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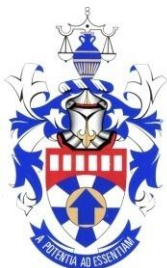
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INVESTIGATING THE ROOT CAUSES OF LONG LEAD TIMES IN THE AUTOMOTIVE AFTERSALES INDUSTRY BY MEANS OF THE LEAN PHILOSOPHY: A SOUTH AFRICAN CASE STUDY

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ABSTRACT

The aftersales service industry has the potential to produce 80% of an organisation's profit, although most only generate 20%. Similarly, the organization, used as a case study, struggles to achieve their operational performance indicators (OPIs) and the consequent profit margins. The aim of the study was therefore to investigate the root causes and develop corresponding preventative actions.

The research followed a DMADV (Define-measure-analyse-design-verify) approach, uniquely designed by integrating specific methods: Gemba walks defined the scope of the problem and aim; The root causes determined by a 20-Key audit and five-why analyses were reported in a thematic map; Potential solutions were developed utilising Kernel theories, and verified via the Delphi technique.

This study points out the many challenges, such as low employee moral and high staff turnover rates, when implementing a German adaptation of a Japanese philosophy (Lean) in the South African service industry, emphasizing the misunderstanding of lean principles. Furthermore, it highlighted the implications of a cross-cultural adaptations of lean, within organizational cultures.

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1 INTRODUCTION

The aftersales service department of a company has the potential to produce 80 percent of a company's profit and improve Operational Performance Indicators (OPIs), although most only generate 20 percent [1]. In 2018, the South African automotive industry was under strains due to fiscal uncertainties. Ergo, automotive dealerships around the country have begun to attentively focus on the improvement and optimisation of their after sales service departments [2].

Conversely, it has been discovered that the after sales department of an automotive dealership, used as case study, is currently experiencing a decline of the department's OPIs (productivity, efficiency and effectiveness). This poses a potential loss of income for the organisation.

The organisation, used as a case study, is part of an international German automotive company. This German company adapted the lean approach (with its Japanese foundation) and are implementing it in their different organisations, worldwide. However, this could lead to complications within the organisational cultures of these different companies.

The lean methodology often provides organisations with a continuous improvement approach needed to combat organisational inefficiencies (amongst other things) [3]. However, although there are many Lean Production System (LPS) techniques that may be utilised in the after sales services, there is no all-inclusive route available for every and any company [1]. This lends to the idea that companies will require tailored lean procedures, ergo building a lean culture specific to the organisations' systems and goals.

2 RESEARCH AIM

The aim of this research was to investigate the root causes of the organisation's poor OPIs: productivity, efficiency and effectiveness, by means of the lean continuous improvement approach.

The next section explains the research design that was followed, while section 4 provides the findings of each phase of the research. The study is concluded in section 5, with further research recommendations stated in section 6.

3 RESEARCH DESIGN

The research spanned across multiple departments of the after-sales service centre, with a complex problem and unknown root causes. Therefore, the research design incorporated many problem-solving methods, in order to narrow down the problem and its causes that needed to be addressed. These methods were integrated using a DMADV (Define, Measure, Analyse, Design, Verify) approach [4], which is an adaption of the DMAIC (Define, Measure, Analyse, Improve, Control) approach. The DMADV method is ideally used for improvements, adjustments or the creation of new concepts, which made it well suited for this improvement focused study [4].

The research design (Figure 1) illustrates the different methods and finding during the various phases of the research. The detail of each segments in the diagram is discussed in the corresponding section (illustrated with section "§" numbers)

Referring to Figure 1, the research initiated by scoping the study and measuring the current state. The problem diverged into multiple issues during the five-why analysis, but converged again into common root causes, during the thematic analysis. Subsequently, diverging once again into multiple solutions, which later converged to the best suited solutions for verification. The resulting research design is explained in the sections to follow. The results of each phase of the research is presented in Section 4.

