts. Therefore the literature will continue to describe, flesh out and critique key concepts of change management and in particular change readiness. The literature will also seek to explain the various tools used for evaluating readiness of shop floor employees within MBSA CV for the planned MPS implementation and see what tool will be most suitable for this research. Holt *et al.* (2007: 234) states that readiness is arguably one of the most essential elements involved in employees support for change initiatives. The basis of readiness could be entrenched in several theoretical models of the process through which the change unfolds and for that change to occur in a direction which the leadership desires all unresolved conflict should be resolved (Holt *et al*., 2007: 234).

2.4 Change Management

MPS is a change project to achieve the associated business results and therefore could be a fundamental driver of organisational change.

Nordin *et al.* (2010: 2) explains that lean manufacturing principles, as adopted by production systems like MPS, represents a holistic approach to change, with multiple initiatives undertaken to foster a culture of continuous improvements. This creates the foundation for lean manufacturing to take control of a significant organisational and cultural change within organisations.

Mohrman and Lawler (2012: 41- 42), state that a key capability for an organisation is the ability to adapt as to context, opportunities and challenges change. There are many organisations that explored new approaches that failed, while other organisations designed new approaches that modelled the competitive landscape for the future, such as Henry Ford's assembly line, Dell's mass computer customisation, Amazon's electronic retailing and Toyota's integrated supplier networks, these are examples of fundamental approaches of changed organisations setting the benchmark for others (Mohrman and Lawler, 2012: 42).

Nordin *et al*. (2010: 2), expresses that change is not an exception rather a steady process going forward and that change requires attention on both processes and people.

According to Drzensky *et al*. (2012: 95) "In times of globalization and competitive pressure, the capability of organizations to develop and change is becoming more

and more important. The competence to handle change efficiently is a key variable for long-term organizational success".

2.4.1 Organisational Change.

Kotter (1995), states that transformation triumph depends on a strategic and sequential approach to change. Self *et al.* (2007: 212) citing Kotter and Cohen (2002) states that organisational change failures occur, but these failures are commonly related to human issues rather than technical issues.

Moravec (1995: 15) describes such organisational change as reengineering, which does not only eliminate processes to gain productivity, but unlike downsizing and restructuring, it requires a re-evaluation of assumptions and beliefs about process, systems, structure, people, culture, practices, and technologies.

The research of van Heerden (2011: 10), mentions that organisations have to deal with dynamic and diverse people that are required to adapt to challenges of the ever changing competitive economic, technological and social environments.

2.4.1.1 Understanding Change

To define and understand change is difficult as there are many interpretations of the concept (Sventelius and Öhrström, 2013: 29). The research of Sventelius and Öhrström (2013: 29) defines change as;

"There can never be a universal theory of organizational change, as change involves a movement to some future state that comprises a context and time that remain unknown."

Nordin *et al.* (2010: 2), differ from the quote above by describing organisational change as a process by which organisations move from their present state to a desired state to increase effectiveness. Based on the two definitions, in today's competitive environment, organisations would create change to a state of competitiveness, where context and time is not completely unknown. Barnett and Carroll (1995: 219) support this, by stating that organisational change involves by definition a transformation of an organisation between two points in time and comparing the before and after of that transformation.

The research of Sventelius and Öhrström (2013: 29), describe a framework that provides a structured way of defining change, this is based on a number of questions

consisting of *what, why, who* and *how*. These questions can be considered critical when considering organisational change.

Nordin *et al.* (2010: 2), describes change from the traditional manufacturing system to a lean manufacturing as a complex task, which depends on four critical factors; leadership and management, finance, skills and expertise and supportive organisational culture of the organisation. Organisational change management in practice focuses on conforming that the people change is addressed correctly, aligning them with the business strategy, technology and processes (Nordin *et al.,* 2010: 2). Any form of lean change requires people with the correct attitude and vision towards lean manufacturing, thus creating a successful platform for lean transformation (Nordin *et al.,* (2010: 2).

2.4.1.2 Drivers for Change

The external and internal environment drivers change in an organisation, where external changes are in the economy, politics, legislation or socio-cultural changes, to more immediate factors such as competitors changing strategies, an increased level of competition and supplier quality. The internal factors are elements such as the structure, products or services, technology, culture and human resources (Sventelius and Öhrström, 2013: 30). Parry *et al*. (2014: 99), point out six key drivers of change, the amount of change and turbulence, available resources, alignment with the company's vision and direction, quality of change management, work roles and emotional energy. These are all factors that could lead to organisational change.

2.4.2 Change Readiness

Todnem (2007: 4) mentions that change is unavoidable irrespective if organisations are ready or not. Todnem (2007: 4) citing Armenakis *et al* (1993), Armenakis and Harris (2002), Kotter (1996) and Luecke (2003) are all of the opinion that it is vital for any organisation to be ready for the change before attempting to implement and manage any kind of change. A premature implementation of change could lead to outcomes that were not originally desired because employees are not psychologically ready (Todnem, 2007: 4).

Change readiness can be defined as the cognitive precursor of the behaviours of resistance to support the organisational change (Armenakis and Harris, 2009: 132).

2.4.3 Resistance to Change

Van Dijk and van Dick (2009: 143) state that there is a significant impact and influence on the success of an organisational change project due to resistance to change. A behaviour that is not aligned to the change leader is best described as resistance to change, however resistance is a socially constructed phenomenon that identifies, defines and re-defines continually through the interaction of all parties included in the change (Van Dijk and van Dick, 2009: 143).

According to Oreg (2006: 73), the term 'resistance to change' is frequently used in the research and literature on organisational change and therefore resistance to change is used as an explanation why efforts for introducing huge changes in production methods (like MPS), technology, management practices or compensation systems fail or do not meet the expectations. Recent studies have revealed that resistance to change is attributed by the relationship between a change in conditions and work related outcomes (Oreg, 2006: 82). Added factors for resistance to change were associated with lower levels of job satisfaction (Oreg, 2006). The anticipated impact of the change on individuals personally often exhibit resistance to change rather than the resistance of the change itself (Self *et al.*, 2007:213).

According to Drezensky *et al.* (2012: 95), the failure of the change is mostly attributed to the so called soft factors such as 'resistance to change'.

According to Yorkshire and Humber (Online: 2014) there are resisting factors at this stage which include being comfortable with the status quo, the credibility of the manager or change agent, debate or denial that the change is needed and rumour machines and misinformation. The resistance factors can be minimised by communication with all stakeholders, providing access to information, having an event or general meeting or by creating an observable condition or need (Yorkshire and Humble, 2014).

2.4.4 Change Management Process Models

"Many of the factors proposed as decisive in an organization's readiness for change can be linked to those identified in Kanter *et al.'s* (1992) ten commandments for executing change, Kotter's (1995) eight-stage process for successful organizational transformation and Luecke's (2003) seven steps as suggestions on how to facilitate emergent change" (Todnem, 2007: 4). Mento *et al.* (2002: 45) states that in literature

there are numerous change models that exist for guiding and instructing the implementation of major changes within organisations. Some of these models are Lewin's (1947) "unfreeze – change – re-freeze" model, Kotter's strategic eight-step model for transforming organisations, Jick's tactical ten-step model for implementing change, General Electric (GE)'s seven-step change acceleration model and Hiatt (2006) ADKAR model to evaluate employee change readiness. These models exist however the research needs to briefly discuss, compare and determine which model would best serve to evaluate the change readiness of the employees in Mercedes Benz South Africa Commercial Vehicles. The suitable model should have simplicity; fit the intended purpose and be relevant with regards to the context of the proposed change (Bedser, 2012).

