

# **The impact of lean leadership on lean supply chain management**

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Mini-dissertation submitted in partial fulfilment of the requirements for the degree *Master of Business Administration* at the North-West University

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Graduation ceremony: May 2019

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## **ABSTRACT**

The purpose of the study was to investigate the impact of Lean leadership on Lean supply chain management in the mining organisation. This was investigated using cross sectional quantitative design, where a survey was used to collect data from supervisors, junior, middle, senior and executive management. A total of 113 responses were obtained, of which they were equitably distributed from Engineering Department, Production (mining), Technical Services (Survey, Geology, Ventilation Occupational Health Engineering) and Supply Chain. The 113 responses constituted a response rate of 50.2% from the distributed sample of 225. This data was analysed using IBM Statistical Package for Social Sciences (SPSS) version 25.

Based on the analysis, there were several main findings in the study. Firstly, the results revealed that the respondents were of the view that Lean leadership was critical for the implementation of the Lean system particularly, Lean success factors, Lean leadership behaviour, Lean concepts and principles and Lean skills and competencies. Secondly, the results had revealed that there is no improvement or slight improvement on the Lean supply chain in the mining organisation, some of the worst highlighted were the contracts management, purchase catalogue, after hours purchasing and bypassing of supply chain procedures. Lastly, there was a positive significant weak relationship between Lean skills and competencies, while there was a medium significant relationship between Lean concept and principles. Noticeably, there was no significant relationship found between Lean leadership behaviour and Lean success factors with Lean supply chain management.

With these findings it could be concluded that Lean leadership does have an impact on Lean supply chain management. As such, it is recommended that management put plans in place for the implementation of Lean leadership and Lean supply chain management in the organisation. Furthermore, management should align Lean leadership and Lean supply chain management in order to ensure the smooth and effective implementation of Lean supply chain management in the organisation

### **Keywords**

*Lean leadership, Lean supply chain management, mining organisation, impact of Lean*

## **DEDICATION**

I want to dedicate this work to my family, who allowed me the time to excuse myself from very important family businesses and gatherings. But, special I dedicate this work to my wife Nthabeleng and our three beautiful daughters, Sinethemba, Noluthando and Ubuhlebethu. I love you so much and want you to join me in enjoying the love and beauty of learning.

## **ACKNOWLEDGEMENTS**

Many thanks to my supervisor Mr Jordaan and my co-supervisor Mr Van Zyl for encouraging me to push on when I felt the work was too much. I also want to pass my sincere gratitude to all MBA staff members of the North West University for their true dedication to their calling as lecturers, it has had an impact in my own work environment.

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## CHAPTER 1

### NATURE AND SCOPE OF THE STUDY

#### 1.1 INTRODUCTION

The concept of Lean originated in Japan with the development of the Toyota Production System (TPS) to assist Toyota to survive capital and resource constraints following the devastating second world-war (Bhamu & Sangwan, 2014:876). Lean is a business philosophy focused on reducing lead times through removal of waste and concentrating on value-added processes (Sisson & Elshennawy, 2015:263). Lean is considered the most effective method of continuous improvement applicable to any kind of organisation (Urban, 2015:728). Alefari *et al.* (2017:756) contend that even though Lean started with Lean manufacturing, the concept is used everywhere, examples include: Lean services, Lean entrepreneurship, Lean software development, Lean accounting and Lean supply chains

Dombrowski and Mielke (2014:566) define Lean leadership as "a methodical system for the sustainable implementation and continuous improvement of Lean production systems" that entails cooperation of employees and leaders in their focus on perfection. Lean leadership (LL) is a way of sustaining and improving employee performance that requires management commitment in the form of developing clear vision and provision of resources and strategic Lean leadership (Alefari *et al.* 2017:756). Lean leadership is critical for the successful implementation and sustainability of Lean production systems (LPS) (Trenkner, 2016:129). Aij and Teunissen (2017:713) stress that systemic change and strong Lean leadership is required for the successful implementation of Lean. In a study (Seidel *et al.* 2017:2175) suggest a positive correlation between Lean leadership competencies and leader's maturity level in LPS and the level of organisational maturity in LPS.



Lean supply chain (LSC) is described as a dynamic ecosystem constituted of processes, products and organisations that work together to deliver products and services that add value to the entire network as they satisfy customer demands (Bhasin, 2015:52). Lean supply chain focuses on supply chain process optimisation and simplification whilst reducing waste and non-value adding supply chain activities (Afonso *et al.* 2015:270).

Lean implementations fail to deliver to expectations because of the sole focus on waste reduction and methods without the creation of a Lean thinking organisation that develops Lean leaders (Dombrowski & Mielke, 2014:565). As result there is a need to establish the impact of Lean leadership on the implementation of Lean supply chain management.

## **1.2 BACKGROUND AND RATIONALE FOR THE STUDY.**

Globalisation, uncertainty and volatility in the markets are major contributors to organisational move to Lean management systems (Czarnecka *et al.* 2017 177). To be competitive and sustain that competitive advantage organisations must adopt evolving strategies, Lean is one such strategy (Verrier *et al.* 2014:83). Lean management started as a set of tools and techniques to becoming a management philosophy (Salonitis & Tsinopoulos, 2016:189). Lean is a collection of tools and practices used to achieve operational and financial goals, however this is not sufficient for the successful implementation of Lean which requires a culture of continuous improvement (CI) and Lean leadership (Van Assen, 2016:1).

Lean transformation is driven from the shop-floor but of importance is top management taking a lead in the initial stages of the process (Alefari *et al.* 2017:757). The uniqueness of Lean leadership is that it engages shop-floor employees in identifying problems, proposing solutions and correcting issues (Merlino & Petit, 2015:309). Lean management concepts cease to meet expectations vested in them in the long-term, because of concentration only on the elements of Lean concept and paying less attention on Lean thinking, Lean leadership and continuous improvement (Trenkner, 2015:130).

The full effectiveness of Lean management requires that the Lean system is extended down through to supply chain which in turn identifies waste in the value stream of supply chain and eliminate the waste (Kram *et al.* 2015:161). The aim of Lean supply chain is to strengthen the chain links and to focus primarily on the structure of the supply chain and continuous improvement by improving the flow through all participants of the chain (Czarnecka *et al.* 2017:181). In a country with high interest rates and fierce competition in the global market, it is possible to improve supply chain performance by implementing Lean supply chain management and be competitive (Tortorella *et al.* 2017:109). Finding the appropriate supply chain strategy and identifying the critical Lean practices on which management should focus in order to achieve competitiveness is paramount (Govindan *et al.* 2015:15).

Organisational buy-ins is imperative in understanding how Lean leadership can have an influence on Lean management and other quality tools (Iyer, 2017:35). Successful training programs during Lean transformation on Lean tools need to be complemented with the effort of altering leader's practices, beliefs, behaviours and mind-sets (Kim & Hochstatter, 2016:20). A Lean organisation transfers and adapts Lean principles to all business segments including, sales and service, supply chain management, administrative processes and leadership to optimise the whole system even though each uses different Lean principles that include specific Lean tools and methods (Dombrowski *et al.* 2017:341). Unsuccessful implementation of Lean can have an impact on organisation's resources and lowers employee confidence in the Lean philosophy (AlManei *et al.* 2017:750).

The challenges with achieving Lean objectives lies not on management commitment but squarely on management ignorance of what they should commit to, the required Lean management knowledge (Pearce *et al.* 2018:94). Some of the requirements of active learning is to engage in problem solving, reading, writing and discussing ways to maximise knowledge, attitude and skills improvement (Leming-Lee *et al.* 2017:415). Lean concept implementation barriers are people related and include lack of knowledge and motivation, lack of support from top management and resistance to change (Ciarniene & Vienazindiene, 2015:232). Human integration in Lean coupled with uncertainty in demand, pressure from customers and top management, non-effective methods, knowledge and information transfer and training if not managed properly derail Lean implementation (Wong & Wong, 2014:51). Successful and

lasting Lean implementation hinges on both organisational and technical barriers to be eliminated and that poor involvement of employees and excessive reliance in Lean tools and techniques be changed (Lodgaard *et al.* 2016:595).

Successful future lean organisations bank on strategically designing their structure, function and effective dynamics the same way as the human brain to ensure consensus to set goals (Villalba-Diez *et al.* 2016:140). Lean leadership and the development of Lean-focused performance review reports, and nonfinancial incentives linked to Lean implementation allow for extensive Lean implementation practices (Netland, *et al.* 2015:90). A strong Lean mindset that promotes organisational culture is ideal for the sustainable and effective implementation of Lean (Tyagi *et al.* 2015:213). There exist a positive relationship between the effectiveness of Lean implementation and the level of transformational leadership applicable (Kim & Hochstatter, 2016:25).

### **1.3 PROBLEM STATEMENT**

Strong Lean leadership is critical for the successful implementation of Lean, this requires a change in leadership practices, behaviours and the mindset facilitated through development of cross divisional boundaries that support the long-term vision of the organisation's value producing processes and keeping employees accountable to Lean objectives (Goodridge *et al.* 2015:4). The components of a Lean management system work together when top management adapts to Lean leadership way of managing (Kim, 2018:54). There are qualitative aspects of leadership such as ethical values, respect for others, modesty, vision and interpersonal skills that makes a good leader (Aij *et al.* 2015:132).

Tay, (2016:1158) contends that Lean improvement projects should shift focus from improving the efficiency of individual resources to looking at the interconnections between them, this means that Lean improvement projects should aim to achieve "flow efficiency" as opposed to "resource efficiency. Lean is a lifelong journey of an improvement culture that ensures that improvements are aligned, behaviours are exemplified, systems are checked, people are continually coached and developed and that improvement is planned and pure (Hines *et al.* 2018:16). Ultimately Lean implementation success is based on both the application of tools and

techniques, top management's involvement and leadership, worker's attitude, resources and organisational culture (Jadhav *et al.* 2014:122). Strategic partnership with suppliers, cross-functional teams, cross-organisational design and development teams have measure influence on the success of Lean management (Sharma *et al.* 2015:1218).

Lean thinking is a new way of thinking about the roles of organisations, functions and careers to channel the flow of value from conception to launch, order to delivery and raw material to customer (Carvalho *et al.* 2017:76). Lean leadership is seen as the missing link between toolbox Lean and sustainable continuous improvement (Dombrowski & Mielke, 2014:565). Seidel *et al.* (2017:2172) suggest that Lean theory has not paid special attention to the individuals' personality traits and unique personal qualifications. Aij *et al.* (2015:209) advice the use of a strong combination of coaching and motivational skills and learned behaviours when implementing Lean strategy.

Flowing from the above, problem statement is summarised as follows:

The successful implementation of Lean supply chain management requires the employment of a leadership style that will promote Lean supply management. Knowing the tools and techniques of Lean supply chain management is not enough. The primary objective of this research is to establish the impact of Lean leadership on Lean supply chain management in the mining industry.

#### **1.4 PURPOSE OF THE STUDY**

The purpose of the study is to study the impact of Lean leadership (independent variable) from all management levels on Lean supply chain management (dependent variable).as leadership is identified as a critical success factor (CSF) in Lean implementation.

## **1.5 RESEARCH OBJECTIVES**

The research objectives of the study are two-fold, a primary objective and a secondary objective.

The primary objective of the study is to investigate and study the impact of Lean leadership on Lean supply chain management. To achieve the primary objective of the study, the following secondary objectives were made:

- To understand the criticality of Lean leadership in the mining organisation
- To understand the perceived improvement levels of the Lean supply chain management
- To understand the impact of the perceived criticality between Lean leadership and Lean supply chain management.

## **1.6 SCOPE OF THE STUDY**

The scope of the study is limited to Lean management, Lean leadership and Lean supply chain management in the mining industry. The focus is on the impact of Lean leadership on Lean supply chain management. The study will concentrate on leadership in the mining industry which include, senior and top management, middle management, junior management and supervisors.

## **1.7 LIMITATIONS OF THE STUDY**

The research study is limited to the primary sources of information from the mining industry, their willingness to partake in the study and the honesty with which they complete the questionnaire. The theoretical part of the study relies on past researches done in the field of Lean management, lean leadership and Lean supply chain management.

## **1.8 SIGNIFICANCE OF THE STUDY**

Organisations in South Africa and around the world have realised the important contribution supply chain management makes to the organisation's bottom line earnings. More and more organisations are transforming to Lean supply chain management. Understanding the Lean

leadership style of managing Lean projects and exploring its effect on Lean supply chain management provides a foundation for Lean leadership development initiatives.

Fierce global competition in the markets requires of captains of the industries to continually look at ways not only to reduce costs and improve performance but also to sustain and improve performance excellence. Leadership is at the centre of continuous improvement and Lean leadership knowledge is required to sustain Lean systems.