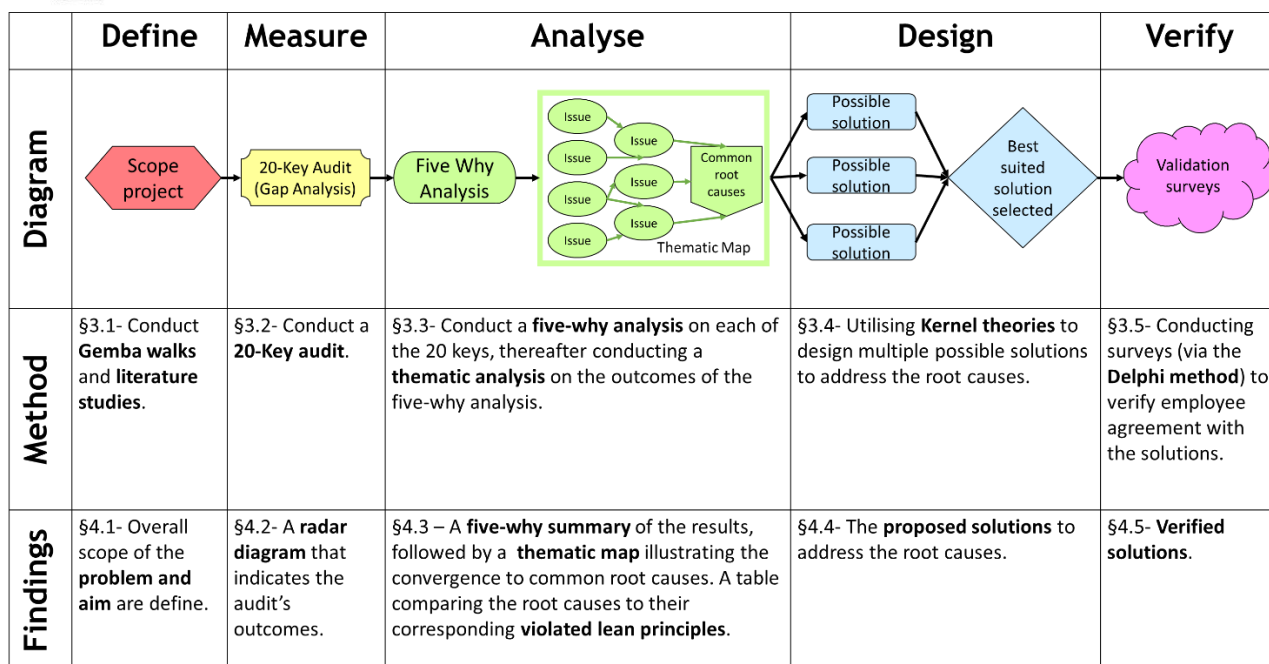


Figure 1:Research design

3.1 Define Phase - Gemba walks and literature study

For the define phase, the overall scope of the problem and aim were defined. This was achieved through Gemba walks, where walking the shopfloor allowed for the observations of process executions and activities [5].

Literature studies on lean were also conducted in order to compare the current state of the organisation to literature [6] [7] [8] [3]. It was found that lean is the philosophy of focusing on eliminating waste, ergo only including the value adding activities to a process [2] [8] [6]. These wastes are identified as transportation, inventory, motion, waiting, over-production, over processing, defects and underutilised intellect [7] [6]. The lean philosophy was selected for this research, as the organisation (used as a case study) utilised lean approaches and concepts in daily operations. This South African dealership is part of an international German automotive company, who has also adapted the lean philosophy from Japan. The results of this phase are captured in section 4.1.

3.2 Measure Phase - 20 key audit

This phase of the study composed of collecting (measuring) information on the current state of the organisation. The 20 Keys strategy was engineered by Iwao Kobayashi, as a system to improve an organisation in 20 different operational zones [9]. In his book 20 Keys to Workplace Improvement, Kobayashi [10] defined his approach as a Practical Program of Revolutions in Factories (PRORF), a five-point (five level) evaluation system [10]. Furthermore, the 20 Keys approach allows one to conduct a gap analysis in an organisation, in order to discover which areas (of each of the 20 keys) needs the most attention. For this study, Kobayashi's book was utilised in developing a 20-key audit sheet, allowing for the placing of the organisation on one of the five levels for each of the 20 keys. Information for the 20-keys audit was gathered by interviewing several employees and via observations during further Gemba walks. The results from the audit, a radar diagram is presented in Section 4.2. This proved to be useful in narrowing the scope of the problem's causes.

3.3 Analyse Phase - 5-Why analysis

The analyse phase investigated (and converged) the root causes of the issues highlighted during the 20-key audit in the measure phase. A five-why analysis was conducted on each one

of the 20 keys. Whilst conducting the analysis, trends in the root causes started to emerge. When working with data that converges (or diverges), it is recommended that a thematic map be utilised for analysis [11] [12] [13] [14]. and visual representation of patterns in data, [15] [13], while not overlooking the smaller data points in the grand scheme of things [14].