2.4.4.1 Lewin's Model

Holt *et al.* (2007: 232 -233) explains that Lewin (1947) argued the progression of individuals through the change, three stages of 'unfreezing, moving and refreezing' are experienced by the individuals involved with the change.

Burnes (2004: 985), states that Lewin (1947a) argued that a successful change project involved three steps:

Step 1 – Unfreezing

In order for change to take place the equilibrium needs to be unfrozen before the old behaviour can be removed or unlearnt and the new behaviour successfully accepted. People have to feel safe from loss and humiliation before accepting new information and accepting the change (Burnes, 2004).

Step 2 – Moving

Burnes (2004: 985) describes the moving step as a continuation from the unfreezing step as it creates the motivation to learn, but not necessarily providing direction or control.

Step 3 – Re – freeze

This step is seen as the final step to maintain the new behaviours which are cemented in the organisational culture, norms, policies and practices (Burnes, 2004: 986).

Burnes (2004: 992 -994), underlines some of the criticisms made by numerous authors regarding Lewin's model:

- Too simplistic and mechanistic where organisational change is continuous and an open ended process.
- The model is limited to incremental and isolated change and not able to incorporate radical, transformation change.
- It ignores the role of power and politics in organisations.

2.4.4.2 Kotter's eight step model

A discovery that a majority of major change efforts failed, Kotter formulated his model to avoid major errors in the change process (Mento *et al.*, 2002: 45). Kotter's model is viewed as a change process model with two key phases, the change process passes through a series of phases each lasting a considerable amount of time and that at any stage a critical mistake can have serious impact of the change process (Mento *et al.*, 2002: 45).

Mento *et al.* (2002:46) explains that Kotter's eight step model is aimed at the strategic level of change management.

Kotter (1995: 61) believes that are eight stages to successfully transforming an organisation, these stages or steps are described below:

- Establishing a sense of Urgency: Examine the market and competition, and identify and discuss risks, potential risk and opportunities.
- Forming a powerful guiding coalition: Gather a group with enough power to lead the change, and encourage team work.
- Creating a vision: Creating a vision to guide the change, and creating strategies to accomplish that change.
- Communicating the vision: Using every possibility to communicate the vision and strategies, and the coalition needs to lead by example, to achieve the expected behaviour.
- Empowering others to act on the vision: Get rid of obstacles, change the systems and structures that undermine the vision, and encourage risk taking, non-traditional ideas, actions and activities.

- Plan and Create short term wins: Plan visible performance wins, create those wins, and recognise employees' efforts in those improvements.
- Consolidate improvements and produce more change: Using increased credibility to change systems, structures and policies that do not fit the vision. Hire, promote and develop employees that can implement the vision, and reinvigorating the process with new projects, themes, and change agents.
- Institutionalising new approaches: Articulating the connection between new behaviours and corporate success and developing the means for leadership development and succession planning.

2.4.4.3 Jick's Tactical level Model

Jick developed a tactical level model to guide the implementation of a major organisational change, which served as a blueprint for the change process and an evaluation tool for the change already in progress (Mento *et al*., 2002: 46).

The model is more for a tactical level of change and can be utilised as a method to guide and to initiate change or to evaluate change that is already in progress in an organisation (Pryor *et al*., 2008: 10). Jick's tactical level model can be used to indicate change as an ongoing process (Pryor *et al*., 2008: 10). This model will not suit the purpose the research set out to evaluate.

2.4.4.4 GE seven step change acceleration process

The seven step change acceleration model follows closely to Lewin's (1947) model (unfreezing, moving and re-freezing), with the essence of the model focusing on the leader's role in creating urgency for change, crafting and communicating the vision, together with measuring the performance and institutionalising the change (Mento *et al*., 2002: 46). The model focus is on the leader's role; however the research sets out to evaluate the change readiness of the employees and not the leader's role.

2.4.4.6 ADKAR change readiness model

The ADKAR change model is a model to manage change during the early stages of the change and particularly the readiness element of the change (Hiatt, 2006). The ADKAR model was first published in 1998 by Prosci Research who has been doing research for over ten years and researched approximately 900 organisations (Hiatt, 2006).

ADKAR is a change model that is mostly connected to change readiness levels in a change process (Hiatt, 2006). Bedser (2012: 54) explains that the ADKAR change process, proposes a need to create awareness until changes are reinforced and ensuring that the changes are sustained. The ADKAR change readiness assessment is merely an instrument that assists change management practitioners to determine the current readiness levels of employees for planned or proposed change. (Bedser, 2012: 54). The ADKAR model is designed to evaluate where there are difficulties or problems in the change process (Hiatt, 2006).

ADKAR model reflects the necessary building blocks for individual change and it was developed on analysis of research data from numerous organisations over a decade (Prosci Research, 2006). According to Hiatt (2006) the ADKAR model comprises of five elements namely;

- **Awareness** – The need for change.
- **Desire** – To support and participate in the change
- **Knowledge** – The know how to change.
- **Ability** – The implementation of the change.
- **Reinforcement** – Sustaining the change.

2.4.4.6 The ADKAR Instrument and its context in the Change Process Model.

The simplicity and application of the model is an advantage in comparison to other complicated change readiness assessment tools (Hiatt, 2006). Prosci Research (2006) describes the ADKAR model as a link between individual performance, organisational change management and business results. The ADKAR model primarily focuses on the individual, individual readiness and the early phases of the change (Bedser, 2012: 58).

The ADKAR model is very adaptable for numerous changes and can be applied in the public or private sectors and in an individual's personal life (Suganthalakshmi and Muthuvelayutham, 2011).

There are many different models organisations can use to evaluate the readiness for change from employees; however the simplicity and focus of the ADKAR model is a benefit over the more complex models and readiness evaluation tools (Hiatt, 2006).

Suganthalakshmi and Muthuvelayutham (2011: 81) state that ADKAR describes successful change at individual level and the ADKAR model can be utilised for the following:

- Diagnose employee resistance to change.
- Help employee transition through the change process.
- Create a successful action plan for personal and professional advancement during the change.
- Develop a change management plan for your employees.

The application of the ADKAR change readiness evaluation tool will be used to analyse the research. In summary the ADKAR model provided simplicity and focused on the change readiness of the individuals, which is a keen in implementing lean manufacturing as people, are the soul of a lean process and crucial to the success of lean transformation (Nordin *et al.*, 2010: 1). In the literature above there were other change models analysed and the ADKAR model's simplicity and focus on the individual.. The researcher will therefore use an ADKAR change evaluation tool but adapted for the questionnaire for the purposes of this study.

The ADKAR instrument has very little published research available and validity as the tool is most utilised by management practitioners in organisations instead of scholars or researchers.