The study will see the development and training of leaders specifically to lead and manage Lean supply chain projects. Supply chains have proven to be hubs of any organisation and understanding the correlation between Lean leadership and Lean supply chain management will contribute to the attainment of sustainable continuous improvement. The drive to eliminate waste and contributing to the bottom line earnings is expected from all departments of an organisation and supply chain is a strategic department where cost accumulation is experienced. The impact of Lean leadership on Lean supply chain management is crucial in ensuring the long-term sustainability of Lean supply chain management.

## **1.9 RESEARCH DESIGN**

The approach to the study is a quantitative approach using a survey method. Bryman *et al.* (2017:31) describe quantitative research approach as the collection of numerical data that involves distribution of self-completion questionnaires that are quantified and transformed into data that can be processed using a computer. According to Creswell cited by Biswas and Muthukkumarasamy (2017:793) quantitative research is defined as "a scientific method which follows a number of procedures such as generation of models, identifying theories and hypotheses, development of instrumentals and methods for measurement, experimental control and manipulation of variables, collection of empirical data, modelling and analysis of data and evaluation of results".

A research design ensures that what is unknown is revealed also include reflections about theories, methods for generating, analysing and interpreting data and making the link in the process (Freitag & Young, 2017:422). The dependent and independent variables are mostly used in research and the independent variable is termed the experimental or predictor variable because it is manipulated to observe the effect of the dependent variable (Usman, 2015:56).

## **1.10 RESEARCH METHODOLOGY**

The approach to the study is a quantitative approach using the survey method. The research will look at two variables of interest, the dependent variable being Lean supply chain management and the independent variable as Lean leadership. This allowed for the necessary theoretical literature review and the subsequent collection, analysis and interpretation of the data. Chapter three deals with the methodology employed in the study in detail, the design of the questionnaires, sample and data collection and the methods used in interpreting and analysing the data. The data was collected with survey using an online platform, and then analysed using IBM Statistical Package for Social Science (SPSS). In this study, a total of 113 respondents were obtained, and several stages of analysis were conducted. These included data preparation, descriptive data analysis, and multivariate analysis for validity using exploratory factor analysis and for reliability using Cronbach Alpha. The last stage was inferential statistics, where the level of criticality and improvement was analysed using a one sample t-test, also analysed was the relationship with Pearson correlation and prediction using linear multiple regression.

## **1.11 LAYOUT OF THE STUDY**

The research study comprises of five chapters with each chapter tackling a different focus area that complements the objective of the study. The chapters are divided as follows:

### **CHAPTER 1 NATURE AND SCOPE OF THE STUDY**

The aim of chapter 1 is to introduce the study by giving a background to the study, formulating the research problem which forms the basis of carrying out the study. The objectives, research design, method, limitations and the significance of the study are discussed in chapter 1.

### **CHAPTER 2 LITERATURE REVIEW**

The literature review looks at recent work done on Lean leadership and Lean supply chain management. The literature review allows for a more and comprehensive understanding of Lean leadership and Lean supply chain management, the successes, failures and opportunities for further research on the subject.

## **CHAPTER 3 RESEARCH METHODOLOGY AND DESIGN**

The chapter explains the research design and methodology used in the study. This includes the methods used for collecting, analysing and interpreting data for the study. The methodology and design flows from the knowledge and information acquired in the comprehensive literature review and the objective of the study. The sample size and scope of the research and the methods used for the design discussed in detail and reconciled with the research objective.

## **CHAPTER 4 RESULTS**

This chapter elaborates of the findings of the research by trying to give answers to the research questions. The research objectives are uncovered and discussed

## **CHAPTER 5 RECOMMENDATIONS AND CONCLUSION**

In chapter five, conclusion from the study are drawn and recommendations advanced with regards to the impact of Lean leadership on Lean supply chain management.

### **1.12 CHAPTER SUMMARY**

The aim of chapter 1 is to introduce the research study and give a detailed background of Lean management, Lean leadership and Lean supply chain management. The problem statement is discussed that culminate in the purpose for carrying out the study. The objectives of the study together with the limitations, scope and significance of the study are advanced. The chapter concludes with the research design and methodology used in the study and the layout of all the chapters of the study.

A brief discussion of the origins of Lean management is done followed by a background to Lean leadership and Lean supply chain management is introduced. A relationship of Lean manufacturing and the application of Lean management in the service sector is put to the fore with the aim of depicting the move from a complete manufacturing ideology to employing Lean thinking in the service sector. Lean leadership as the independent variable in the study is discussed.

The study uses quantitative research design to collect data and the chapter was concluded with a layout of the whole research.



## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 INTRODUCTION

Lean is a rapidly growing management philosophy, its successful implementation is far from problem free and organisations struggle to sustain Lean systems in the long-term which requires attention to performance improvement, capability development and maturity tracking (Soliman & Gadalla, 2014:1). The goal of Lean leadership is to create a workforce that is fully committed to the Lean program and focused on problem solving, implement change, defining and achieving Lean goals and taking accountability (Hughey, 2015:1).

Lean systems work as enablers, determinants and ingredients for sustainable development and integrating Lean tools and practices in supply chain addresses the challenge of improving sustainability in performance (Das, 2018:177). Lean principles and practices need to be spread throughout the supply chain if Lean implementation is to succeed (Martinez-Jurado & Moyano-Fuentes, 2014:134). Organisations struggle to implement lean supply chain management practices because of lack of awareness and improper implementation approach (Tortorella *et al.* 2017:99). Effective competition and cost management require organisations to leverage competencies, resources and skills across their supply chains through the identification of optimal supply chain network design (Mohammaddust *et al.* 2017:632).

A literature review is carried out that extends from Lean management system, Lean leadership and Lean supply chain management and the concepts below have been identified to assist in exploring the impact that Lean leadership can have on Lean supply chain management, Lean management, Lean leadership, Lean success factors, Lean leadership principles, Lean leadership model, Lean wall, Lean leadership competence, Barriers to Lean implementation, Ethical and transformational leadership and Lean supply chain

#### 2.2 LEAN MANAGEMENT

Lean thinking is attributed to Toyota who came up with a production system that was originally called just-in-time (JIT) and is now commonly referred to as the Toyota Production System (TPS) (Fuller *et al.* 2014:415). Rotter *et al.* (2018:3) describe the most cited definition of Lean

as "an integrated socio-technical system whose main objective is to eliminate waste by concurrently reducing or minimising supplier, customer, and internal variability ". Nenni *et al.* (2014:2) describe Lean management as "an intellectual approach consisting of a system of measures and methods which, when considered as a whole, have the potential to bring about a Lean and, therefore, particularly competitive state in a company".

Lean uses simple and visual techniques and Six Sigma on the control and process variability reduction using statistical tools (Tenera & Pinto, 2014:1). The successful implementation of Lean requires that organisations adopt the Lean thinking as a holistic business strategy and integrates Lean practices across operations and business functions (Fullerton *et al.* 2014:414). Successful implementation of Lean management is not only determined by lean management's technical practices, but by soft practices in the form of behaviours and actions of employees and management (Van Assen, 2018:1).

### 2.2.1 LEAN PRINCIPLES & CONCEPTS

Bacoup *et al.* (2017:4) explained some of the basic principles related to Lean concepts. These included the Just-In-Time, Perfect Quality, Team Management, Elimination of Waste, Continuous Improvement and Visual Management (Table 1).

Table 1 Basic principles related to Lean concepts

Lean concepts	Basic principles
Just-In-Time	Pulled flows, pushed flows, just-in-time, Kanban
Perfect Quality	Standard processes, quality management, capability process, detection and resolution of dysfunctions
Team Management	Human resources management, multifunction of teams, teamwork and participation
Elimination of Waste	Production analysis, value streaming
Continuous improvement	Kaizen, continuous improvement
Visual Management	Visual management

Source (Bacoup *et al.* 2017:4).

### 2.2.2 LEAN SUCCESS FACTORS

Sisson and Elshennawy (2015:264) developed the six key success factors of Lean improvement as follows:

1. Deployment - bottom-up implementation of Lean projects has proven to be problematic, top down approach and management commitment in Lean transformation is a crucial success factor.
2. Engagement - early engagement of stakeholders in the organisation is important including the use of HR policies to support Lean projects, dedication of full-time resources and engage in regular communications on Lean.
3. Training - investment in the training of employees on Lean and the development of internal Lean leaders in the organisation is crucial for Lean to succeed.
4. Processes - the conversion of inputs into outputs requires the utilisation of value stream mapping to identify opportunities for improvement and the importance of standard work as the baseline for continuous improvement.
5. Drivers - the use of the Voice of the Customer, use of kaizen and the utilisation of metrics and visual management tools to drive improvement is crucial for the success of Lean projects.
6. Culture - sharing a common set of beliefs and practices and acknowledging that Lean culture is a continuous process is important for Lean success.

### 2.3 LEAN LEADERSHIP

Lean leadership is a sustainable process where leaders and followers concentrate on mutually inclusive practices of growth (Iyer, 2017:40) A system of regular identification and development of leaders that consists of a model with four stages was developed by the pioneers of Lean management Toyota (Trenkner, 2016:131).

- Self-improvement - going to the gemba (the place of work) to thoroughly understand the actual work situation to improve themselves and others.
- Coaching and stimulating the development of others - familiarising oneself with the strength and weaknesses of the subordinates with the view of stimulating the employees' development.

- Supporting the daily kaizen process - promoting leadership development by standards, objectives and visual management through being present at gemba.
- Creating the vision and coordinating objectives - full participation in the process of setting objectives and the methods to achieve them (HoshinKanri).

## 2.4 LEAN LEADERSHIP PRINCIPLES

The Lean leadership principles are based on five fundamental Lean areas that are meant to support Lean leaders in their daily activities and they include the following (Dombrowski & Mielke, 2014:565):

1. The area of the culture of continuous improvement:
  - Consistent, continuous and internally consistent leadership developed through long-term personal development of leaders.
  - Lean leaders support the problem-solving process and allowing employees to do the actual solving of problems.
  - Allowing the space for employees to learn from making mistakes.
2. The area of self-development:
  - Self-awareness regarding the identification of development needs for leaders is the important starting point.
  - Internalisation of acquired knowledge and skills should form part of the promotion process of leaders.
  - Unique skills and behaviours are important for Lean leaders to be able to identify and translate customer needs into specific processes and employees.
3. The area of qualifications:
  - Independence of the team is important for succession planning.
  - Individual development planning should be formalised for each employee.
  - Learning through problem solving should have immediate feedback reports to motivate employees.
4. The area of gemba:
  - Decision making should be informed by personally confirmed facts in gemba (the genchigenbutsu principle).
  - Going to the gemba should be used as an opportunity to learn for the leader.

- Small teams for each leader in the gemba is recommended so that the leader is able to give enough attention to each employee.

5. The area of HoshinKanri:

- Long-term objectives should always take priority to short-term objectives.
- The development of employees should be inculcated in the company's objectives.
- Define intermediate objectives in line with the company's perfection strategy.

## 2.5 LEAN LEADERSHIP COMPETENCIES

Seidel *et al.* (2017:2175) suggest existence of a significant correlations between Lean leadership competencies and leader's maturity level in Lean systems and the organisational maturity level of Lean production systems. There is again a positive correlation between the development of competencies and operational performance and the following identified Lean leadership competencies sets a basis for designing a formal Lean leadership development program (Seidel *et al.* 2017:2175): These included, Identify what adds value to internal and external clients, Identify and solve problems with their teams using coaching, Use continuous Lean practices and principles, Manage with emphasis on value flow rather than on isolated operations, See the problems with your own eyes (based on data and facts), Leading by example, Brings stability to the process, Provide value-added information clearly and objectively, Put team's interest above individual's interest, Develop and implement guidelines, plans and policies to enhance development, Practice personal professional development and continuous evolution, Identify and manage barriers in the Lean journey, Approach Lean as an interrelated system of principles and practices, Develop actions based on long-term projections, Develop ethical principles, respect community and environment and safety for all and Develop innovative and challenging actions.

## 2.6 LEAN LEADERSHIP BEHAVIOUR

Van Assen (2016:4) describes Lean leadership behaviour to include the following:

- 1 Leadership commitment, involvement and leading the way.
- 2 Open and communicating future strategies and plans.

- 3 Empowerment and promotion of employee responsibility.
- 4 Building and enforcing a culture of trust amongst all stakeholders.
- 5 Having humility and respect for people.
- 6 Collaboration and facilitating teamwork through coaching.
- 7 Setting ambitious goals and having high expectations.
- 8 Sharing information and giving timely feedback.
- 9 Monitors performance in rational and persuasive manner.
- 10 Celebrating and recognising success.

## 2.7 BARRIERS TO LEAN IMPLEMENTATION

### 2.7.1 LEAN WALL

The focus on the techniques and tools of Lean management is strong at the initial stages of the Lean process creating a wall that can only be broken down if the focus moves away from technical to mindset through strengthening leadership at all levels in the organisation (Ghimere, 2017:55).