The data obtained during the five-why analysis converged to six root causes as indicated by the thematic map, explained in Section 4.3. The thematic map also illustrates the links between the data gathered from the five-why analysis.

3.4 Design Phase - Kernel theories

The design phase proposed different solutions to the root causes outlined in the thematic map. All proposed solutions were based on various Kernel theories, which are described as nuggets (kernels) of knowledge and theories from nature or science, that allows for the justification of a process design [16] [17]. By utilising Kernel theories, the design of a solution is based on previous evidence discovered within academia.

The alternative solutions that were proposed in this stage, were evaluated based on the following criteria (using a 5-point Likert scale for each criterion) (table 1):

- Cost to the company,
- Implementation time,
- Complexity of solution,
- Resistance expected from management, and
- Resistance expected from workshop employees.

Table 1: Likert scale used to score alternative solutions

Extremely High	High	Average	Low	Extremely Low
(1)	(2)	(3)	(4)	(5)

This allowed for the selection of the possible best-suited solution to address each root cause. These solutions are discussed, in terms of implementation details, in section 4.4.

3.5 Verify Phase - Delphi method

The verify phase made use of surveys via the Delphi method. The Delphi method is defined as gathering input from relevant people on a specific topic [18]. Due to the structure of the Delphi method, it allows for multiple rounds of surveys, each based on the outcome of its predecessor [19]. The rounds of surveys may only stop once consensus is reached on each research question. This may be declared if the average rate on a question is greater than 75% (e.g. 3.75 on a 5-point Likert scale) [18]. On average, consensus is reached after three rounds [18] [20] [21]. The surveys allowed for the testing of the suggested solutions, as well as testing the suggested implementation time frames, detailed in section 4.5.

4 FINDINGS

4.1 Define phase - Problem and aim

From the Gemba walks and literature studies, it was revealed that the problem causing the decline of organisational OPI's was long lead times. Thus, the aim of the study was to investigate the root causes of the organisation's poor OPIs, by means of the lean continuous improvement approach, as provided in section 2.

4.2 Measure Phase - Radar Diagram

The results from the 20-key audit are illustrated as a radar diagram (figure 2). The findings indicate that the organisation did not score more than three (out of five) for any of the 20 operational zones. This is indicative of the fact that there is room for much improvement within the organisation. Upon conducting the 20 key audit, it was also apparent that the

service centre lacked synergy. The lack of synergy was observed during the interviews (on the Gemba walk), when employees were confused on the roles and responsibilities for different operational zones and/or were unaware of their existence.