2.5 Conclusion

The literature review describes the numerous concepts of lean production, production systems and the culture of continuous improvements institutionalise through various authors since 1911 to provide organisations with a competitive advantage. All the techniques and tools have a common purpose and that is to incorporate team work and a culture of continuous improvements to create sustainable organisations. The theory in the literature review has shown that theory has to evolve and new theory is required to our ever changing world and that there is not one set of ideas which can be unilaterally applied for the ideal formula of success. The implementation of production systems especially MPS requires the total buy-in and involvement of everyone in the organisation, the involvement of people thus there is a need to implement change management practices. The theory of change management is to provide the framework to evaluate the change readiness prior to the implementation of MPS in departments where the production system (MPS) has not been implemented.

The literature review deals with change management, change readiness and components of change readiness.

The background of the literature review will assist in knowledge and understanding of the research as the researcher seeks to evaluate the impacts of the implementation of MPS within MBCV.

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SECTION 3: RESEARCH METHODOLOGY

3.1 Introduction

Chapter 3 describes how the research was conducted. The chapter sets out to describe the aim and objectives of the research. It describes the method used to achieve the objectives of the research and described the paradigm of the research. The data collection and analysis techniques used will be defined, together with the quality and ethical considerations taken in the research.

3.2 Research Aim and Objectives

The aim of the research was to evaluate the implementation of Mercedes Benz Production System (MPS) at Mercedes Benz Commercial Vehicles (MBCV) with regards to the changes of the organisational KPI's (SQDCM), secondly to evaluate the change readiness of the employees, where MPS has not yet been implemented. The MPS project started in July 2013 and the research evaluated it up until the end of June 2014 when the project ended. The research commenced in April 2013 and will be completed by the end of June 2014. The objectives of the research were:

- Evaluate the changes to the organisational KPI's (Safety, Quality, Delivery, Cost, and Morale) that emerged from the implementation of MPS through each phase of the project and at the overall completion of the project.
- Evaluate the level and stage of readiness in areas where the change has not been implemented using the ADKAR change readiness prior to MPS implementation.
- Provide an evaluation report and recommendations on how the implementation of MPS has affected changes to the organisational KPI's and report on the change readiness of the shop-floor, with the implementation of MPS.

3.3 Research Paradigm

The paradigm is post-positivism with critical realism ontology (Guba and Lincoln, 1994:107). Paradigms are "a basic set of beliefs, a set of assumptions we are willing to make, which serve as touchstones in guiding our activities" (Guba and Lincoln, 1994: 80). A post-positivism research methodology, the researcher knows that what

is observed could be influenced by bias, background, education and standards, but will still conform to thorough evaluation and rational reasoning (Guba and Lincoln, 1994).

The ontology describes a view that reality exists by what is defined, rather than a view that it exists independently of what is being observed (Guba and Lincoln, 1994:108). In this paradigm, the ontology that the researcher holds is that of critical realism (Guba and Lincoln, 1994) where “Reality is assumed to exist but to be only imperfectly apprehendable because of basically flawed human intellectual mechanisms and the fundamentally intractable nature of phenomena” (Guba and Lincoln, 1994: 110). The epistemological view of the research paradigm will be objectivism which is the knowledge gained through reason (Guba and Lincoln, 1994:108). The epistemology of post-positivism, the findings are probably true (Guba and Lincoln, 1994:109).

3.4 Research Method

The research paper is that of an Evaluation Research Paper which refers to a research purpose rather than a specific research method (Babbie, 2011: 361). Watkins (2012: 46) describes this as research that examines the difficulties in implementing new procedures and techniques in an organisation and evaluating the benefits of that implementation. This is described as a process of determining whether an intervention has produced the intended result (Babbie, 2011:362). The intervention in this case is the implementation of MPS within MBCV and the readiness of the employees to the intervention.

The researcher will gather data using ‘Mixed method’ which includes both quantitative and qualitative methods.

Watkins (2012: 5) describes quantitative research as collecting and analysing quantitative data and analysing such data using ‘statistical methods’ whereas qualitative research involves collecting qualitative data and analysing this data using ‘interpretive methods’.

Quantitative approaches generally answer what, and how questions, whereas, qualitative approaches explore why issues (Maluleke, 2008: 24).

Bryman and Bell (2011: 629) discuss the paradigm argument where it regards quantitative and qualitative research as paradigms in which epistemological assumptions, values and methods are inextricably intertwined and are incompatible

between paradigms. Bryman and Bell (2011: 629), citing (Kuhn 1970) states although there is a paradigm argument between quantitative and qualitative research, it is definitely not clear that quantitative and qualitative can be consider paradigms.

Watkins (2012: 9) explains that research academics provide a plethora of distinguishing characteristics to the quantitative and qualitative research paradigms. Collis and Hussey (2009:63) use the terms 'quantitative' and 'qualitative' to describe data rather than paradigms. Remenyi *et al.* (2009:125) refer to the terms 'quantitative' and 'qualitative' as evidence.

Leedy and Ormrod (2010:96) provide a practical perspective between the differences of qualitative and quantitative research paradigms in terms of research focus. These differences are described in the table 3.1 below.

Table 3.1 – Distinguishing characteristics of qualitative and quantitative research paradigms

Research Focus	Quantitative research	Qualitative research
Purpose of the research	• Explaining and predicting • Confirming and validate • Testing theory	• Describing and explaining • Exploring and interpreting • Building theory
The research process	• Focused • Known variables with established guidelines • Predetermined methods • Context free • Detached view	• Holistic • Unknown variables with flexible guidelines • Emergent design • Context – bound • Personal view
Data description and collection	• Numeric • Representative, large samples • Standard instruments	• Textual or image based data • Informative, small sample • Freely structured

		and non-standardised observations and interviews.
Data analysis	• Statistical analysis • Deductive reasoning	• Search for themes and categories. • Inductive reasoning
Communication method of findings	• Numbers • Statistics or aggregated data • Scientific style	• Words • Narrative, individual quotes • Literacy style

(Source: Watkinds, 2012: 10, adapted from Leady and Ormrod, 2010: 96

Based on the table above the analogy can be made between qualitative and quantitative research that there is an overlap between the two (Watkins, 2012: 10). Both qualitative and quantitative researchers examine data from either qualitative or quantitative research even if they differ in significance. Babbie (2005: 25) supports this and express the view that "… recognising the distinction between qualitative and quantitative research doesn't mean that you must identify your research activities with one to the exclusion of the other. A complete understanding of a topic often requires both techniques".

The reasons for using both approaches were informed by the above mentioned intellectual overviews. The research study had both a qualitative and quantitative dimension approach. This involved document analysis and questionnaire survey. The quantitative dimension comes from the data collected from the questionnaire and analysed in a quantitative manner. The qualitative dimension will be through document analysis from primary data.

3.5 Population and Sample Size

Welman and Kruger (2001: 46) explain that a population is the study of objects which can comprise of individuals, groups, organisations, human products and events. The sample is a subset of the population (Welman and Kruger, 2001: 46). "A 'sample' is

made up of some of the members of a 'population' (the target population), the latter referring to a body of people or to any other collection of items under consideration for the purpose of the research" (Watkins, 2012: 63).