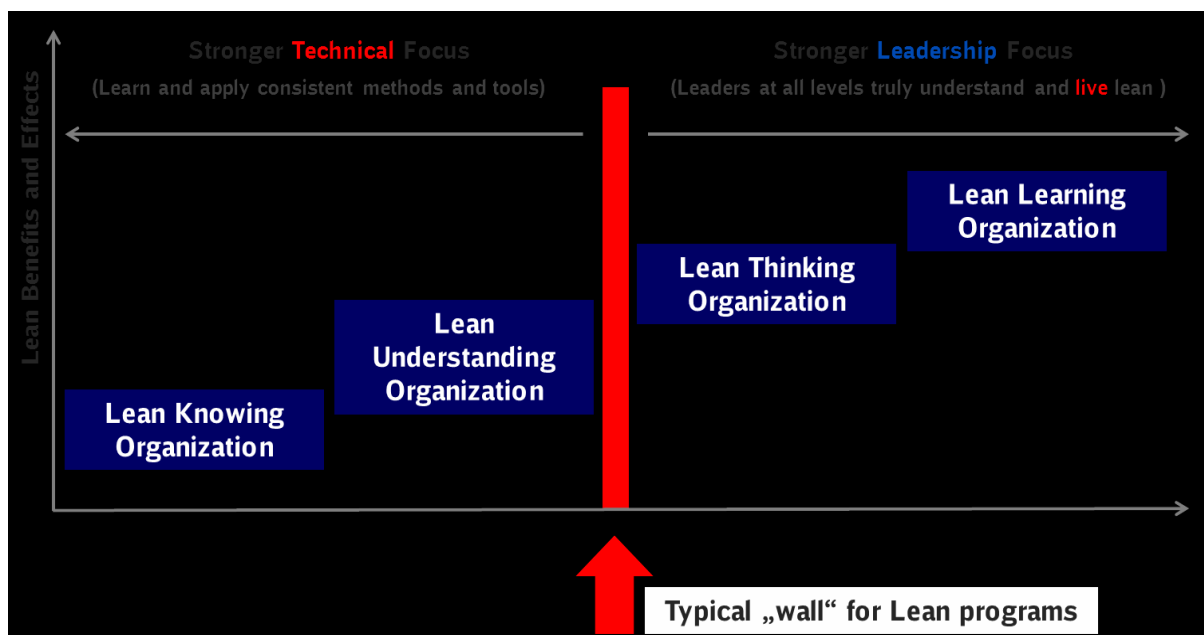


Figure 1 The Lean wall. Source: (Ghimere, 2017:55)

### 2.7.2 BARRIERS

Productivity improvement systems face challenges in their lifecycles and Lean implementation is no exception and failure to ensure organisational and individual change readiness may require additional resources and time at a later stage (Jadhav *et al.* 2014:6).

Jadhav *et al.* (2014:6) summarises the barriers in Lean implementation as follows:

1. Top management resistance.
  - Resistance is experienced from all functions of the organisation and includes all management levels and employees at the shop floor and this is caused by lack of clarity of the change, pressure and pushing back on learning new things.
2. Lack of top/senior management focus leadership.
  - The successful implementation of Lean management requires a vision, strategy and good leadership to drive and sustain Lean change
3. Lack of top/senior management involvement (commitment and support).
  - The successful implementation of Lean requires strong leadership and commitment from the top management of the organisation especially the chief executive officer in the form of both intellectual support and physical engagement in the process.
4. Lack of communication between management and workers
  - Information about the changes and the progress of the project need to be communicated to all employees, successes and challenges also need to be explained to the employees.
5. Lack of empowerment of employees.
  - The decision-making process should be relaxed to allow employees to take decision based on their level of understanding as people at the shop floor and management need to provide support for the taken decision.
6. Workers' resistance
  - Change brings about the fear of job security as most Lean management systems are characterised by the reduction of the so called non-value adding staff members.
7. Lack of perseverance.

- The reduction in manpower as part of the Lean management process leaves the remaining employees reluctant to contribute in future improvement activities and this hinders the Lean process.
8. Lack of consultants and trainers in the field.
- Inappropriate training methods due to the difficulty in finding outside experts to assist in the shift from traditional to Lean process result in Lean failures.
9. Lack of formal training for managers.
- For every new initiative the organisation need to ensure that there is enough understanding of all the facets of the new initiative by first the managers and then cascaded down to the shop floor employees.
10. Lack of formal training for workers.
- Formal training is required for all employment levels in the organisation depending on the competency level required for the different job levels.
11. Cultural differences.
- There is a need to ensure that a Lean culture is created that will take priority over all other cultures the organisation might be experiencing at the time.
12. Lack of cooperation and mutual trust between management and employees.
- Mutual trust and strong cooperation between management and employees is a prerequisite to creating a sustainable and successful Lean implementation program.
13. Cross-functional conflicts.
- The criticality of cooperation between cross-functional teams cannot be understated as change initiatives affect every function of the organisation and high interactions and information sharing become very important.
14. Incompatibility of Lean with the company bonus, rewards or incentives system.
- Recognition and rewards boost employees' participation in the Lean implementation process and this requires a strategy in line with the expected outcomes of the Lean project.
15. The lack of resources to invest.
- Cost and time is a constraint in Lean implementation as low levels of implementation are often encountered due non-availability of funds.
16. Slow response to market.



- The response to changes in the product attributes can lead to slow responses from the market and thereby causing inaccurate scheduling and demand planning.
- 17. Lack of information sharing or communication with suppliers and customers.
  - Customer and suppliers' relationship management requires consistent communication between downstream customers and upstream suppliers.
- 18. Lack of cooperation from suppliers.
  - Unreliable supply of production materials stalls proper production planning and scheduling and makes the implementation of Lean difficult.
- 19. Lack of influence over suppliers or lack of involvement of suppliers in the actual implementation.
  - Early supplier involvement in the Lean process is important as suppliers are extensions of the customer organisation and the lack thereof has an influence over suppliers and the lack supplier involvement disrupts Lean schedules.
- 20. Lack of supplier collaboration or lack of mutually beneficial strategic partnership with suppliers and customers (supply chain members).
  - All supply chain management activities should be geared towards the Lean projects the extension on the Lean process to the organisation's supply chain management.
- 21. Quality problems with supplied material.
  - The maintenance of the supply of quality products and services is critical as poor quality may lead to waste which Lean intends to eliminate.
- 22. Absence of a sound strategic action/logistical planning system.
  - A carefully planned and well understood implementation strategy motivates and builds trust amongst employees in the organisation.
- 23. Lack of logistic support.
  - Inventory optimisation is crucial for Lean implementation and this requires maximum support from the logistics function of the organisation.
- 24. Problems with machines and plant configuration
  - Lean management banks on the reliability and efficiency of machines and this in turn is supported by a flexible facility layout where time and movement are kept to a minimum.

## 2.8 AUTHENTIC AND TRANSFORMATIONAL LEADERSHIP

### 2.8.1 INTRODUCTION

Banks *et al.* (2016:634) suggest that there is a strong relationship between authentic leadership and transformational leadership. Bass and Steidlmeier (cited by Banks *et al.* 2016:636) suggest that "true" as opposed to "pseudo" transformational leaders are authentic in nature and that authentic leadership serves as a construct of other forms of positive leadership styles. Hoch *et al.* (2016:26) argue that the inclusion of explicit moral or ethical dimension in transformational leadership makes it more effective in explaining employee and follower outcomes.

### 2.8.2 AUTHENTIC LEADERSHIP

Avolio (cited by Regan *et al.* 2014:55) define authentic leadership as "a pattern of transparent and ethical leader behaviour that encourages openness in sharing information needed to make decisions while accepting input from those who follow". A leader's self-awareness, openness, clarity behaviours, sharing of information required to make decisions, accepting other's inputs, and disclose personal values, motives and sentiments all characterise an authentic leadership style (Wang *et al.* 2014:5). Authentic leaders are positive, transformational, moral and true to themselves, bring the best in themselves and others (Laschinger *et al.* 2015:3). The authenticity of leaders and followers is influenced by their individual personal histories (Hinojosa *et al.* 2014:595).

Authenticity comes from Greek philosophy and describes a humanistic psychological stance which means "to thine own self be true" Zielinska (cited by Waite *et al.* 2014:283). Authentic leadership is based on the premise that leaders can express their natural selves in an open and honest manner that promotes positive and ethical work outcomes (Banks *et al.* 2016:646). Authentic leadership reduces leader's stress, increases work engagement and the effects are mediated by leader mental depletion and these are reliant on the extent of leader's interaction with subordinates (Weis, *et al.* 2018:309). Authentic leadership buffers followers' work-family conflict and drives work-family enrichment (Braun & Nieberle, 2017:780).

Summing up their examination on the impact of leader's championing of collective (group) interest on authentic leadership Steffens *et al.* (2016:738) found that followers regard leaders as more authentic when they are seen acting as advocates of the collective they lead, translating into people's willingness to follow the leader, leaders' championing of collective interest exhibits stronger relationship with authentic leadership when leaders affiliate with the group and this self-categorisation is even stronger for followership. Cianci *et al.* (2014:591) highlight the role of authentic leadership as a critical interpersonal, contextual factor that morally strengthens followers and enables them to resort to ethical decisions when faced with temptations.

A leader's values and beliefs tend to be aligned with the vision and mission of the group and the organisation the leader leads (Steffens *et al.* 2016:727). The concepts of self-awareness, unbiased processing, authentic behaviour and authentic relational orientation compliments each other in forming authentic leadership (Arda *et al.* 2016:248). In analysing the influence of authentic leadership on creativity and innovativeness Muceldili *et al.* (2013:673) concluded that there is a positive relationship between authentic leadership and employee's creativity, that creativity impacts innovativeness positively and that authentic leadership has a positive relationship with innovativeness.

Walumbwa *et al.* (cited by Petan & Bocarnea, 2016:143) define authentic leadership as "a pattern of leader behaviour that draws upon and promotes both positive psychological capacities and a positive ethical climate, to foster greater self-awareness, an internalised moral perspective, balanced processing of information and relational transparency on the part of leaders working with followers, fostering positive self-development". The domains of authentic leadership emerging from the definition are: self-awareness, relational transparency, internalised moral perspective and balanced processing (Petan & Bocarnea, 2016:143).

Self-awareness refers understanding and accepting the leader's unique talents, strength and values, relational transparency suggests that leaders are transparent to their followers about their true feelings and emotions, internalised moral perspective is self-regulation supported by internal moral standards and values and balanced processing describes the process of

objectively analysing data and involving other team members before a decision is taken (Petan & Bocarnea, 2016:143). An individuals' organisational identification is positively related to the individuals' identification with the leader (Fallatah *et al.* 2017:174). Moral reasoning combined with low Machiavellianism (higher orientation towards others' needs and interests) produce higher authentic leadership behaviour and that authentic leadership promotes leaders' moral action when influenced by lower Machiavellianism (Sendjaya *et al.* 2016:138).

Leaders' authentic leadership mediates relationship between departmental authentic leadership and individual level leader-member exchange and intra-team trust mediates the influence of team authentic leadership on both team helping behaviour and individual-level supervisor-directed helping behaviour (Hirst *et al.* 2016:485). Authentic leadership exhibits a positive relationship with positive outcomes such as satisfaction, commitment, trust and perceptions of choice (Bandura & Kavussanu, 2018:1). Authentic leadership promotes employees' creativity and generates hope that leads individuals to challenge the status quo (Rego *et al.* 2014:207). Authentic leadership is positively related to the creativity of employees and knowledge sharing behaviour is found to be mediating the relationship between authentic leadership and employee creativity while information technology moderates between information sharing behaviour and employee creativity (Malik *et al.* 2016:28).

Authenticity is complex in that it is practised within specific contexts, in relationship with other players such as peers and followers and as such knowing oneself and acting true to that self-knowledge is not as simple as the role of others and the context in which the relationship is enacted is critical (Ngunjiri & Hernandez, 2017:397). For authentic leadership to thrive and succeed organisational cultures should be crafted with special attention to those in the margins of the organisation (Ngunjiri & Hernandez, 2017:404).