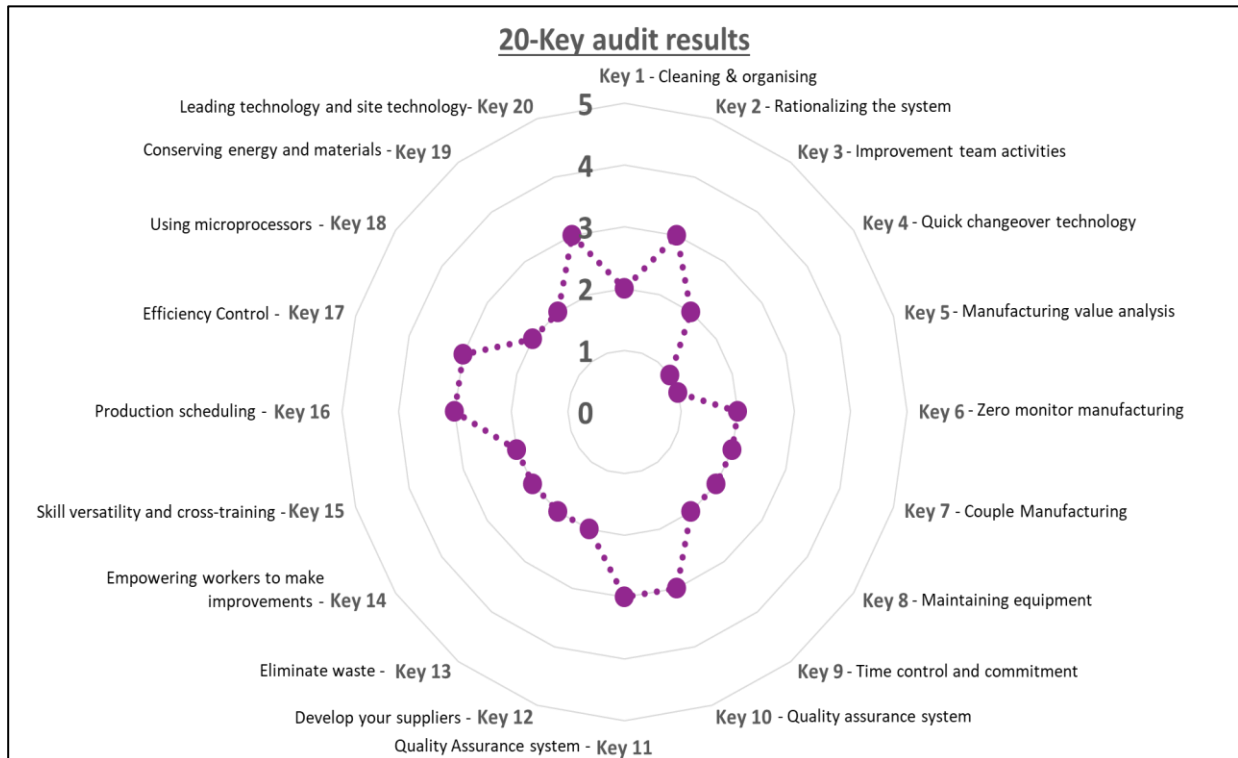


Figure 2: Radar diagram of the results from the 20 key audit

4.3 Analyse Phase - Thematic Map

A five-why analysis was done to find the causes for the low score of each of the 20 keys. The five-why summary is shown in Fig 3. This matrix grid was created by allocating the 20 key numbers to the rows and allocating A to E levels for each of the five whys across the columns. During analysis of the data suspected trends emerged, which were colour-coded.

The outcome of the five-why analysis was further investigated by means of a thematic analysis in order to discover the root causes of each of the 20 keys. The thematic map is illustrated in Fig 4.

The matrix grid created by the 1-20 numbers and A-E levels, were used to illustrate the correlation between the five-why summary and the thematic map. Ergo, section A1 in the five-why summary (Figure 3) is labelled block A1 in the thematic map (Figure 4). Each of the suspected trends were confirmed as a root cause theme and therefore allocated the same colour as in the five-why summary.

The thematic map illustrates the convergence to the six common root causes of the low score of each of the 20 keys: (1) late job distribution to employees, (2) low employee morale and norms, (3) high staff turnover rate, (4) low employee skill level, (5) insufficient/absent tools and equipment, and (6) lack of demarcated areas; of which “high staff turnover rate” and “low employee morals and norms” were found to be the root causes for most of the issues (evident by the number of arrows ending at it).

The organisational culture could have had an influence on the employee moral and norms (root cause nr 2), as well as creating the work atmosphere, which could in turn influence staff turnover rates (root cause nr 3) [22]:

“Organisational culture is manifested in the typical characteristics of the organisation. It therefore refers to a set of basic assumptions that worked so well in the past that they are accepted as valid assumptions within the organisation... (which manifests itself in attitudes and behaviour)”.

Hence, an ineffective organisational culture may have contributed to the situation in the case study organisation, as it dictates how things are done within an organisation (regardless if it is wrong or right) [22].