Population in this research comprised of the departments, where the introduction of MPS had not yet been introduced. There were 86 shop floor employees from the following departments: Freightliner/Fuso Leg 2, Freightliner/Fuso logistics and the Vehicle Preparation Centre (VPC) where MPS had not been implemented and these departments were chosen to evaluate the employee change readiness.

The sampling of the research is purposive sampling. Watkins (2012: 65) states that purposive sampling is choosing people for a purpose that is typical of a group that represent diverse perspectives on an issue. In this particular research the group was chosen in particular, the group had to consist of individual or departments where the implementation has not yet taken place, to assess the change readiness of the employees.

3.6 Data Collection

The first phase of data collection was collecting primary data that is quantitative in nature through documents which were used as part of the project such as the implementation plans of the system and the results for the KPI (Safety, Quality, Delivery, Cost and Morale). These documents included presentations, reports, time and motion study documents as well as the organisation's Global Balance Scorecard (GBSC). The GBSC is reviewed monthly for tracking organisational KPI's such as SQDCM.

Phase one (document analysis).

The aim of data collection in phase one (document analysis) was to identify the following:

- Develop an understanding and described the reasons why the Mercedes Benz Production System (MPS) was introduced in MBCV.
- Describe what MPS entails.
- Provide a description of how MPS was developed and implemented in MBCV.
- Provide a comparison of MBCV's key performance indicators (KPI) (SQDCM) before and after the implementation of MPS.

Phase two (questionnaire surveys).

Phase two of the study was quantitative in nature, and this involved questionnaire surveys.

The second phase of data collection was through the completion of the ADKAR change readiness questionnaire. The questionnaire was in the form of 'closed' questions. The questionnaire was distributed, explained and completed during the weekly team meetings. The researcher explained the questionnaire to the supervisors of each department and was available to provide clarity on any uncertainty. The weekly meetings are thirty minutes long. The weekly meetings are normally used to discuss company topics and raise employee concerns. This did not affect production time and fits well with the forum to raise any issues regarding the implementation of MPS. The questionnaire did not take more than fifteen minutes and was distributed to the departments where MPS has not yet been rolled out to evaluate the change readiness of the employees.

A questionnaire was used to collect large quantities of numeric evidence, or evidence that will be converted to numbers (Remenyi *et al.*, 2009: 290). The aim of the questionnaire was to establish what a selected group of participants do, think or feel (Watkins, 2012: 74).

The questionnaire was in a *5 point scale* format and distributed to the entire population mentioned above.

3.7 Data Analysis

For this study, raw data was collected through document analysis, and questionnaire surveys. The raw data from questionnaires based on the response to the research statement, which was to evaluate the level of change readiness of employees prior to the change. After the collection of data derived from questionnaires, it was analysed in order to establish the level of change readiness of the employees.

Data analysis involved transcription of data from the data derived from consolidation of the questionnaires which was analysed and consolidated.

The information was stored in a data base and was extracted by the researcher and analysed in Microsoft Excel (version 2010) for descriptive statistical analysis.

The research method employed was an Evaluation Research with a document analysis of organisational reports such as presentations, project reports, time and motion study documents as well as the organisation's Global Balance Scorecard (GBSC).

Quantitative analysis of the data from the questionnaire was utilised for numerical representation and manipulation of observations for describing the phenomena of which those observations reflect (Babbie, 2011: 420).

Quantitative analysis techniques assist the process analysing and interpreting data to be useful (Saunders *et al.,* 2000: 326). Exploratory data analysis approach emphasised the use of diagrams to understand data and descriptive statistics enable you to describe and compare variables numerically (Saunders *et al.,* 2000: 351).

3.8 Data Reliability and Validity

Saunders *et al.* (2000: 100) state that reliability can be assessed with two questions:

- Will the measurement yield the same results on different occasions? (A deductive approach), or
- Will similar observations be made by different researchers on different occasions?

According to Saunders *et al.* (2000: 307) testing for reliability can be conducted through internal consistency which involves correlating the responses to each question in the questionnaire with those to other questionnaire or measuring consistence of responses either across all questions or sub groups from the questionnaire in this case according the ADKAR categories.

"Validity refers to the extent to which an empirical measure adequately reflects the real meaning of the concept under consideration" (Babbie, 2011: 131).

Construct validity was attempted to evaluate both theory and the measuring instrument used (Watkins, 2012: 75),

There were measures taken to ensure the reliability and validity of the results and minimise the rate of errors. Time may have had an impact on the reliability as questionnaires had to be distributed to employees where the change had not yet taken place, but in certain departments the implementation of MPS had already started. The reliability of the study could definitely yield the similar observations by different researchers on different occasions, given the situation is similar. The validity

of the research measures the theory of change readiness and the ADKAR tool is an instrument for measuring the level of change readiness of individuals.

3.8 The Instrument

The research used an ADKAR change readiness questionnaire as an instrument, the instrument was slightly modified by the researcher. The instrument comprised of 20 ADKAR change readiness statements on a *5 point scale* to evaluate the employee readiness for the implementation of MPS. The questionnaire was divided into two categories, with five biographic questions.

The second part of the instrument was the ADKAR change readiness questionnaire that comprised of 20 statements based on a *5 point scale.* The *5 point scale* instructed the respondents to read questions carefully and select 1 if they strongly disagreed with the statement; 2 if they disagreed; 3 if they were neutral; 4 if they agreed and 5 if they strongly agreed with the statement.

Questions one to six in the ADKAR change readiness questionnaire dealt with *Awareness* of the change, questions seven to ten dealt with *Desire* for the change, questions eleven to fourteen with *Knowledge* for the change, questions fifteen to seventeen with the *Ability* to do the change and the last three questions eighteen to twenty dealt with *Reinforcement,* sustaining the change.

3.9 Ethical Considerations

Saunders *et al*. (*2000: 130), states that "ethics refer to the appropriateness of your behaviour in relation to the rights of those who become the subject of your work, or affected by it".* Leedy and Ormrod (2010: 101 -104) explains that the majority of ethical issues in research fall into four categories such as protection to harm, informed consent, right to privacy, and honesty with professional colleagues.

The following ethics was observed during this research (right to privacy, honesty with professional colleagues and confidentiality/anonymity). The questionnaire front page explained that participation in this research is voluntary and confidential and participants have the option to opt out if they want to.

Babbie (2011: 500) states that "social researchers have an ethical obligation to the community of researchers as well as to the subjects. These obligations include

reporting results fully and accurately as well as disclosing errors, limitations and other shortcomings in the research".

3.10 Research Constraints and Conclusion

Research constraints are commonly referred to as 'limitations' and 'de-limitations' which are inhabiting factors which constrain the research student's ability to conduct the research in the standard way (Watkins, 2012: 86). According to Watkins (2012: 86);

- Limitations – identify weaknesses in the research.
- De-limitations – describe how the scope of the study was focused on one particular area or point opposed to a wider holistic approach.

There are limitations in this paper, where the change readiness focused on the employee readiness and would suggest that future research evaluate the organisational readiness for the implementation change.