### 2.8.3 TRANSFORMATIONAL LEADERSHIP

"Transformational leaders encourage employee commitment to the mission and values of the organisation and inspire motivation by building collective aspirations and beliefs and a sense of community that is based on relationships, shared values, and common goals" (Guay & Choi, 2015:851). Bass *et al.* (cited by Lehmann-Willenbrock *et al.* 2015:1018) define

transformational leadership as "a leadership style that raises followers' awareness of the importance of task outcomes, activates higher-order needs, and motivates followers to transcend self-interests for the sake of the organisation". Transformational leadership is pivotal in supply chain for employees to engage in exploration and exploitation practices (Ojha *et al.* 2018:228). There are two aspects of follower relationship, the first, follower associates leader with certain qualities that the followers want to emulate and second, leaders make an impression to followers through their behaviour (McCleskey, 2014:130). Qu *et al.* (2015:298) credit transformational leadership with the promotion of follower creativity through enhancing follower relational identification with the leader. There are four dimensions that constitute transformational leadership, idealised influence, intellectual stimulation, inspirational motivation and individual consideration (Aga *et al.* 2016:807). Transformational leaders foster innovation and promote employee creativity and employees with high creative-self-efficacy resort to creative behaviour when subjected to supportive innovation climate (Jaiswal & Dhar, 2015:30).

Transformational leadership aids in increasing employee motivation and performance through evoking heightened perceptions of meaningfulness (Frieder *et al.* 2017:7) Using multilevel, multisource survey data from team members, team leaders and supervisors Dong *et al.* (2016:1) found that individual-focused transformational leadership has a positive indirect effect on creativity through skills development and that team-focused transformational leadership has a partial impact on team creativity through sharing of information. Four transformational behaviours, articulating a vision, providing an appropriate model, high performance expectations and supporting leadership have a positive effect on entrepreneurial orientation and organisational performance (Engelen *et al.* 2015:1069). There is a positive relationship between transformational leadership and work engagement and consequently with pro activity in terms of personal initiative and voice (Schmitt *et al.* 2016:588).

The supervisors' transformational leadership exhibit a positive influence on employee creative self-efficacy and creativity (Wang *et al.* 2014:79). Transformational leadership that focuses on every team member of the organisation increases team effectiveness and organisational performance (Zhang *et al.* 2015:1898). Transformational leadership is associated with high levels of job satisfaction (Olu-Abiodun & Abiodun 2017:1). Transformational leadership has a positive impact on workplace empowerment which in turn increases job satisfaction (Boamah

*et al.* 2017:180). Henker *et al.* (2015:243) suggest that promotion focus breeds higher employee engagement in the creative process and that there is an indirect relationship between transformational leadership and creativity. Transformational leaders promote employee use of job crafting which in turn is facilitated by employees' promotion focus Hetland *et al.* (2018:1).

Transformational leadership has an indirect effect on the reduction of employee turnover due to the increases in employees' job satisfaction (Eberly, *et al.* 2017:72). Transformational leadership style exhibits a decrease in thriving at work when the level of emotional exhaustion moderates and this results in less pro-activities from employees (Niessen *et al.* 2017:41). Transformational leadership has a positive effect on leader performance and that personality factors are important for success (Deinert, *et al.* 2015:1110). Leaders' effective work experience and organisational commitment are important to transform followers (Jin *et al.* 2016:81). Nguyen *et al.* (2017:210) conclude that transformational leadership has a direct and positive relationship with managerial performance and performance management systems.

## **2.9 LEAN SUPPLY CHAIN MANAGEMENT**

### **2.9.1 INTRODUCTION**

The current economic conditions require of organisations to integrate different supply chain concepts to satisfy customer demand efficiently and effectively (Ciccullo *et al.* 2018:2336). Organisations operate as part of dynamic global supply chains where the ability to quickly adjust supply chain tactics and operations is crucial (Gligor *et al.* 2015:71). Lummus *et al.* (cited by Purvis *et al.* 2014:102) argue that supply chain flexibility allows for promptness of supply chain in responding to customer demand and the rate to which it can adjust its speed, destinations and volume in response to the market. Bortolini *et al.* 2016:859) suggest that Lean thinking is beneficial to green practices and generate positive effects on time reduction and process quality increase. Lean Six Sigma, a method used to eliminate defects in products, when applied to supply chain eliminates unnecessary processes and defects in the produced products and increases efficiency of supply chain (Jayaram, 2016:93). Lean philosophy pertains to organisational operations and policy and can assist in examining supply chain processes with the view of minimising unnecessary costs, eliminating waste and improving efficiency (Zhu *et al.* 2018:203).

### 2.9.2 LEAN SUPPLY CHAIN

Womack *et al.* (cited by Achieng *et al.* 2018 1157) define lean supply chain management as "the management of a set of organisations linked directly by downstream and upstream flows of products, services, information and finances that work together to reduce cost in production and reduce waste incurred during production, by efficiently and effectively coming up with products that meet the needs of customers". Lean supply chain is focused on cost reduction and flexibility and encompasses all the processes from the product design to product sale (Ruiz-Benitez *et al.* 2017:850). Continuous improvement is key to Lean supply chain management as it increases operational and financial performance (Adebanjo *et al.* 2016:953). Qi *et al.* (cited by Cheung *et al.* 2018:71) define Lean supply chain strategy as "building a value stream to eliminate all waste to create niche of supply chain members by operating cost-effectively". Drohomeretski *et al.* (cited by Al-Tit, 2016:20) summarise Lean supply chain (LSC) objectives as waste elimination in supply chain, better customer value delivery, stakeholder involvement, collaboration and development. Jayaram (2016:89) defines supply chains management as the economic management of supply activities that maximise client value through the management of product development, sourcing, production and coordination of supply.

Nimeh *et al.* (2018:1) found that there is a positive and significant relationship between the three Lean supply chain management practices namely, just-in-time system, information flow and customer relationship with market performance. Supplier partnerships and long-term strategic alliance are the two success factors in Lean supply chain systems (Khorasani *et al.* 2015:1). Soni and Kodali (2016:502) put forward the six pillars of Lean supply chain as supplier management, collaboration management, marketing management, logistics management, manufacturing management, and strategic management. Lean thinking is associated with the optimisation of the flow of services and products through the entire value stream that flow across technologies, assets and departments to customers (Carvalho *et al.* 2017:76). Lean improves workplace standard through increased investments in training and development and reduces labour turnover (Distelhorst *et al.* 2015:30). Knowledge sharing is the key enabler for the achievement of Lean supply chain performance objectives (Chen *et*

*al.*2017:44). Lean supply chain emphasises the importance of variation reduction and flow enablement making it unnecessary to keep buffer stock (Singh & Pandey, 2015:33).

Jasti and Kodali (2015:1061) proposed an eight-pillar framework for Lean supply chain management and described it as follows:

1. Information technology management

- Use of electronic data interchange (EDI), database management, enterprise resource planning (ERP), use of bar coding, e-commerce and computer aided decision-making supporting system.

2. Supplier management

- Strategic supplier development, supplier evaluation and certification, early supplier involvement in design, supplier partnership, supplier feedback, supplier proximity and joint cost savings decisions.

3. Elimination of waste

- Visual control, standard products and processes, focused factory production, point of use tool system, manufacturing design, 5S, and seven wastes.

4. JIT production

- JIT deliveries, pull production, kanban, plant layout, small lot size, production scheduling and levelling, synchronised operational flow, storage at point of usage and pacemaker.

5. Customer relationship management

- After sales service, customer involvement in design, customer enrichment, customer feedback evaluation, performance improvement, quality management, and failure analysis and reporting.

6. Logistics management

- Elimination of buffer stocks, demand forecasting, effective logistics network, consultants as logistics, advance material requirement planning and scheduling, and A, B, C material handling.



## 7. Top management commitment

- Create vision and objectives, leadership development, resource allocation, employee empowerment, strategy and policy development, employee turnover, and organisational relationship management.

## 8. Continuous improvement

- Workforce skilling, quality systems, new product development, value engineering, cross functional team management, value stream mapping, use of flat hierarchy, and statistical process control.

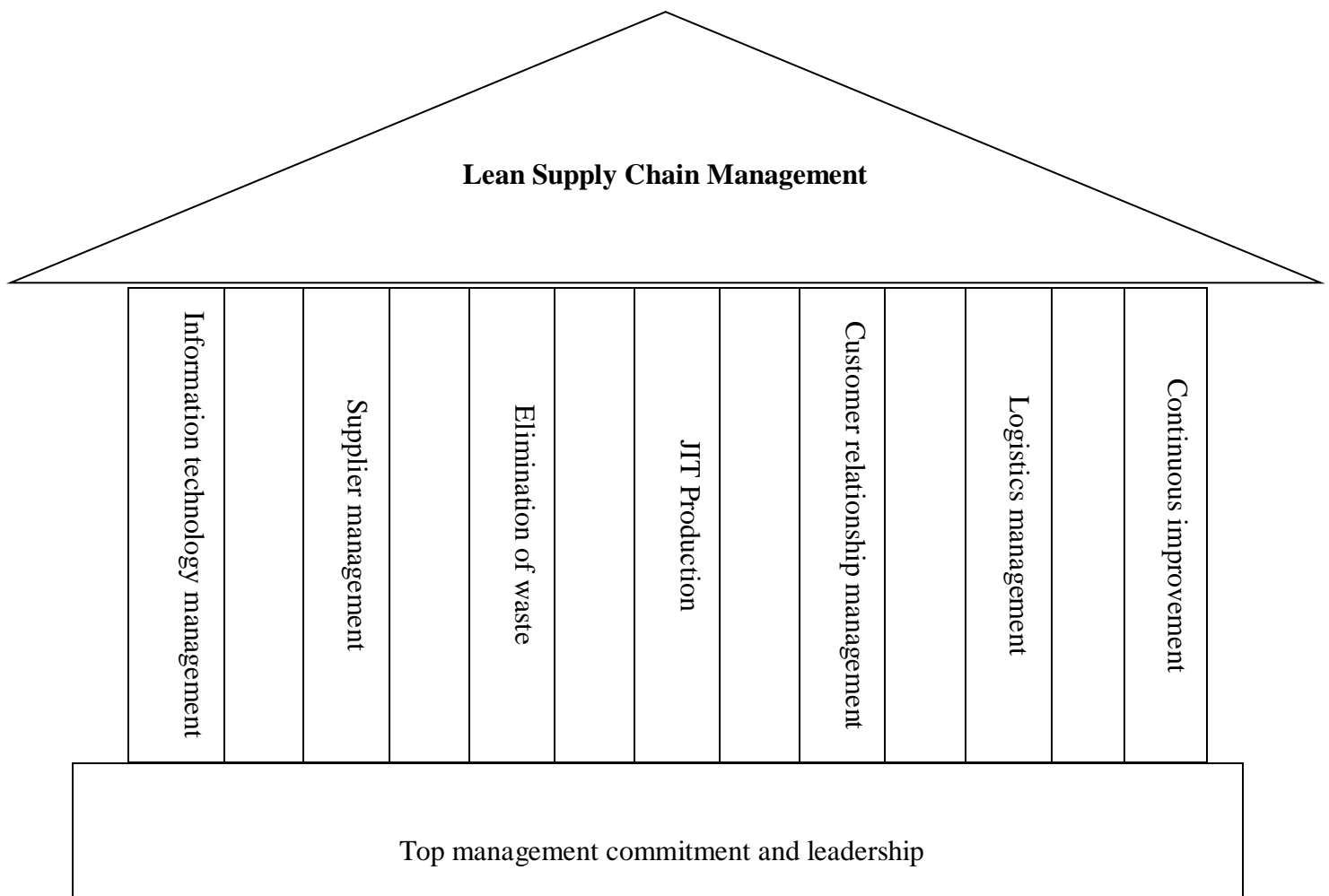


Figure 2 The conceptual LSCM framework Source: (Jasti & Kodali 2015:1061)

Lean supply chain practices are drivers of resilient supply chain practices and Lean supply chain leads to higher performance (Ruiz-Benitez *et al.* 2018:190). Lean practices implementation requires the consideration of the performance of the whole supply chain (Jakharet *al.* 2018:269). Ciccuro *et al.* (2018:2338) derive the practices that characterises a Lean supply paradigm as follows:

- Waste reduction practices such as: inventory optimisation, value stream mapping and the use of tools such as total quality management (TQM).
- Closeness to suppliers' practices, focusing on reducing lead time and supplier relationship management.
- Continuous improvement and workforce involvement practices, concentrating on production improvement through training, engagement and delegation.
- One-piece flow, such as Just-In-Time to increase replenishment rate and reducing set-up time.
- Internal manufacturing efficiency practices, utilisation of efficient production process technologies to increase utilisation rate and equipment efficiency.

Lean supply chain strengthens the relationship between the chain links and focus on the provision of value to the customer (Czarnecka *et al.* 2017:180). Through employing Lean management in supply chain Czarnecka *et al.* (2017:181) describe the benefits of Lean supply chain management as follows:

- Consolidation and restructuring of suppliers and customers.
- Information sharing.
- Inventory reduction and introduction of just-in-time systems.
- Speedy solutions to problems and cost reduction.
- Customer involvement and quality improvement.

Jayaram (2016:90) describe the main advantages of Lean supply chain management as follows:

- Increase in revenue through the employment of Lean six sigma that assists organisations to produce more with less input resources.
- Reduction in costs through the elimination of non-value adding supply chain activities.