Figure 3: Five-why summary

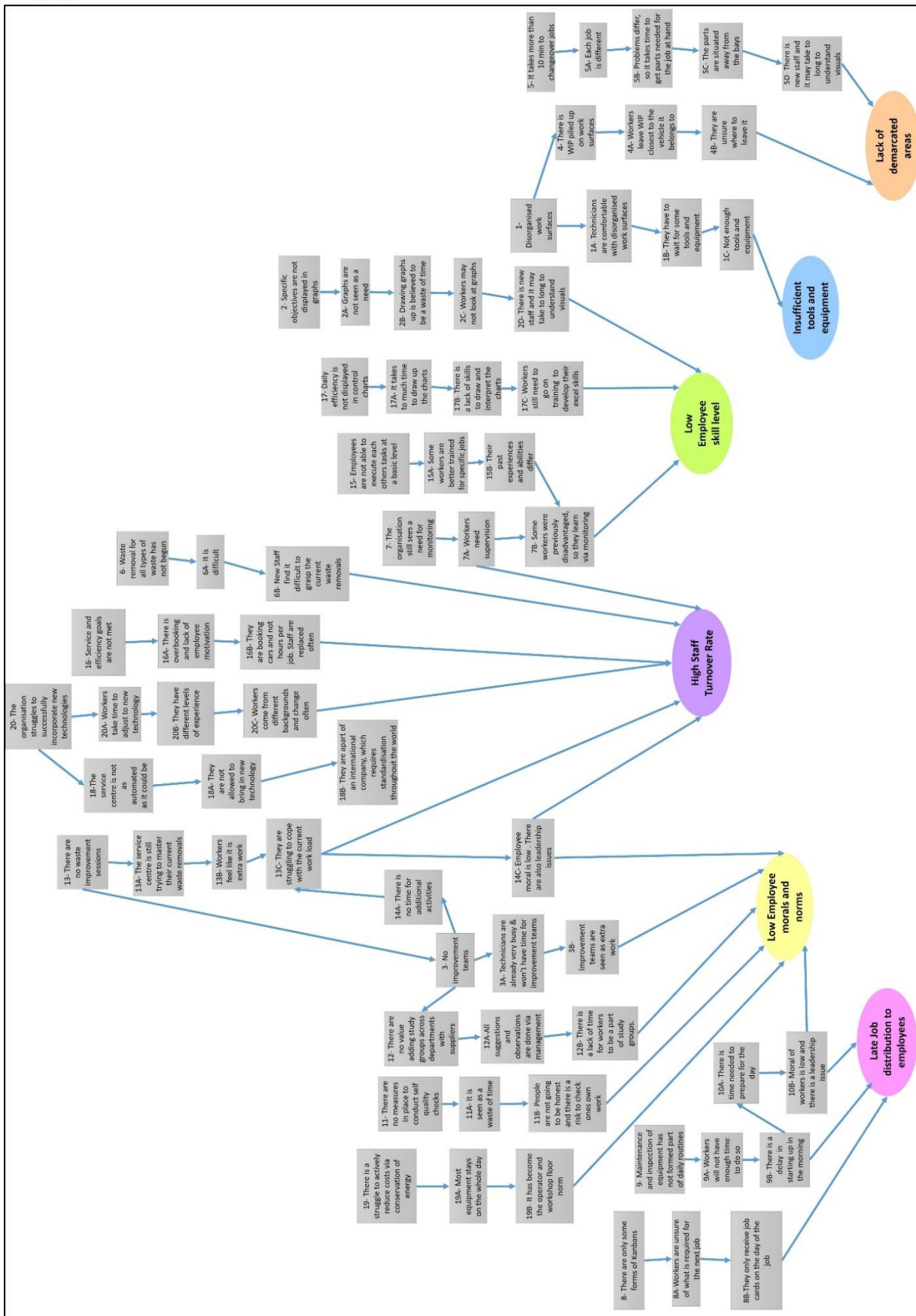


Figure 3: Thematic Map of root causes

The thematic analysis contradicted the case study organisation's opinion that they have implemented or adopted lean principles, while the results indicated that there was a mismatch of multiple principles [7]. The root causes and the violated lean management principles [7] are provided in table 2: The left column states the root cause and the right column, states which of the 14 management principles of the Toyota way [7] was violated, indicated with a "P" and the principle number.

Table 2: Identified root causes and contrasting lean aspects

#	Identified Root Cause	Violated Lean Principle
1	<u>Late job distribution to employees</u> - The organisation takes extra time to start up operations in the morning, because jobs are only distributed to the employees in the morning. As a result, there is a delay in acquiring the parts and tools required to complete the job for that day.	1.1. P4 - <i>Level out the workload (heijunka)</i> - Planning 1.2. P6 - <i>Standardised tasks are the foundation for continuous improvement and employee empowerment</i> - Standardised tasks
2	<u>Low employee morale and norms</u> - Worker morale is low; this was recognised by management. Management has identified leadership issues. Many shop floor employees expressed their feeling of not being heard within the organisation, as there are not enough opportunities to express their suggestions. This leads to the waste in the form of unused employee creativity.	2.1. P10 - <i>Develop exceptional people & teams who follow your company's philosophy</i> - Respect for people 2.2. P2 - <i>Create continuous process flow to bring problems to the surface</i> - Eliminate waste (Unutilised employee creativity)
3	<u>High staff turnover rate</u> - The high staff turnover rate refers to the fact that workers are often resigning. Like with many organisations, some workers leave to pursue better opportunities at other companies.	3.1. P1 - <i>Base your management decisions on a long-term philosophy</i> - Long life employment 3.2. P10 - <i>Develop exceptional people & teams who follow your company's philosophy</i> - Employee development
4	<u>Low employee skill level</u> - Some employees come from disadvantaged backgrounds. In addition to this, not all employees are at the same skill level. These factors culminate to impacts the work experiences and skill levels of the various employees.	4.1. P10 - <i>Develop exceptional people & teams who follow your company's philosophy</i> - Employee development 4.2. P9 - <i>Grow leaders who thoroughly understand the work, live the philosophy, and teach others</i> - Grow leaders
5	<u>Insufficient/absent tools and equipment</u> - Technicians and shopfloor employees are required to bring their own toolboxes. Specialised equipment and tools are supplied at the specialised tools room. Due to this, employees frequently must share tools, which causes delays in jobs.	5.1. P6 - <i>Standardised tasks are the foundation for continuous improvement and employee empowerment</i> - Standardised tasks
6	<u>Lack of demarcated areas</u> - Employees leave parts and tools used on vehicles next to the vehicles, as there are no demarcated areas for work-in-progress and tools. This causes multiple wastes in terms of motion, as workers walk around the parts and tools on the floor, as well as having to move them often	6.1. P6 - <i>Standardised tasks are the foundation for continuous improvement and employee empowerment</i> - Standardised tasks 6.2. P7 - <i>Use visual control so no problems are hidden</i> - Visual management