In addition to this the issue of timing of the survey could be a limitation as the employee change readiness could vary depending where in process the change process is.

The following research paper can be added to contemporary literature and added to the body of knowledge of organisational change readiness, concepts of production system and lean manufacturing. The research could contribute to the body of knowledge where other manufacturing plants within the Daimler group companies see the need to implement Mercedes Benz Production System.

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Appendices

Appendix A: Questionnaire Letter.

Dear Colleague:

My name is Rozane McAllister currently working for Mercedes Benz South Africa in commercial vehicles as a manager of Mercedes Benz production and maintenance. I am currently in the final year of my MBA degree at Rhodes University. I am conducting my dissertation of which I have chosen to evaluate organisational change readiness prior to the implementation of Mercedes Benz Production System (MPS). This forms part of my research topic. Mercedes Benz South Africa (MBSA) and the University see the research to be both suitable and valuable.

There are 20 questions, please read each question carefully. You are being asked to rate yourself on a scale from 1-5 on your agreement to the statement:

1 = Strongly Disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly Agree

The survey will be completely anonymous and will be manually collated to form the data base of the research.

Your participation in this research is completely voluntary and you will be able to withdraw your answers should you feel you need to, however I please encourage you to complete the survey as it may be helpful to the organisation in knowing where to focus their attentions in order to ensure a more successful change in future change projects. The results of the dissertation may also be used for future academic purposes.

Thank you for your time.

Yours sincerely

Rozane McAllister

Appendix B: Questionnaire.

B. Questionnaire

Please complete table 1 with an X to indicate your current state and complete table 2 by marking each question with an X in the respective circle.

Department:	VPC	MB Mech 1	MB Mech 2	MB Sub Assembly	
	MB Logistics	Fuso/FTL Logistics	Fuso/FTL Leg 1	Fuso/FTL Leg 1	
Gender:	MALE		FEMALE		
Age:	20 – 30	31 – 40	41 – 50	51 – 65	Other
Years' Experience:	0 – 10	11 – 20	21 – 30	31 – 40	Other
Job Grade:	Level 1	Level 2	Level 3	Level 4	Level 5

No.	Questions	Scores (1 = Strongly Disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly Agree)					ADKAR Categories
		1	2	3	4	5	
1	I am aware of the implementation project of MPS within MBCV.	◯	◯	◯	◯	◯	AWARENESS
2	I understand the reasons why MPS is being implemented in MBCV.	◯	◯	◯	◯	◯	
3	I understand the reasons why MPS is being implemented in my department.	◯	◯	◯	◯	◯	
4	I understand the goals and objectives for the implementation of MPS.	◯	◯	◯	◯	◯	
5	I am aware of the challenges/risk the implementation of MPS will bring about.	◯	◯	◯	◯	◯	
6	MPS is relevant to all employees.	◯	◯	◯	◯	◯	
7	I am interested in being part of the implementation project of MPS.	◯	◯	◯	◯	◯	DESIRE

8	MPS implementation will present opportunities for me in the workplace.	◯	◯	◯	◯	◯	
9	I will support the implementation of MPS in my department.	◯	◯	◯	◯	◯	
10	I personally foresee benefiting from the implementation of MPS.	◯	◯	◯	◯	◯	

11	I understand what MPS is about.	◯	◯	◯	◯	◯	KNOWLEDGE
12	I am aware that MPS is in existence in MBSA Passenger cars division.	◯	◯	◯	◯	◯	
13	I understand how the implementation of MPS will change my work.	◯	◯	◯	◯	◯	
14	I have the necessary knowledge/information of MPS to cope with the change.	◯	◯	◯	◯	◯	
15	I can positively contribute to the change MPS brings about.	◯	◯	◯	◯	◯	ABILITY
16	My ability for continuous improvements ideas will be better.	◯	◯	◯	◯	◯	
17	The implementation of MPS will allow me to perform better at my job function.	◯	◯	◯	◯	◯	
18	The team will support the implementation of MPS.	◯	◯	◯	◯	◯	REINFORCEMENT
19	My manager will support the change.	◯	◯	◯	◯	◯	
20	My personal development will improve due to the change.	◯	◯	◯	◯	◯	

Note: Questionnaire adapted from Bedser (2012) to reflect MBSA MPS change readiness assessment.

Appendix 1: Figure 1 - Figure 6

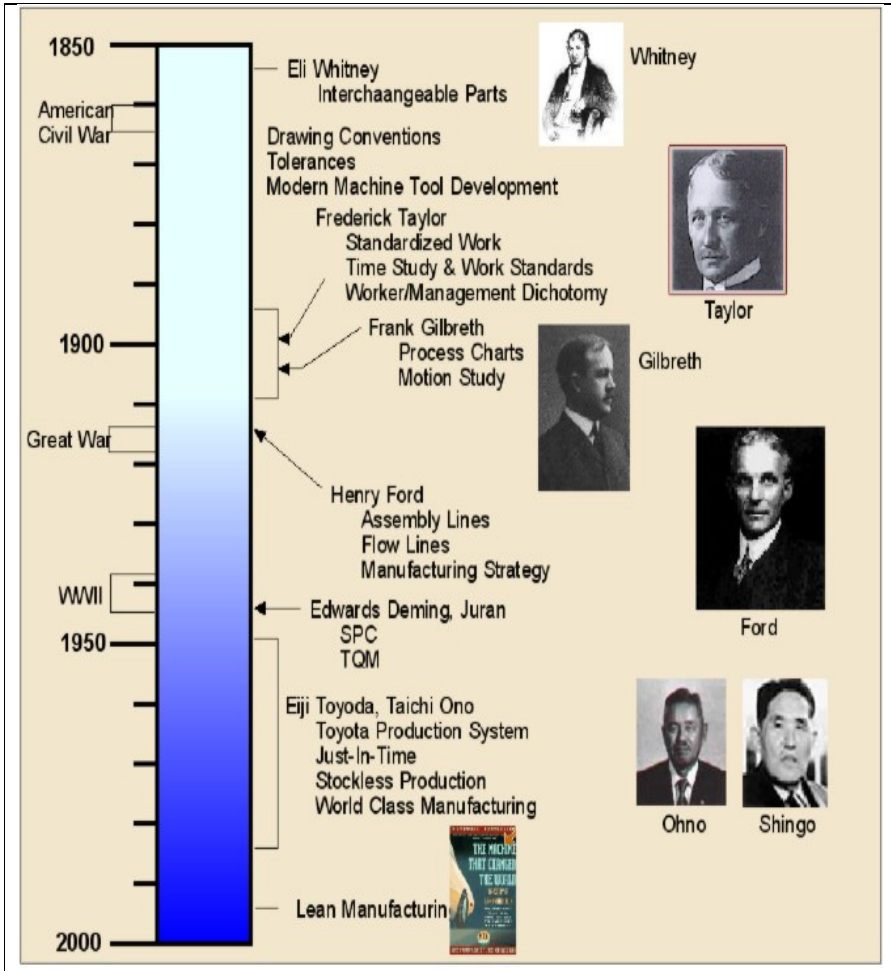


Figure1 : Timeline of Production Concepts Strategos (2013: Online)