- Increased efficiency through enhanced policies and procedures that delivers satisfactory products to clients.
- Increased and active employee involvement in championing innovative ideas that result in efficiency.

## **2.10 CONCLUSION**

Based on the literature review Lean leadership requires leadership that is transformational and ethical to drive and impart to the followers a leadership behaviour that promote Lean philosophy. Lean supply chain management has as its ultimate outcome faster, efficient and systematic management of supply chain activities.

## **2.11 CAPTER SUMMARY**

This chapter looked at the different views of Lean leadership, transformational leadership, ethical leadership and Lean supply chain management. Both transformational leadership and ethical leadership complement Lean leadership. Transformation to Lean leadership can only thrive if the concepts of both transformational leadership and ethical leadership are embedded into the implementation of Lean leadership and Lean supply chain management. Chapter two looked at the relevant literature pertaining to the objectives of the study and moreover this chapter sort to view as much as was possible sources of information that made it possible for the researcher to meet the objectives of the study. Lean leadership, transformational leadership, ethical leadership and Lean supply chain management formed part of the literature review that enabled the researcher to complete the maze of meeting the objectives of the study.

## **CHAPTER 3**

### **RESEARCH METHODOLOGY AND DESIGN**

#### **3.1 INTRODUCTION**

The main objective of this research is to determine the impact of Lean leadership on Lean supply chain management with the special attention of supply chain in the coal mining industry. In Chapter 1 the research methodology and research design were introduced. This research focuses on Lean leadership as the independent variable and the impact it has on the performance of Lean supply management as the dependent variable. To source solutions to the research questions mentioned in Chapter 1, it is imperative that individuals currently involved in management positions are invited to help supply with information on the current Lean leadership and Lean supply chain management experiences.

#### **3.2 RESEARCH DESIGN**

Bryman *et al.* (2017:100) describe research design as a framework that generate evidence that uses criteria such as reliability, validity, authenticity, trustworthiness and the research question. Kumar (2014:122) defines a research design as the road map that the individual researcher chooses during the research journey to gather answers for the research question in a valid, objective and economical way. Research design details the plan which the researcher will utilise to collect information from respondents, how the researcher will choose respondents, how the collected information will be analysed and lastly how the findings of the research will be communicated (Kumar, 2014:123).

Research design assist with the theoretical background that the researcher uses to answer the research question using sound scientific principles (Edmonds & Kennedy, 2013:2). Holness (2016:63) describe research design as the culmination of the art and craft of research that entails the important decision about the way the research is to be carried out to ensure that it is manageable and meaningful. The purpose of research design is to decide, describe, justify and explain how the answers to the research question will be found (Kumar, 2014:39). Based on

the view of (Leedy and Ormrod 2015:99) the design for the study, was cross-sectional descriptive quantitative design, which employed correlation for investigating the relationship.

### **3.3 RESEARCH METHODOLOGY**

Research methodology describes the way in which the research design was carried out (Holness 2016:213). Creswell *et al.* (2016:162) define quantitative research as “a process that is systematic and objective in its ways of using numerical data from only a selected subgroup of a universe (or population) to generate the findings to the universe that is being studied”. The quantitative research approach uses statistical data as a tool for saving time and resources and is characterised by being structured and the use of predetermined variables, hypothesis and design (Daniel, 2016:94). There are three most common methods, which are quantitative, qualitative and mixed research. In this study, the quantitative study was preferred and the applicable method. This is done to numerous reasons as explained in the following sections.

Quantitative methods ask questions which are then translated into numbers which are analysed using statistical means (James *et al.* 2012:21). Bacon-Shone (2015:16) describe the explanatory level of quantitative analysis as understanding why things happen and the reliability of that understanding. Quantitative data describes information that can be counted or expressed in numerical and analysed statistically (Holton & Walsh, 2017:58).

Quantitative research represents research where comparative data is analysed in terms of numbers that can be quantified (Fox & Bayat, 2012:77). Furthermore, quantitative research methods use systematic scientific steps while applying numerical systems to investigate the relationship between predetermined variables (Edmonds & Kennedy, 2013:20). The quantitative research approach stresses that proof can be shown numerically within a determined time frame (Repko, 2012:129). Quantitative designs are well structured, specific, passed the validity and reliability tests and can be explicitly described (Kumar, 2014:132). A quantitative research deals with quantities or amounts of the variables of interest using acceptable measures (Leedy *et al.* 2014:97).

The survey research method entails the collection of data by issuing pre-formulated questions in a structured questionnaire to the individuals drawn from the population (Fox & Bayat, 2012:87). Questionnaires is a list of questions pertaining to the study that are compiled by the researcher and administered to the sample unit to supply answers (Fox & Bayat, 2012:88).

The study intends to employ the survey method of using questionnaires to be issued to the sampling unit for completion. Questionnaires were issued to management teams of the Production, Engineering, Technical services and Supply chain departments.

### 3.4 SAMPLING

The sampling frame is a complete list of the targeted population in which each unit of analysis is used only once and the process of drawing elements from the sample is termed sampling (Fox & Bayat, 2012:52.).

#### 3.4.1 SAMPLING METHOD

The non-probability method using convenience technique was employed in this study instead of random selection of the population elements and is done with a specific purpose in mind (Creswell, *et al.* 2016:198). The non-probability convenience sampling entails choosing sampling units at random until the predetermined sample size is reached (Fox & Bayat, 2012:59). The researcher targeted individuals both in leadership positions and followers' positions in the organisation that are exposed to and implementing Lean leadership and Lean supply chain management. The organisation in question is constituted of three business units that are geographically separated from each other. The three business units employ the same policies and procedures but under different middle management leadership.

#### 3.4.2 SAMPLING UNIT

The unit of analysis is the individual or group of individuals that will be the primary focus of the study (Edmonds & Kennedy, 2013:15). The unit of analysis in this study is the same as the sampling unit. (Zikmund, Babin, Carr and Griffith, 2010) explains that there are four common sampling units, which are individual, groups, organisation as well as artefacts. The applicable sample unit for the study is the individual leadership and follower respondents that are engaged in the leadership and implementation of Lean supply chain management in the three business units.

#### 3.4.3 SAMPLE SIZE

The homogeneity of the population with respect to the variables that are under investigation allows the use of smaller sample sizes even though bigger samples are advantageous in terms of representativeness, statistical analysis and accuracy (Creswell *et al.* 2016:199). Fox and

Bayat (2012:61) maintain that the size of the population determines the size of the sample. Based on the available data, there was a total of 3000 employees in the mines, however, there was 450 employees as the targeted population (Supervisors and above – Patterson Band C upper). Based on the proposal of Gay, Mills and Airasian (2012:139), when the population is around 500, 50% of the population should be sampled. As such, a sample of 225 was made in this study.

### **3.5 DATA COLLECTION**

There were two critical aspects in the data collection in this study, this is the research instrument and the data collection approach.

#### **3.5.1 RESEARCH INSTRUMENT**

Several journals were used to compile the instrument of the study. This instrument comprised on three sections, which were the biographic information, lean leadership and lean supply chain.

The first section of biographic information was important to understand the characteristics of the sample. This was done using three work related characteristics, which were the department in which the respondents were working in, the level of employment and tenure in the mining organisation.

The second section, comprised of 21 variables which were compiled in a Likert scale to determine the perceived level of criticality of the lean leadership aspects. The Likert scale used was: 1= Not important, 2 = Slightly important, 3 = Important, 4= Highly important and 5 = Critically important. These were compiled from variables related to the success factors, leadership behaviour, lean concepts and principles as well as lean skills and competencies.

The third section comprised of lean supply chain management aspect. In this section there were 12 variables. These variables were related to sustainability-inventory optimisation, on-time supplier payment, on-time resolution of supplier queries, small and medium supplier (SMME) development, contract management, catalogue purchases, availability of critical to production spares, availability of critical safety spares, consignment stock management, on site deliveries (re-routing and paperwork), after-hour procurement practices and bypassing of supply chain

procedures. The focus was to understand the levels of improvement. These levels of improvement were evaluated using a 5-point Likert scale, 1 = Not improved, 2= Slightly improved, 3 = Improved, 4 = Substantially improved, 5 = Highly improved.

The full questionnaire of the study is provided in the appendix (appendix A) of this document.

### 3.6 DATA ANALYSIS

Data analysis entails the manipulation and inspection of collected data (Locke *et al.* 2010:121). Quantitative research approach relies on deductive reasoning, starting from a certain basis and drawing logical conclusions whilst ensuring objectivity in the data analysis (Leedy & Ormrod, 2014:99). Statistics assist the researcher to describe the data and to draw conclusions from the data (Leedy & Ormrod, 2014:10). A quantitative statistical tool was used to analyse the collected data. Both the descriptive and inferential statistics were used during the data analysis.

The collected data was transported from the online platform to IBM Statistical Package for Social Science version 25. The analysis comprised on four stages, which are data preparation, descriptive statistics, multivariate statistics for validity and reliability of the constructs and inferential statistics.

During the data preparation, the data was analysed for missing values and it was found that missing values were reasonable, at worst at about 8.8% (Appendix B), and as such all the 113 questionnaires were retained for further analysis. The second step was to analyse the data for extreme outliers. The outliers which were within 1.5 times interquartile range were retained, while those at 3 times interquartile range were going to be removed. From this data none of the outliers were extreme namely at 3 times interquartile range (Appendix C).

In the descriptive statistics, both the central tendency and the spread was performed. For central tendency, the mean and median were analysed, while the frequency (% frequency), standard deviation, Skewness and Kurtosis were performed. Flowing from this was the multivariate analysis where the exploratory factor analysis and reliability were performed. After this the inferential statistics were performed where the relationships were analysed using Pearson correlation and linear multiple regression. In addition, the criticality levels and improvement



levels were analysed using the one sample t-test. The significance of the determined at 95% confidence levels ( $p < .05$ ) while in other at 99% confidence level ( $p < .01$ ).

### **3.7 RESEARCH VALIDITY AND RELIABILITY**

Leedy and Ormrod (2014:91) define the validity of the measurement instrument as the scope to which the analysis tool measures what it is intended to measure. In this study, the pilot study was conducted to ensure that the questions were focused on the objective and were understandable and free from error. Recommendation from pilot study, were incorporated in the final questionnaire. The construct validity was conducted using Principal Component Analysis (PCA) with Varimax rotation. Kaiser-Meyer-Olkin (KMO) Measure for Sampling Adequacy and Bartlett's Test for Sphericity were conducted to determine the suitability of PCA. The Extracted variance and Eigen value were used, with 0.3 loading regarded as being significant. Rotated component matrix was used to allocate the variables to their respective subscales. For reliability, the Cronbach Alpha Coefficient was employed.

### **3.8 RESEARCH LIMITATIONS**

The methodological limitation of the study was that it was using non-probability method, which makes it difficult to generalise the study. This was further caused by the small sample of the study. Despite this, there outcomes were adequate for the study.

### **3.9 CHAPTER SUMMARY**

This chapter presented the 'how' part of the study. This study employed a cross-sectional descriptive quantitative study employing deductive reasoning. The study sampled, 225 employees of a mining organisations, of which 50.2% responded. This data was collected using an online platform. The data was then analysed using one sample t-test for level of differences and Pearson Correlation and Linear Multiple Regression for relationship and prediction, respectively.

## CHAPTER 4

### FINDINGS OF THE STUDY

#### 4.1 INTRODUCTION

The purpose of the study was to investigate the effect of Lean leadership on Lean supply chain management. This was done within the mining organisation, using hypothesis testing which were developed with the conceptual model in Chapter 2. The investigation was based on quantitative methods as discussed in Chapter 3. In this Chapter, firstly the characteristics of the respondents are presented. This is followed by the findings of the research study which are presented flowing in a format of the research objectives.

Of the 225 sample which the survey questionnaire was sent to, 113 responded. Based on the guidelines by Zikmund *et al* (2010) the response rate was 50.2%.

#### 4.2 BIOGRAPHIC INFORMATION

There were three characteristics that were employed to profile the biographic information of the respondents. These were the department of employment of the respondents, level in the organisation and the tenure in the organisation (Table 2).