4.4 Design Phase - Improvement

During the improvement phase of the study, Kernel theories were used to develop suitable solutions, to address the root causes. These Kernel theories were aligned with the violated lean principle in table 2, striving towards achieving a true lean transformation. The root causes, applicable Kernel theories, solutions and implementation details are depicted in Table 3.

Table 3: Table of explanations of solutions

Root Cause	Kernel Theory	Solution	Implementation details
1 - Late Job distribution to employees	Optimisation tool for planning	Weekly job schedule	Employees skill levels must be evaluated to ensure that they are able to complete jobs allocated to them. In order to allocate jobs fairly, a justified method of allocating jobs must be identified. Weekly meetings must be set up to allocate jobs to employees for the up and coming week.
2 - Low employee moral	Improvement via team activities (Key 3 of 20 Keys)	More team building activities.	Group activities must be identified and scheduled. Thereafter, all employees must be invited to the events
3 - High staff turnover rate	Toyota's approach to Maslow's need hierarchy	Small improvement teams	Small improvement teams will aid in utilising employee creativity and involvement within the organisation. As it will require developing teams of 5 people from different departments, determining the roles within the teams and identifying improvement projects.
4 - Low employee skill level	Growing leaders who thoroughly understand the work, live the philosophy and teach it to others	Mentorship program	Employee skill levels must be reviewed to determine where they need to improve. This will allow for allocation of mentors based on the skill level of employees. A list of tasks to train on must be drafted and employees must be tested on their ability to complete the tasks.
5 - Insufficient (absent) tools and equipment	Standardise work (Using standard times)	Schedule for tools and equipment	A schedule will aid in providing structure to the method of sharing tools and equipment. A tool schedule must be created. Time studies must be conducted to determine the standard times for using tools. Lastly employees must be trained on how to use the tool schedule and it should be displayed on the workshop floor.
6 - Lack of demarcated areas	Use visual control so no problems are hidden	Standardised workstation layouts	A Kaizen event must be hosted to implement 5S in work cells. Hereafter, employees must be trained on how to set up their work cells based on the outcome of the 5s kaizen event. Lastly, all work cells must be inspected on a monthly basis.

4.5 Verify Phase - Testing Solutions

The Delphi method was used to verify the proposed solutions that were designed in the previous phase, by developing a survey to investigate employee's agreement with the proposed solutions.

Since each solution was developed from a Kernel theory, these Kernel theories were utilised to develop a hypothesis-based outcome for each solution which was in turn utilised to design a corresponding survey statement. Hypothesis-based outcomes allowed the researcher to assume what the outcome of the solution would be (based on literature) in order to test the participants agreement. The statements were compiled in a survey with a 5-point Likert Scale (Table 4) to evaluate their agreement with each of the statement. All statements were written in basic English (ensuring all jargon was explained).

Table 4: Likert scale used in the survey

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
(1)	(2)	(3)	(4)	(5)

Table 5 provides a summary of the root causes, proposed solutions, Kernel theories, hypothesis-based outcomes and survey statements).