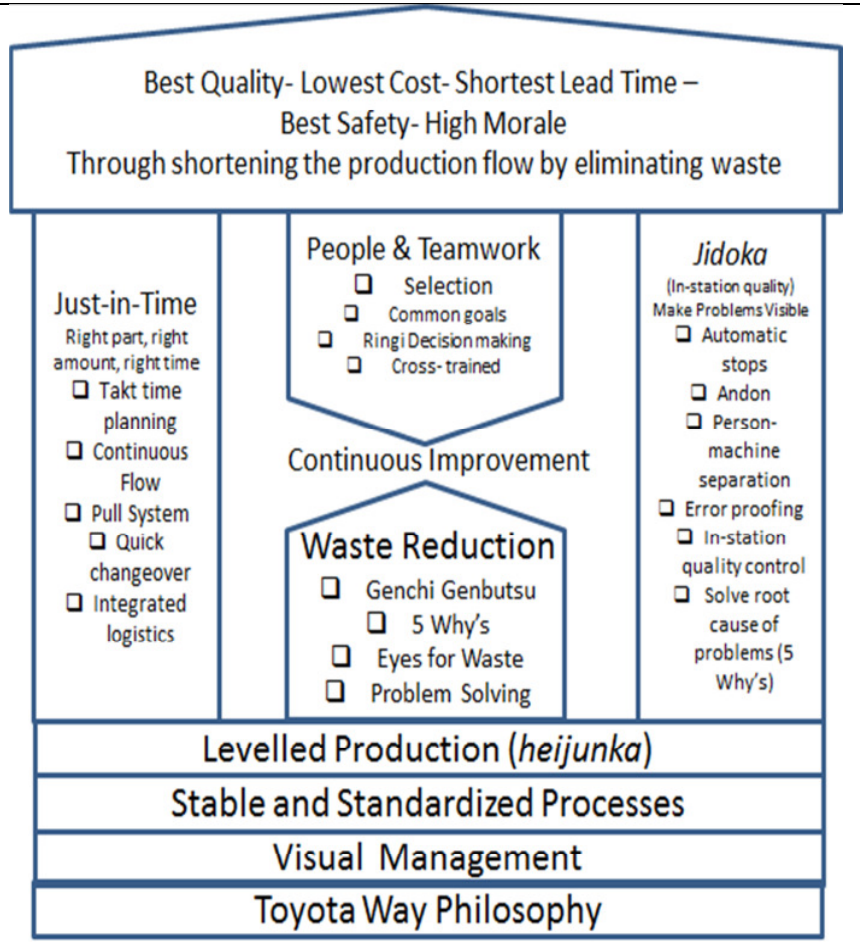


Figure 2: TPS House Diagram (Liker, 2004:33)

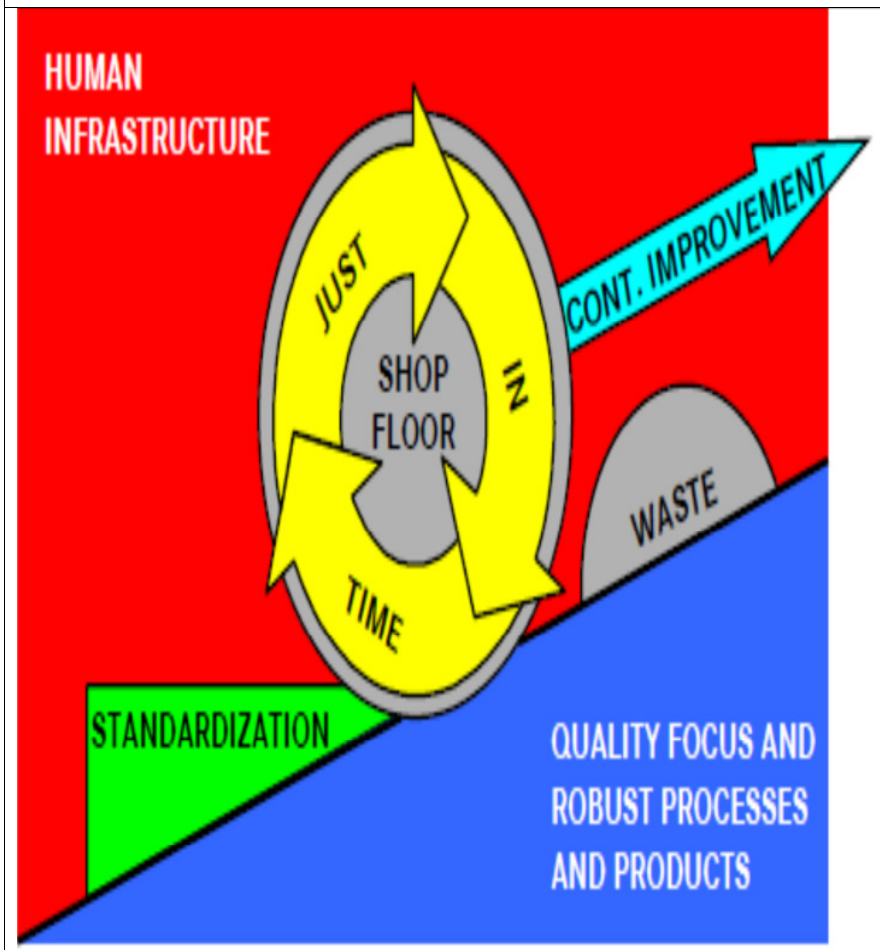


Figure 3: The MPS Model (Clarke, 2005:138)