Of the 113 respondents 31.0% (n=35) were from Engineering Department, followed by 29.2% (n=33) from Technical Services Departments, which included Survey, Geology and VOHE. The other included Department were all also well represented, with Supply Chain Management comprising 22.1% (n=25) of the responses, while Production (Mining) formed 17.7% (n=20) of the responses. The highest group of these participants were supervisors with a total of 41.6% (n=47) followed by those who were junior managers with 27.4% (n=31). The lowest group of these participants were senior and executive managers which were 9.7% (n=11), however those who were in middle management were a total of 21.2% (n=24). The participants indicated their tenure in the organisation, of the 113 participants, 26.5% (n=30) had 11-15 years of experience, followed by those who had 6-10 years of experience with a total of 25.7% (n=29). 23.9%

(n=27) participants had 5 years or less experience in the organisation while 16.8% (n=19) had more than 20 years. A further 7.1% (n=8) participants has 16-20 years of experience

Table 2 The biographic information of the respondents

Biographic information		Frequency	Percent
Department	Production (Mining)	20	17,7
	Technical (Survey, Geology, VOHE)	33	29,2
	Engineering	35	31,0
	Supply Chain Management	25	22,1
	Total	113	100,0
Level of employment	Supervisor	47	41,6
	Junior Management	31	27,4
	Middle Management	24	21,2
	Senior and Executive Management	11	9,7
	Total	113	100,0
Tenure in the organisation	5 years or less	27	23,9
	6 - 10 years	29	25,7
	11 - 15 years	30	26,5
	16 - 20 years	8	7,1
	More than 20 years	19	16,8
	Total	113	100,0

## 4.2 LEVEL OF CRITICALITY OF LEAN LEADERSHIP

### 4.2.1 DESCRIPTIVE STATISTICS

There were 21 variables which were investigated levels of Lean leadership in the mining organisation. The median value of these variables ranged from a low median of 4 to a high median of 5 (Table 3). There was not much of a difference between the mean scores of these variables and they ranged from mean 4.58 to mean 3.85, the highest mean value was 4.58 (SD=0.615) of LL12, followed by LL8 with a mean score of 4.50 (SD=0.614) and mean 4.47 (SD= 0.733) of LL1. The lowest mean value was mean 3.85 (SD= 0.815) LL13, meanwhile variables LL15 and LL16 had the same mean value which was 3.89 but with different standard deviation. Overall the perspective of the respondents was that the identified variables were mainly ‘highly important’ or ‘critically important’ for Lean leadership in the mining organisation. Additionally, the skewness and kurtosis were conducted to ascertain if the data

was normally distributed. Based on the guidelines of (Hair *et al.* 2010), the data was normality distributed as all their skewness and kurtosis were within  $\pm 2$ .

Table 3 Descriptive statistics on the variables of Lean leadership

Variables	N	Mean	Median	Std. Deviation	Skewness	Kurtosis
	Valid					
LL1	113	4,47	5,00	0,733	-1,277	1,095
LL2	113	4,37	4,00	0,630	-0,484	-0,634
LL3	113	4,19	4,00	0,675	-0,242	-0,802
LL4	113	4,30	4,00	0,693	-0,645	-0,046
LL5	108	4,41	5,00	0,684	-0,729	-0,599
LL6	106	4,25	4,00	0,794	-0,608	-0,782
LL7	103	4,17	4,00	0,818	-0,644	-0,321
LL8	113	4,50	5,00	0,614	-0,807	-0,322
LL9	111	4,41	4,00	0,623	-0,550	-0,594
LL10	111	4,32	4,00	0,700	-0,688	-0,056
LL11	111	4,32	4,00	0,660	-0,445	-0,722
LL12	107	4,58	5,00	0,615	-1,178	0,351
LL13	113	3,85	4,00	0,815	-0,017	-0,902
LL14	112	3,92	4,00	0,941	-0,234	-0,846
LL15	113	3,89	4,00	0,948	-0,232	-0,824
LL16	109	3,89	4,00	0,906	-0,083	-1,217
LL17	113	4,27	4,00	0,671	-0,387	-0,779
LL18	113	4,46	5,00	0,682	-0,886	-0,396
LL19	111	4,34	4,00	0,694	-0,578	-0,775
LL20	112	4,24	4,00	0,701	-0,373	-0,909
LL21	111	4,25	4,00	0,744	-0,447	-1,070

Std. Error of Skewness = 0,230 Std. Error of Kurtosis = 0,455

## 4.2.2 LEAN LEADERSHIP CONSTRUCT

As the instrument was composed from several instruments, the validity and reliability of the instrument was no longer valid, as such validity and reliability of the instrument was done in this study

### 4.2.2.1 Exploratory factor analysis

An exploratory factors analysis was performed using principal component analysis (PCA). Before it can be done, a Kaiser-Meyer-Olkin (KMO) Measure for Sampling Adequacy and Bartlett's Test for Sphericity were conducted to determine the suitability of PCA. The results

confirmed the suitability, with KMO = 0.806 (which is higher 0.5 minimum), while the Bartlett's Test for Sphericity was significant,  $\chi^2(210) = 1486.2$ ,  $p < .001$  (Table 4).

Table 4 KMO and Bartlett's Test for suitability of PCA of Lean leadership variables

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.806
Bartlett's Test of Sphericity	Approx. Chi-Square	1486.171
	df	210
	Sig.	.000

The analysis extracted four sub-scales with a total variance of 71.074%. Subscale 1 extracted 46.9% with Eigenvalue of 9.842, Subscale 2 extracted 10.9% with Eigenvalue of 2.29, Subscale 3 extracted 8.156% with Eigenvalue of 1.713% with Subscale 4 extracted 5.155% with Eigenvalue of 1.082 (Table 5). All the extracted sub-scales had an Eigenvalue of more than 1.0.

Table 5 Extracted variance and Eigenvalues of the sub-scales of the Lean construct

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9,842	46,868	46,868	9,842	46,868	46,868	4,461	21,243	21,243
2	2,288	10,895	57,763	2,288	10,895	57,763	3,721	17,720	38,963
3	1,713	8,156	65,919	1,713	8,156	65,919	3,424	16,307	55,270
4	1,082	5,155	71,074	1,082	5,155	71,074	3,319	15,804	71,074
5	0,890	4,240	75,314						
6	0,809	3,851	79,165						
7	0,748	3,563	82,728						
8	0,658	3,133	85,861						
9	0,501	2,388	88,249						
10	0,450	2,142	90,391						
11	0,410	1,953	92,344						
12	0,323	1,539	93,883						
13	0,257	1,223	95,107						
14	0,233	1,109	96,215						
15	0,211	1,003	97,218						
16	0,157	0,749	97,967						
17	0,121	0,575	98,542						
18	0,111	0,530	99,072						
19	0,086	0,408	99,480						
20	0,075	0,357	99,837						
21	0,034	0,163	100,000						

Extraction Method: Principal Component Analysis.

The rotated components matrix showed the variables for each of the four sub-scales of the Lean leadership construct. Subscale 1 comprised on LL1, LL3, LL4, LL5, LL6, LL7 and LL11. Based on the content of the variables the subscale 1 was named Lean leadership success factors. Subscale 2 comprised of LL13, LL14, LL15, LL16 was named Lean leadership concepts and principles. Subscale 3 comprised of LL2, LL8, LL9, LL10, LL12 and was named Lean leadership behaviour. Subscale 4 comprised of LL17, LL18, LL19, LL20, LL21 which was named Lean leadership skills and competencies (Table 6).

Table 6 Rotated component matrix

	Component			
	1	2	3	4
LL7	0,868	0,199	0,009	0,185
LL6	0,863	0,201	0,043	0,249
LL4	0,796	0,244	0,229	0,079
LL3	0,707	0,243	0,246	0,081
LL5	0,650	-0,001	0,311	0,144
LL1	0,540	-0,038	0,474	0,121
LL11	0,525	0,343	0,452	0,055
LL14	0,176	0,837	0,230	0,182
LL15	0,256	0,818	0,182	0,257
LL16	0,097	0,809	0,084	0,281
LL13	0,237	0,749	0,157	0,279
LL12	0,091	0,202	0,800	0,230
LL8	0,160	0,243	0,715	0,138
LL2	0,289	-0,069	0,679	0,280
LL9	0,178	0,328	0,599	0,319
LL10	0,468	0,216	0,551	0,213
LL19	0,115	0,366	0,293	0,805
LL20	0,133	0,294	0,383	0,767
LL17	0,321	0,169	0,115	0,725
LL18	0,075	0,280	0,371	0,722
LL21	0,412	0,481	0,090	0,579

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 7 iterations.

#### 4.2.2.2 Reliability of the Lean leadership construct and subscale

The reliability of the overall Lean leadership construct and four subscales was analysed using Cronbach alpha coefficient and the results are presented in Table 7. The reliability for Lean

leadership success factor and Lean leadership behaviour were 0.895 and 0.842, respectively. This is considered ‘good’ based on the guidelines provided by George and Mallery (2003). Lean leadership concepts and principles and Lean leadership skills and competencies had excellent Cronbach also which were 0.917 and 0.915, respectively.

Table 7 Reliability of Subscales of Lean leadership construct

Subscales of Lean leadership construct	Number of items	Cronbach alpha	Decision based on George and Mallery (2003)
Lean leadership success factors	7	0.895	Good
Lean leadership concepts and principles	4	0.917	Excellent
Lean leadership behaviour	5	0.842	Good
Lean leadership skills and competencies	5	0.915	Excellent

#### 4.2.3 ONE-SAMPLE T-TEST

The composite score from the Likert scale data was used to understand the level of criticality of the Lean leadership with regards to Lean leadership success factors, Lean leadership success factors, Lean leadership behaviour and Lean leadership skills and competencies. Table 8 presents the one sample t-test. For this study, the hypothesised mean ( $\mu$ ) of 3.2 was utilised. This means that when mean is higher than 3.2, the variable is regarded as important to critically important. The results show that the respondents regarded all four subscales, success factors, leadership behaviour, concept and principle and skills and competencies. For success factors, there was significant differences between the hypothesised mean and the actual mean which was 4.34,  $t(99) = 20.7$ ,  $p < .001$ , this was the same with Leadership behaviour with mean of 4.43,  $t(105) = 25.44$ ,  $p < .001$ . The other two, the Concept and Principles,  $t(107) = 8.812$  and Skills and Competencies,  $t(107) = 18.85$ ,  $p < .001$ , with mean significantly different higher than hypothesised mean.

Table 8 One sample t-test of lean leadership subscales

One-Sample Statistics						
	N	Mean	Std. Deviation	Std. Error Mean		
Success factors	100	4.3400	.55152	.05515		
Leadership behaviour	106	4.4396	.50175	.04873		
Concept and Principles	108	3.8843	.80697	.07765		
Skills and Competencies	108	4.3019	.60743	.05845		
	Test Value = 3.2					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Success factors	20.670	99	.000	1.14000	1.0306	1.2494
Leadership behaviour	25.437	105	.000	1.23962	1.1430	1.3363
Concept and Principles	8.812	107	.000	.68426	.5303	.8382
Skills and Competencies	18.851	107	.000	1.10185	.9860	1.2177

### 4.3 LEVEL OF IMPROVEMENT FROM LEAN SUPPLY CHAIN

#### 4.3.1 DESCRIPTIVE STATISTICS

The Lean supply chain management construct consisted of 12 variables (Table 9). The overall median value of these variables was 2. There was no big difference between the mean values and they ranged from a low of 1.95 to a high of 2.37. The highest mean value was 2.37 (SD=1.308) of SC8, followed by mean 2.35 (SD= 1.008) of SC4 and mean 2.29 (SD=1.265) of SC7. The lowest mean value of these variables was mean 1.95 of SC5 (SD= 1.160) and SC11 (SD= 1.123), followed by mean 1.98 of variables SC6 (SD=1.162) and SC12 (SD= 1.186), meanwhile variable SC2 had a mean score of 2.07 (SD= 1.191).

The range of skewness was from 1.008 to 1.308 with a standard error of 0.228, and the range for kurtosis was -0.594 to 0.614 with a standard error of 0.453. As this data was within the values of  $\pm 2$ , for both the skewness and kurtosis, it can thus be regarded as being normally distributed.



Table 9 Descriptive statistics on lean leadership variables

	N	Mean	Median	Std. Deviation	Skewness	Kurtosis
	Valid					
SC1	113	2,19	2,00	1,238	0,713	-0,594
SC2	112	2,07	2,00	1,191	0,968	0,124
SC3	113	2,12	2,00	1,189	0,828	-0,206
SC4	113	2,35	2,00	1,008	0,835	0,450
SC5	110	1,95	2,00	1,160	1,059	0,238
SC6	112	1,98	2,00	1,162	1,017	0,263
SC7	113	2,29	2,00	1,265	0,857	-0,242
SC8	112	2,37	2,00	1,308	0,790	-0,448
SC9	113	2,19	2,00	1,265	0,856	-0,282
SC10	113	2,13	2,00	1,161	0,747	-0,425
SC11	111	1,95	2,00	1,123	1,148	0,614
SC12	109	1,98	2,00	1,186	1,189	0,589

Std. Error of Skewness = 0.28 Std. Error of Kurtosis = 0,453

#### 4.3.2 CONSTRUCT VALIDITY AND RELIABILITY

There were 12 variables that were used to evaluate the Lean supply chain management. A principal components analysis was conducted the KMO test of 0.940 and Bartlett's test of Sphericity which was significant ( $p < .001$ ) confirmed the suitability of the PCA (Table 10).