Table 5: Table of summary for developing the survey

No.	Problem (Root causes)	Solution to address the problem	Kernel theory	Hypothesis-based outcome	Survey Statements
1	Late job distribution to employees	Develop a weekly job schedule	Optimisation tool for planning	A weekly job schedule will enable workers to coordinate jobs and prepare for jobs before the time.	1. A weekly jobs schedule will help workers to prepare for their up and coming jobs.
					2. A list of skills needed to complete each job can be compiled in 2 months.
2	Low employee morale and norms	Implement more team building activities	20 keys to workplace improvement - key 3 (Improvement via team activities)	Team building activities will improve employee relationships. This will lead to employees feeling valued by the organisation, which will improve the morale of employees.	3. Team activities will help workers build better relationships with each other.
					4. Team activities will show employees that the company values them.
					5. A suggestion box can be installed in 2 weeks, so employees can suggest team activities they would like to do.
3	High staff turnover rate	Create small improvement teams	Lean's approach to Maslow's Need Hierarchy	Small improvement teams will allow employees to feel valued and a part of the organisation, because it gives them a platform to provide their input. This will lead to employees wanting to stay at the organisation.	6. Small improvement teams (group projects to improve the work environment) will lead to employees feeling valued by the company.
					7. Small improvement teams will lead to employees feeling part of the company.
					8. A small improvement team can focus on one project in a month.

4	Low employee skill levels	Develop a mentorship Program	Principle 9 of the Toyota Way (Growing leaders who thoroughly understand the work, live the philosophy and teach it to others)	A mentorship program will allow more experienced workers to train other workers, via a practical transfer of knowledge. Lower skilled employees will be able to enhance their skill set, while developing leadership in higher skilled employees	9. A mentorship program will allow employees to gain new skills from other experienced employees.
					10. It will take one month to evaluate the skills that employees have and need.
5	Insufficient (absent) tools and equipment	Create a schedule for tools and equipment	The lean tool of standard work (using standard times)	A tool and equipment schedule will allow increase access to tools and equipment. This schedule will further reduce waste in the form of waiting	11. A schedule for tools and equipment will allow workers to use and share tools with each other, so that workers do not wait a long time for tools.
					12. It will take 2 months to measure the time employees spend using a tool/equipment for a job task. (Time measurements will be done for all tools and equipment).
6	Lack of demarcated areas	Create standardised workstation layouts	Principle 7 of the Toyota Way (Use visual control so no problems are hidden)	Standardised workstations will be more organised. This will reduce waste in terms of motion, waiting and defects, as employees will not have to look for parts/tools.	13. Having the same layouts in all the workstations will organise them and reduce waste (motion, waiting and defects).
					14. It will take 2 weeks to hold a 5S kaizen event (A team-based activity to organise the workstations, which allows employees to have a say).

After the employees participated in the survey, their responses were tabulated and analysed using control charts. Consensus was defined as the average for each statement being above 3.75, which is a 75% agreement (on a 5-point Likert scale) [18]. The results are shown in table 6, including their position in the company, years at the organisation and age.

Responses to statements 1-3 and 6-14 of the survey, all displayed an average greater than 3.75 after the first round, declaring consensus and responses within the control limits (Table 6). However, responses to statements 4 and 5 provided challenges, as the response of participant 7 was out of the lower control limit (indicated in red in table 6). Upon investigation, it was revealed that the participant was a 52-year-old individual, placing him in the “aging and high seniority workforce” category [23]. It was also found that he had only been working at the organisation for 3 months. It can be deduced that the combination of being new to the organisation and older than most employees, caused him to view the organisation differently, since his view on feeling valued by the organisation was not yet established. This renders the data point removable with a valid cause, and the average re-calculated for statement 4 and 5. The last row of table 6 portrays that consensus on all statements were reached, as all averages are greater than 3.75.