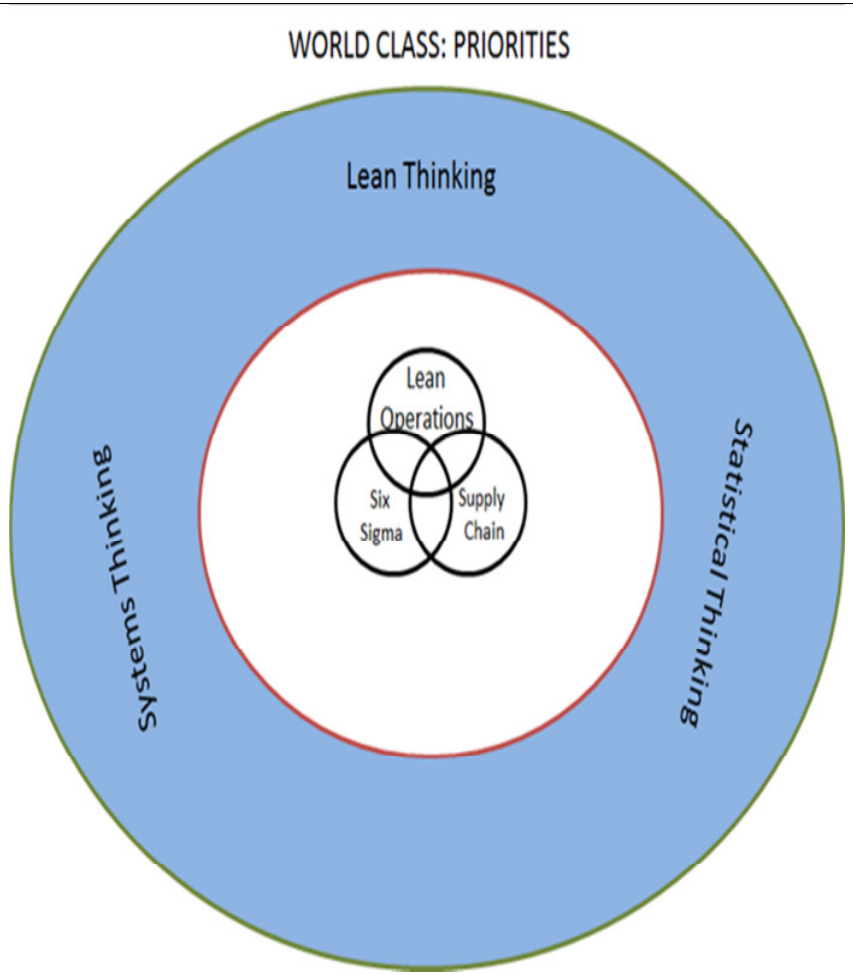


Figure 4: Bicheno model of World Class: Priorities. (Bicheno, 2006:7)

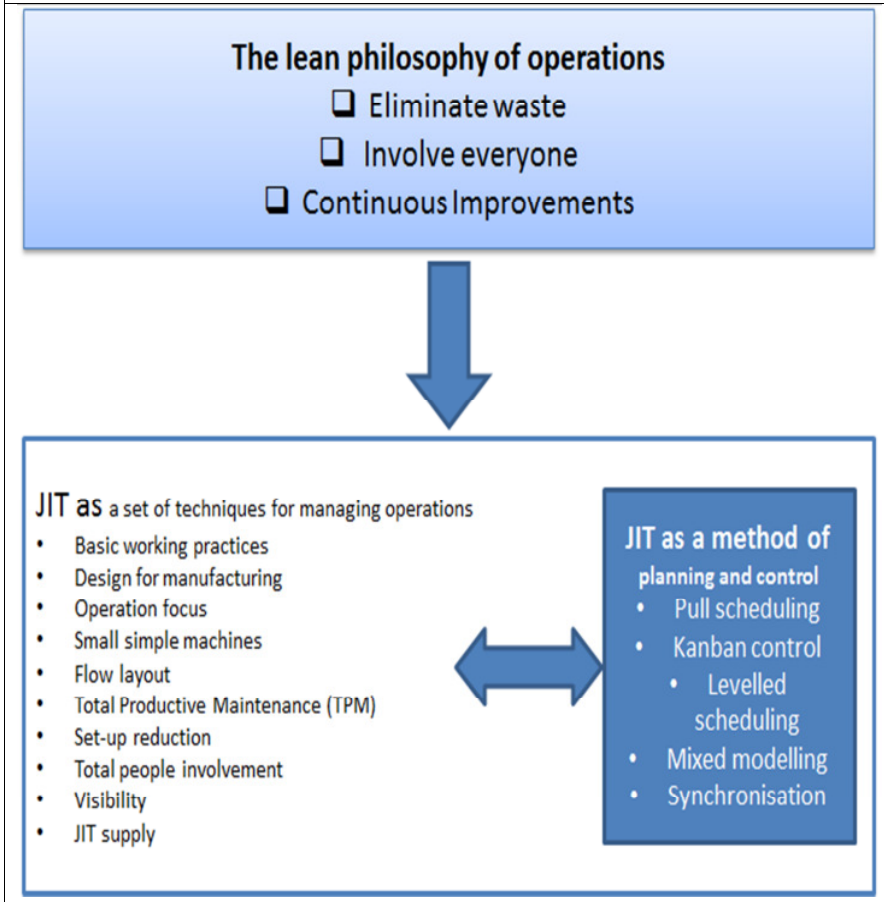


Figure 5: The Lean Philosophy of operations is the basis for JIT techniques. Pycraft et al (2010:438)