Table 10 KMO and Bartlett's Test for suitability of PCA of Lean supply chain variables

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.940
Bartlett's Test of Sphericity	Approx. Chi-Square	1803.703
	df	66
	Sig.	.000

Only one subscale was extracted for the construct of the Lean supply chain, with extraction variance of 81.4%. Due to this there was no need for the analysis the scree plot nor having a rotated component matrix (Table 11).

Table 11 Total variance explained and Eigen values of Lean supply chain management

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.767	81.388	81.388	9.767	81.388	81.388
2	.542	4.513	85.901			
3	.382	3.187	89.088			
4	.376	3.132	92.220			
5	.266	2.214	94.434			
6	.171	1.429	95.863			
7	.125	1.042	96.905			
8	.102	.854	97.759			
9	.078	.650	98.409			
10	.073	.605	99.014			
11	.066	.551	99.565			
12	.052	.435	100.000			

Extraction Method: Principal Component Analysis.

The reliability analysis for the construct, using the 12 variables was conducted, and it yielded a Cronbach alpha of 0.979 (Table 12). This confirms reliability of the Lean supply chain management construct.

Table 12 Reliability of Subscales of Lean leadership construct

Subscales of Lean leadership construct	Number of items	Cronbach alpha	Decision based on George and Mallery (2003)
Lean supply chain management	12	0.979	Excellent

#### 4.3.3 ONE -SAMPLE T-TEST

Table 13 presents the one sample t-test for Lean supply chain. Only a total of 103 over 113 participants took part in this study. The results show a mean score of 2.1489 (SD= 1.08432) with a standard error of 0.10684. The test shows that there was a statistical significance with  $t(102) = -9.838$ ,  $p < 0.01$ .

Table 13 One sample t-test for Lean supply chain

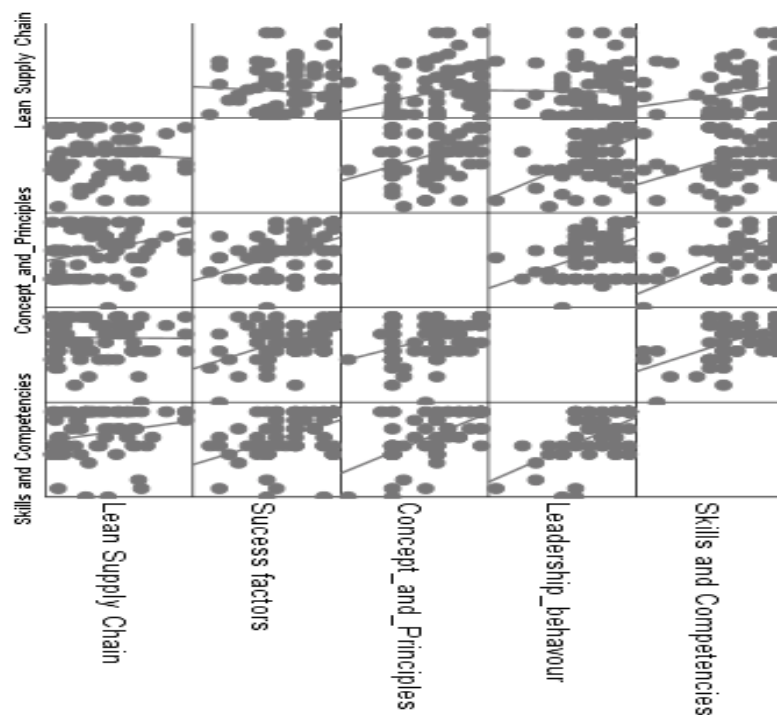
One-Sample Statistics						
	N	Mean	Std. Deviation	Std. Error Mean		
Lean Supply Chain	103	2.1489	1.08432	.10684		
	Test Value = 3.2					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Lean Supply Chain	-9.838	102	.000	-1.05113	-1.2631	-.8392

#### 4.4 EFFECT OF LEAN LEADERSHIP ON LEAN SUPPLY CHAIN MANAGEMENT

##### 4.4.1 Scatter Plots

Figure 1 shows the scatter plot between Lean leadership and Lean supply chain management. The results show existence of both positive and negative relationship between the Lean leadership dimensions and Lean supply chain dimensions.

Figure 3 Scatter plot of Lean leadership and Lean supply chain



#### 4.4.2 CORRELATION OF LEAN LEADERSHP AND LEAN SCM

The results of Pearson correlation are presented on table 8. The results show that there is a significant correlation between Lean supply chain and concept and principles,  $r(98) = .413$ ,  $p < .01$ . This relationship was strong based on the guidelines of Pallant (2010). There was no significant relationship between Lean supply chain management, leadership behaviour,  $r(97) = 0.589$ ,  $p > 0.05$  and success factor  $r(92) = 0.438$ ,  $p > 0.05$ .

Table 14 Correlation of Lean leadership and Lean supply chain management

		Lean Supply Chain	Success factors	Concept and Principles	Leadership Behaviour	Skills and Competencies
Lean Supply Chain	Pearson Correlation					
	Sig. (2-tailed)					
	N	103				
Success factors	Pearson Correlation	-.082				
	Sig. (2-tailed)	0.438				
	N	92	100			
Concept and Principles	Pearson Correlation	.413**	.479**			
	Sig. (2-tailed)	0.000	0.000			
	N	98	95	108		
Leadership Behaviour	Pearson Correlation	0.055	.658**	.517**		
	Sig. (2-tailed)	0.589	0.000	0.000		
	N	97	94	101	106	
Skills and Competencies	Pearson Correlation	.273**	.556**	.611**	.647**	
	Sig. (2-tailed)	0.006	0.000	0.000	0.000	
	N	98	95	103	101	108

\*\*. Correlation is significant at the 0.01 level (2-tailed).

#### 4.4.2 MULTIPLE REGRESSION OF LEAN LEADERSHP AND LEAN SCM

Table 15 presents the results of linear regression between overall Lean supply chain and Lean leadership. There is no multi-collinearity of the independent variables, was 1.551 as it was within the guidelines of Hair *et al.* (2010), with the VIF is less than 5 and tolerance of more

than 0.05. The model summary shows an R-square of 0.149 and adjusted R-square of 0.130. The R-square change was 0.149 and F change was 7.878 with sig. F change being  $p < 0.01$ .

Table 15 Linear regression between Lean supply chain and Lean leadership

Model Summary									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	Change Statistics			Sig. F Change
						F Change	df1	df2	
1	.386 <sup>a</sup>	.149	.130	.99128	.149	7.878	2	90	.001

a. Predictors: (Constant), Skills and Competencies, Concept and Principles

ANOVA <sup>a</sup>					
Model		Sum of Squares	df	Mean Square	Sig.
1	Regression	15.481	2	7.741	.001 <sup>b</sup>
	Residual	88.437	90	.983	
	Total	103.919	92		

a. Dependent Variable: Lean Supply Chain

b. Predictors: (Constant), Skills and Competencies, Concept and Principles

Coefficients <sup>a</sup>							
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics
		B	Std. Error	Beta			Tolerance VIF
1	(Constant)	-.035	.765		-.045	.964	
	Concept and Principles	.475	.160	.360	2.968	.004	.645 1.551
	Skills and Competencies	.075	.217	.042	.346	.730	.645 1.551

a. Dependent Variable: Lean Supply Chain

The mean square of regression is 7.741 while the mean for residual was 0.983,  $p < 0.01$ . The relationship of these variables is significant  $F = 7.878$ ,  $p < 0.01$ , with the concepts and principles being significant predictor of Lean supply chain ( $\beta = 0.386$ ,  $p < 0.05$ ).

## 4.5 CHAPTER SUMMARY

In this chapter the findings of the study were presented. This started by providing the characteristics of the 113 respondents in so far as the Department they work on, with the

majority from Engineering, their level of employment with majority in Supervisory role and the tenure in the organisation, with most having been in the organisation for six to 15 years. There result indicated that the respondents believed that Lean success factors, Lean leadership behaviour, Lean principle and concepts and Lean leadership skills and competencies are critical for Lean leadership. Furthermore, the findings show that there was slight improvement of Lean supply chain management. Finally, the findings have shown that there is a correlation between Lean skills and competencies with Lean SCM as well as Lean concept and principles and Lean SCM. These findings are discussed in detail in chapter 5.

## **CHAPTER 5**

### **RECOMMENDATIONS AND CONCLUSION**

#### **5.1 INTRODUCTION**

In chapter 1 the purpose and objectives of the study was presented which focused on understanding the impact of Lean leadership on Lean supply chain management. In chapter 2 the literature related to the purpose of the study was reviewed and presented. This review is critical as it allowed the researcher to understand the other settings related to the study. As there was an adequate literature, this study followed quantitative research method using deductive reasoning which aimed to investigate if the relationships existed within the mining organisation setting. Overall the design employed in this study as explained in chapter 3 was a cross-sectional descriptive quantitative design. The analysis of the data was conducted, the findings were presented in chapter 4. In this chapter, the findings are discussed and the limitations which contextualised the study findings are presented. Flowing from this the overall conclusions of the study are made and the recommendations as the output of the motivation from chapter 1 are made to the management of the mining organisation and to the academia for future research.

#### **5.2 DISCUSSION OF THE FINDINGS**

In this study there were three main objectives which were understanding the criticality of the Lean leadership within the mining company, to understand the perceived improvement levels of the Lean supply chain management and the impact of Lean leadership on Lean supply chain management. Before the objectives are discussed it was prudent to first discuss the credibility of the findings.

##### **5.2.1 CREDIBILITY OF THE STUDY**

There are several critical factors that were considered to make a conclusion about the credibility of the study.

Firstly, the design of the study. The design of the study was appropriate for being quantitative in nature as it allows for testing of the significance of either the difference (hypothesis mean

versus actual mean) and the relationship between the independent variables (success factors, leadership behaviour, concepts and principles and skills and competencies and the dependent variable (Lean supply chain management). With quantitative methods it was possible to test the significance at 95% confidence level ( $p < .05$ ) and in some cases at 99% confidence level ( $p < .01$ )

Secondly, adequacy of sample size. As already explained in chapter 4 a total of 113 responses from the 225 that was sampled, a response rate of 50.2% was obtained. This was higher than the normal response rate that is achieved with online survey as Nulty (2008) explained that for online survey the normal response rate is about 35%. In addition, before the analysis was conducted an evaluation was conducted whether the sample was adequate to conduct factor analysis and the results of the KMO, and Barlett's test confirm the suitability. Furthermore, there was a ratio of 1:5 between instrument questions and the number of respondents (Comrey, 1992). Analysis was also conducted with GPower and the results are presented in figure 3. The results show that a total sample size of 85 is adequate when conducting a linear multiple regression with a total of 4 predictors at 80% statistical power and with a small Cohen's d of 0.15. In this study the total responses were 113 which confirms that there was adequate sample size for the statistics used.

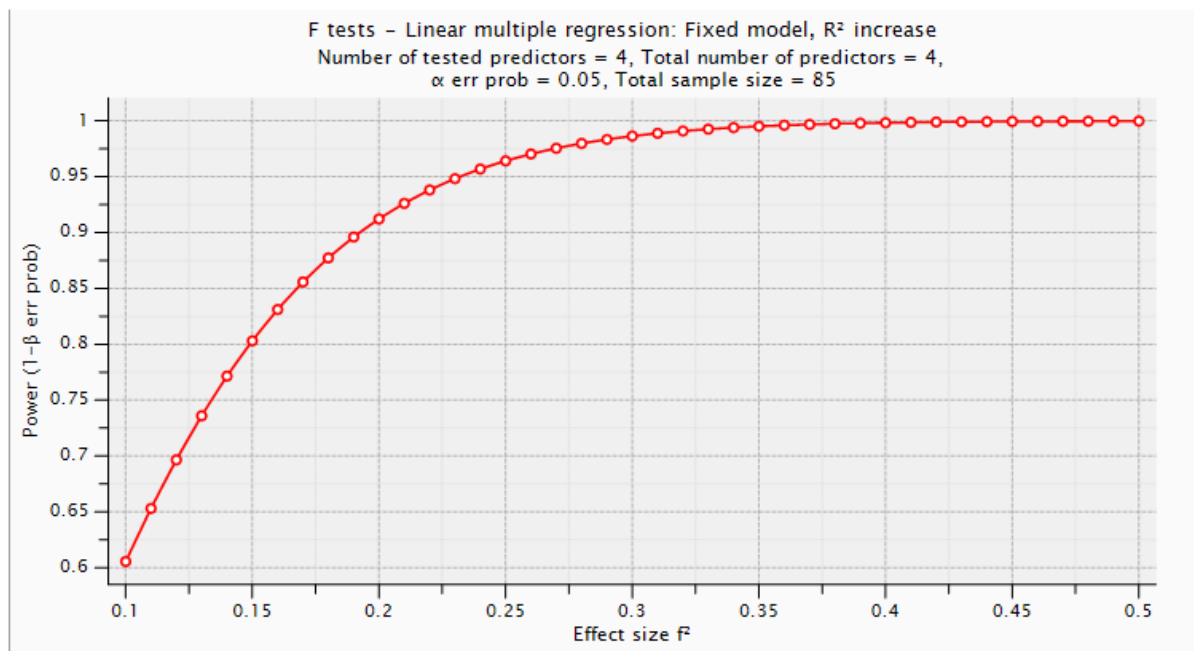


Figure 4 Sample adequacy in the study with GPower ‘



Thirdly, the relevance of the sample. As Guetterman (2015) explained that the findings can be influenced by the relevance of the sample. In this study there was sample relevance as the responses show good representation of production (17.7%), engineering (31.0%), technical services (29.2%) and supply chain (22.1%). The relevant employment levels were also represented with supervisory level (41.6%), junior management (27.4%), middle management (21.2%) and senior and executive management (9.7%). These were the departments and levels that interacted most with both Lean leadership and Lean supply chain management.