Table 6 : Data from survey responses

#	Position	Position details	Years of service	Age	Response to statements													
					1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Management	Service Manager	0.33	28	4	3	4	4	3	4	4	3	4	2	4	3	4	4
2	Management	Workshop manager	0.25	34	1	2	5	5	5	5	5	5	5	4	1	2	4	1
3	Management	Dealership principle	2.00	38	3	4	5	4	5	4	5	4	3	5	5	5	5	2
4	Technician	N/A	3.00	28	5	3	5	5	5	5	5	5	5	5	5	4	5	5
5	Technician	N/A	0.58	31	4	3	5	5	4	4	4	3	5	5	5	4	4	4
6	Technician	N/A	1.00	33	4	4	4	4	4	4	4	4	4	3	4	4	4	4
7	Technician	N/A	0.25	52	5	2	5	2	2	4	5	5	5	5	2	5	4	5
8	Technician	N/A	0.08	32	4	5	4	4	4	4	4	4	5	5	3	3	4	4
9	Technician	N/A	0.50	31	2	3	5	5	5	4	4	4	3	3	4	5	4	4
10	Apprentice	N/A	1.00	26	5	2	5	5	5	5	4	4	5	5	5	4	5	5
11	Apprentice	N/A	0.25	21	4	4	5	5	5	4	4	4	5	4	4	2	5	3
12	Apprentice	N/A	0.17	24	5	5	5	5	5	5	5	5	5	2	5	5	5	5
13	Apprentice	N/A	1.00	36	3	4	5	5	5	5	5	5	5	5	3	4	3	4
14	Apprentice	N/A	0.17	26	5	5	4	4	5	5	5	5	5	5	5	4	5	5
15	Apprentice	N/A	0.50	28	5	3	5	5	5	5	5	4	3	4	5	4	5	2
16	Other	Parts Clerk	3.00	33	5	5	5	4	4	5	4	3	5	4	4	5	5	4
17	Other	Parks Clerk	1.00	45	4	5	5	5	5	5	5	4	5	5	5	5	5	5
18	Other	Contractor	2.00	35	4	5	4	5	5	4	5	5	5	2	2	2	4	5
19	Other	Windscreen Contractor	2.00	41	4	4	4	4	4	4	4	4	4	4	4	4	4	4
20	Other	Customer Relations	1.50	26	4	4	5	5	5	5	5	5	4	4	3	3	5	5
Initial Averages					4.00	3.75	4.70	4.50	4.50	4.50	4.55	4.25	4.50	4.05	3.90	3.85	4.45	4.00
Final Averages					4.00	3.75	4.70	4.63	4.63	4.50	4.55	4.25	4.50	4.05	3.90	3.85	4.45	4.00

This study reached consensus amongst participants after the first round of questions, ergo there was no need for additional rounds of the Delphi method. Since consensus amongst participants were reached, the solution can be considered verified.

5 CONCLUSIONS

In this study the organisation, used as case study, was experiencing a decline of the department's OPIs, which posed a potential loss of income for the organisation. Therefore, the aim of this research was to investigate the root causes of the organisation's poor OPIs by means of the lean continuous improvement approach.

The study was conducted by means of the DMADV approach, combining different problem-solving techniques in a novel approach. The root causes determined by a 20-Key audit and five-why analyses were reported in a thematic map. Potential solutions were developed utilising Kernel theories, after which they were verified via the Delphi technique.

This study indicated, the mismatch of multiple of the 14 lean management principles which is a common problem during lean implementations world-wide [24] [25] [26]. Hoogvelt and Yuasa [24] express that "The experience with Japanese or 'lean' production systems when transplanted to the West has often been below expectations", this was attributed to the misunderstandings in different social, economic and organisational cultures [24].

Furthermore, this research has also revealed the importance of organisational culture, ergo the people (employees) of an organisation have the power to make the organisation succeed or fail. The case study highlighted the issues with trying to implement the same organisational management strategies world-wide, throughout different organisations of the same "parent-company", causing lean and organisational cultural mismatches. From literature, it was made apparent that lean is rooted deeply in the Japanese culture [24]. Japan's history and folklores

depict a lean culture of doing nothing without meaning, thus ensuring that all members in a party understand the implications of decisions made. This ideology has transcended into the business world of Japan, making it the pioneers in lean. This could explain why there is a mismatch of lean in other countries' organisations.

The study also found that when dealing with organisational culture, there is no universal solution, instead continuous improvement approaches must be adapted to the current culture. When lean techniques are used verbatim, it may cause misunderstandings between the organisational culture and lean principles. The aforementioned cross-cultural adaptations of lean, highlights the importance of an effective organisational culture for successful lean implementation. Management should therefore be aware of the difference in cultures when adapting lean cross-culturally.

In summary, this study has developed a novel approach to discovering, analysing and addressing the mismatch of lean principles within an organisation and thereby emphasises the influence that organisational culture has on lean implementation.

6 FUTURE RESEARCH

The focused of this study was on identifying the root causes and solutions for improving the organisations OPI's. However, an implementation plan was not developed for the proposed solutions. It is therefore recommended that future research focus on such an implementation plan.

This research focused on a single organisation of an international automotive company. This international body's parent-company is a German based automotive company, which has taken lean tools from Japan and adapted it to the German culture. This set of adapted tools is utilised in strategies of the international organisation across the world. It is suggested that further research be conducted on the adaption and integration lean tool strategies to the South Africa culture.

During this study, it was proven that there is a misunderstanding of lean principles and it is recommended that future research be done on addressing this problem.

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