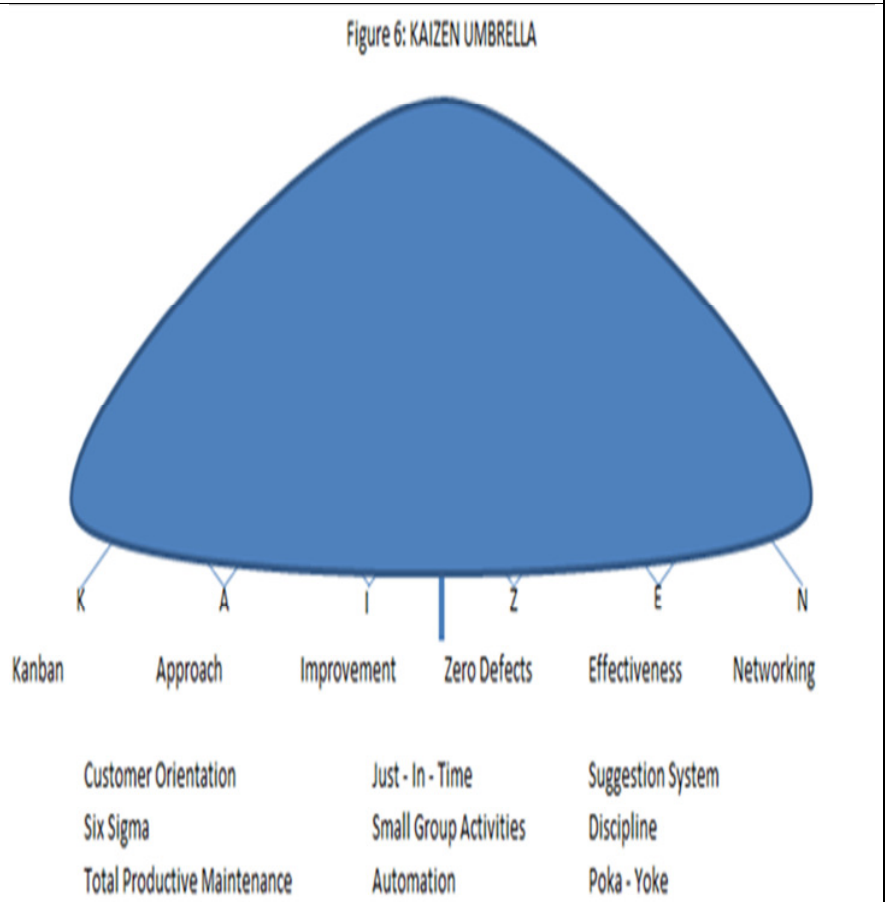
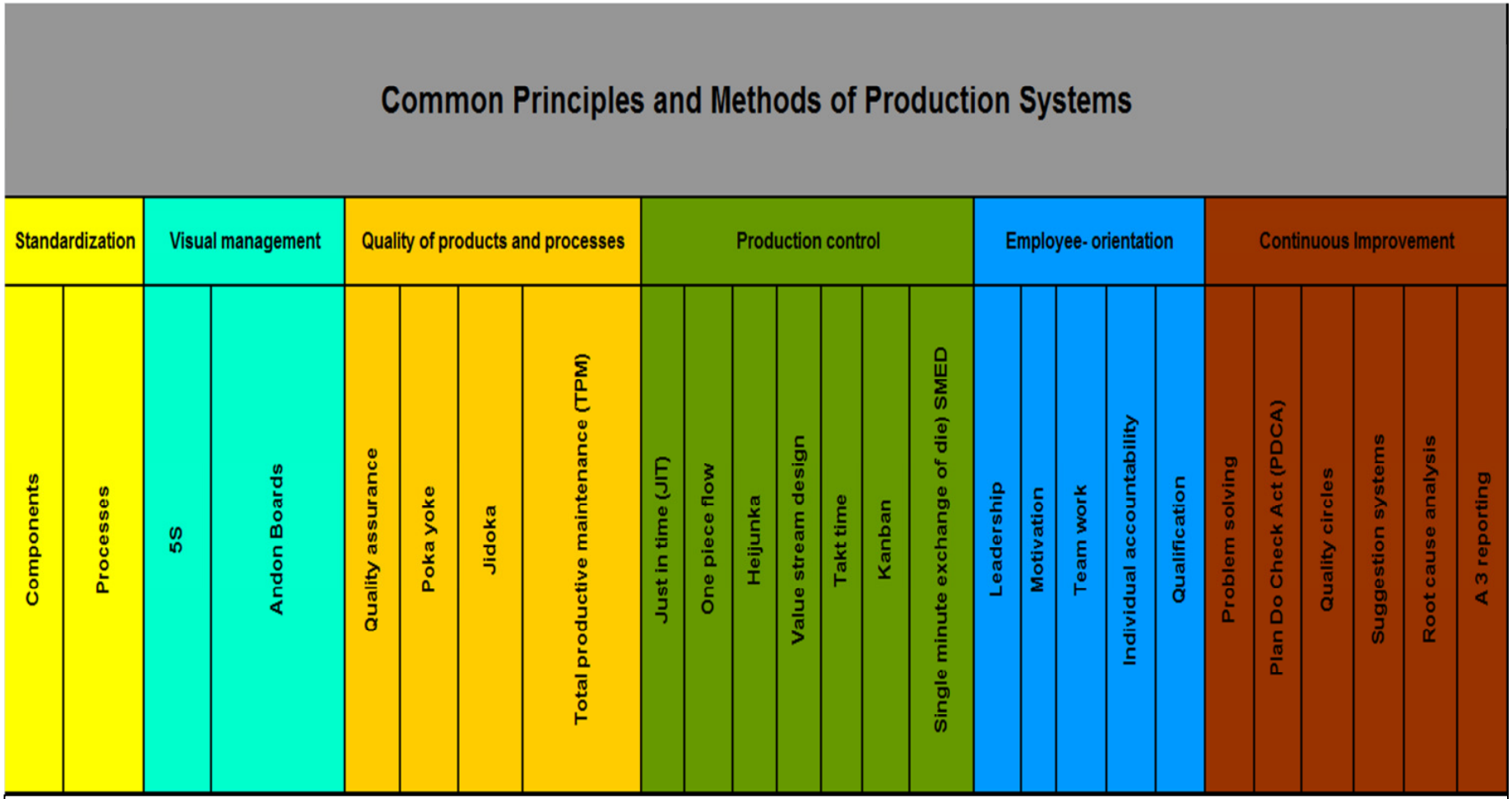


Figure 6: The Kaizen Umbrella (Singh and Singh, 2009: 52)

Appendix 2: Common Principles and Methods of Production Systems



Common Principles and Methods of Production Systems (Schuh *et al.,* 2012: 910).

Appendix 3: Overview MPS - Structure: Sub systems and Operating Principles

MERCEDES BENZ PRODUCTION SYSTEM (MPS)

Subsystems	Human Infrastructure					Standardisation		Quality Focus and Robust Processes and Products			Just in Time				Continuous Improvements
Operating Principles	Leadership	Clarity of Tasks and Roles	Employee involvment and Development	Work Group Organisational Structure	Safe Work Practices and Environmental Awareness	Standardised Methods and Procedures	Visual Techniques/5s	Quick issue Detection and Correction	Robust Process/Products and prev. Quality Ass.	Customer Focus (internal and External)	Production Smoothing	Pull Production	Continuous Flow Processing	Customer Demand Rate	Waste Elimination
Tools (93)	• Policy Deployment • Employee Feedback • Employee Opinion Surveys • Employee Recognition • Appraisal System • Checklists and Monitoring • MPS assessment by management (division audit) • Standardized Communication Channels • Team Development Activities • Management Assessment System • Promotion and Support of Management • Attendance Improvement Program	• Job Descriptions • Process Descriptions • New Hire Orientation	• On the Job Training • Performance Standards • Suggestion System • Selection Process to employ new Team Members • Shop Floor Training Area • Continuous Improvement Implementation Area	• Group task • Team Leader • Group discussions • Integrating handicapped team members•Procedure for assessing team work •Team Boards •Rotation •Qualification Training matrix	• Health and Safety Regulations - also environmental aspects • Visual Safety Signs • Ergonomic Evaluation of Work Processes and Places • Refuse / Waste Separation • Environmental Awareness and Protection	•Standard Work Instructions (SWI`s) •Standard Work Documentation •Standard Work in Process •Scoreboards •Shop floor Measurement •Standard Shift Change Procedure •Standardized Equipment •Quality Gates	• 5S Sift Sort Sanitize Sweep Sustain • Labeling, Marking and Foot printing	•Quality feedback loops on the Shop Floor •Root Cause Analysis •Boundary Samples •Shop Floor Section Audit •Quality Alert System / Quality Stop / Line stop •Quality Alerts / Production Information Boards •Manufacturing test 1,2,3 •Go-ahead for series manufacture	• Total Productive Maintenance (TPM) • Error Proofing • Mistake Proofing • Statistical Process Control (SPC) • Certification Audit • Process Audit • Single Point Lesson • Problem Solving / Closed Circuits • Process - FMEA • Suppliers' Quality Management • Procedure Assurance Plan • Check Function of Testing Equipment and Materials	• Quality Agreements (some with step-ups) • Quality / Zero Defect Gate in Assembly • Customer Quality Measurement Method • High Level Quality Feedback Loops	• Production Planning Schedule • String of Pearls	• Material Flow Planning • Tugger Transport with Mixed Loads • Withdrawal and Fill-up • Order (Kanban) Cards	• Kitting • Quick Set-ups / Die Changes • Small Lot Containers • One Piece Flow • First In First Out (FIFO) • Single Stage Stock Strategy	• Fixed Takt Time • Takt Time / Cycle Time Bar Chart	• Plan, Do, Check, Act (PDCA) • 7 Wastes • 5 Why`s (5 W`s) • Process Map • staff-done Continuous Improvement Workshop • expert-done Continuous Improvement Workshop • Engineering Change Control • Practice Sharing Benchmark • Simultaneous Engineering
Results	Safety, Quality, Delivery, Cost, Morale (SQDCM)														

Overview MPS – Structure: Sub – systems and Operating Principles (Clarke, 2005: 160)