Overall the study and its findings can be regarded as being credible as the design was appropriated, sample size was adequate and the sample that responded was relevant.

### 5.2.2 CRITICALITY OF THE LEAN LEADERSHIP

Objective 1. To understand the criticality of Lean leadership in the mining organisation

Goodridge *et al.* (2015:4) explained that strong Lean leadership is critical for the successful implementation of Lean. These authors went further and highlighted some of the critical factors such as a change in leadership practices, behaviours and the mind-set facilitated through development of cross divisional boundaries that support the long-term vision of the organisation's value producing processes and keeping employees accountable to Lean objectives. In this study 21 Lean leadership related variables were investigated which included, top management commitment and support, employee early involvement. Linking Lean methods to suppliers Linking Lean methods to the business strategy. Linking Lean methods to the business strategy. Cultural change. Linking Lean to customers (end-users). Linking Lean to human resources, engaging employees, celebrating and recognising success, going to Gemba – the real work floor, provide clarity of purpose in the organisation, listening to employees, value driven – ensuring that all actions that bring a product from initial vision through to implementation provide customer value, elimination of waste – waste defined as non-value adding activities, just-in-time – elimination of unnecessary work-in-process to ensure continuous flow of products, visual management – use of visual tools and indicators to ensure that activities flow correctly, creating a culture of continuous improvement, coaching employees, communication skills, motivation skills and monitoring and evaluation. The findings in this study have revealed that the respondents believed that all 21 of them were either highly important or critically important. This underpins the criticality of Lean leadership in any

Lean related implementation in an organisation. These findings are congruent to those of Trenkner, (2016:129) and Aij and Teunissen (2017:713) who found that Lean leadership is critical for the successful implementation and sustainability of Lean production systems (LPS) stress that systemic change and strong Lean leadership is required for the successful implementation of Lean.

Based on the results of the principal component analysis these 21 variables formed four reliable ( $\alpha=0.842-0.917$ ) subscales of the Lean leadership construct. These subscales were used to analyse the perceived criticality of the Lean leadership using one sample t-test. The findings of the study have revealed that Lean concepts and principles, Lean leadership behaviour, Lean leadership skills and competencies and Lean success factors all had higher mean than the hypothesised mean. With all of them being statistically significant. These findings are generally aligned to the literature. Iyer, (2017:35) explained that organisational buy-ins is imperative in understanding how Lean leadership can have an influence on Lean management and other quality tools). Successful training programs during Lean transformation on Lean tools need to be complemented with the effort of altering leader's practices, beliefs, behaviours and mind-sets (Kim & Hochstatter, 2016:20). Furthermore, Lean is a collection of tools and practices used to achieve operational and financial goals, however this is not sufficient for the successful implementation of Lean which requires a culture of continuous improvement (CI) and Lean leadership (Van Assen, 2016:1).

To this end, the findings confirms the literature that Lean leadership is critical to the implementation of Lean management system in the organisation.

### 5.2.3 IMPROVEMENT LEVELS IN LEAN SUPPLY CHAIN MANAGEMENT

Objective 2. To understand the perceived improvement levels of the Lean supply chain management

In this study, the state of Lean supply chain management was evaluated using 12 variables which were, sustainability-inventory optimisation, on-time supplier payment, on-time resolution of supplier queries, small and medium supplier (SMME) development, contract management, catalogue purchases, availability of critical to production spares, availability of critical safety spares, consignment stock management, on site deliveries (re-routing and

paperwork), after-hour procurement practices and bypassing of supply chain procedures. The findings of the study reveal that the Lean supply chain showed either no improvement or slight improvement. This was an indication that the organisation had not practically and effectively employed Lean supply chain management for improvement in the organisation.

Womack *et al.* (cited by Achieng *et al.* 2018:1157) explained that LSCM comprises “management of a set of organisations linked directly by downstream and upstream flows of products, services, information and finances that work together to reduce cost in production and reduce waste”. Soni and Kodali (2016:502) put forward the six pillars of Lean supply chain as supplier management, collaboration management, marketing management, logistics management, manufacturing management, and strategic management. Lean thinking is associated with the optimisation of the flow of services and products through the entire value stream that flow across technologies, assets and departments to customers (Carvalho *et al.* 2017:76). Within these 12 variables the worst of the lot were identified as contract management, catalogue purchasing, after-hour procurement practices and bypassing of supply chain procedures.

According to Distelhorst *et al.* (2015:30) Lean improves workplace standard through increased investments in training and development and reduces labour turnover). Knowledge sharing is the key enabler for the achievement of Lean supply chain performance objectives (Chen *et al.* 2017:44). Lean supply chain emphasises the importance of variation reduction and flow enablement making it unnecessary to keep buffer stock (Singh & Pandey, 2015:33). Incurred during production, by efficiently and effectively coming up with products that meet the needs of customers". Lean supply chain is focused on cost reduction and flexibility and encompasses all the processes from the product design to product sale (Ruiz-Benitez *et al.* 2017:850).

In summary, Lean supply chain management has a pivotal role in improving the supply chain in the organisation. In explaining this, Adebajo *et al.* (2016:953) posits that continuous improvement is key to Lean supply chain management as it increases operational and financial performance.

#### 5.2.4 IMPACT OF LEAN LEADERSHIP ON LEAN SUPPLY CHAIN MANAGEMENT

Objective 3. To understand the impact of the perceived criticality between Lean leadership and Lean supply chain management.

As already explained in chapter 4 the data in this study was normally distributed because both the skewness and Kurtosis of all the variables were within  $\pm 2$  (Hair *et al.* 2010). This meant that the relationship between success factors, concepts and principles, leadership behaviour and skills and competencies with Lean supply chain management could be analysed using Pearson correlation and prediction with linear multiple regression. The Pearson correlation results indicated that there was a medium relationship between Lean concepts and principle ( $r=0.413$ ,  $p<.01$ ) and weak relationship between Lean skills and competencies and Lean supply chain. The strength of the relationship was based on the guidelines as explained earlier of Pallant (2010). Qi *et al.* (cited by Cheung *et al.* 2018:71) define Lean supply chain strategy as "building a value stream to eliminate all waste to create niche of supply chain members by operating cost-effectively". Drohomerski *et al.* (cited by Al-Tit, 2016:20) summarize Lean supply chain (LSC) objectives as waste elimination in supply chain, better customer value delivery, stakeholder involvement, collaboration and development. Jayaram (2016:89) defines supply chains management as the economic management of supply activities that maximise client value through the management of product development, sourcing, production and coordination of supply.

Supplier partnerships and long-term strategic alliance are the two success factors in Lean supply chain systems (Khorasani *et al.* 2015:1). Soni and Kodali (2016:502) put forward the six pillars of Lean supply chain as supplier management, collaboration management, marketing management, logistics management, manufacturing management, and strategic management. Lean thinking is associated with the optimisation of the flow of services and products through the entire value stream that flow across technologies, assets and departments to customers (Carvalho *et al.* 2017:76). Lean improves workplace standard through increased investments in training and development and reduces labour turnover (Distelhorst *et al.* 2015:30). Knowledge sharing is the key enabler for the achievement of Lean supply chain performance objectives (Chen *et al.* 2017:44). Lean supply chain emphasises the importance of variation reduction and flow enablement making it unnecessary to keep buffer stock (Singh & Pandey, 2015:33).

However, and strangely, there results have revealed no significant relationship between Lean leadership behaviour with Lean supply chain as well as Lean success factor and supply chain. This is in contradiction to the findings of Rother 2010 who explained Lean success is due to the thinking and behaviour of staff which is driven by organisational leadership and lived out

by most of the employees. This author explained that the leader's tasks is to change employees' behaviours as opposed to spending a lot of time working on tools, techniques, or a series of principles. This is opposite to the findings of the study which was propagating the opposite, with significance with concept, principle, skills and competencies rather than Lean leadership behaviour. The criticality of behaviour is also explained by McCleskey, (2014: 117-130.) who advanced that inspirational motivation involves behaviours which motivate followers through shared meaning and challenges. Affirming this view, (George et al., (2017: 1–13) explained that Leaders behaviour creates favourable working conditions for employees through motivation, engagement and job satisfaction. And as such is expected to create improvements in the organisation. In summary, to achieve systematic continuous evolution and continuous improvement through Lean management, the challenge management are faced with is to continuously and consistently apply behavioural routines for the staff or as Lean management puts it, conduct kata's (Rother, 2010). Despite this the findings shows that concepts and principles of Lean have an overall prediction on the improvement of the Lean supply chain.

Martinez-Jurado and Moyano-Fuentes (2014:134) explain that the challenges faced by organisations is the increased integration of Lean leadership with supply chain management. Ruiz-Benitez *et al.* (2018:190) found that Lean supply practices act as drivers for resilient supply chain practices which in turn lead to higher performance improvement in organisations. Das (2018:177) explain that the integration of Lean management tools and practices in the supply chain planning is crucial in improving sustainability performances. Czarnecka *et al.* (2017:180) explain that Lean supply chain strengthens the relationship between the chain links and focus on leadership and all participants to ensure the provision of value to the final customer.

### **5.3 LIMITATIONS OF THE STUDY**

Like any research study, this study was not without limitations. These limitations are critical to contextualise the findings. In addition to the limitations that were stipulated in chapter 3 the following limitations are highlighted for the overall study:

Firstly, the overall sample of the study was small and was limited to the three mines of the mining organisation as such the study does not cover the whole mining industry and thus there is a lack of generalisability.

Secondly, the study was based on perception survey and on people's own understanding of the leadership and Lean supply chain. This meant that the responses would have been based on their own understanding and their own experiences. Furthermore, a cross-sectional study which was conducted at a given point in time so there is no way of confirming the perceptions change over time. Exogenous factors and other internal related factors can thus have an influence on how the respondents answered the survey.

## **5.4 RECOMMENDATION OF THE STUDY**

As explained in chapter 1 the motivation to conduct the study was to understand its relevance within business and within academia.

### **5.4.1 RECOMMENDATION FOR MANAGEMENT OF THE COMPANY**

Based on the findings of the study the following recommendations are made to management of the mining organisation:

- Management to put plans in place for the implementation of Lean leadership and Lean supply chain management in the organisation.
- Management to include the 4 critical variables of Lean leadership in their strategy and policies to ensure implementation and sustainability through continual review and performance management.
- Alignment of Lean leadership and Lean supply chain management to ensure the smooth and effective implementation of Lean supply chain management in the organisation.

### **5.4.2 RECOMMENDATIONS FOR FUTURE STUDIES**

The study allows for future research in the relationship between Lean leadership and Lean supply chain management especially in the following aspect:

- The overall quantifiable benefits of Lean leadership on Lean supply chain management in the mining industry. This is critical as setting up and implementing the programmes such as these are generally costly for the organisation. Quantifying the benefit and even calculating return on investment is necessary for all the implementing organisations.
- Expand the research to all the mining sectors to capitalise on the numbers and gain a favourable and sizable view of the subject. This will be critical to obtain the

generalisability in the industry as industry need all the assistance to improve its competitiveness and efficiency especially in South Africa.

- Look into researching on the knowledge of Lean leadership and Lean supply chain management with the view of understanding the different terminology being used for the same strategies.

## **5.5 CONCLUSION**

The study investigated three objectives which were, to understand the criticality of Lean leadership in the mining organisation, to understand the perceived improvement levels of the Lean supply chain management and to understand the impact of the perceived criticality between Lean leadership and Lean supply chain management. The conclusion of the study was that the respondents believed that Lean leadership was highly important and critical to the mining environment which practices Lean leadership. Furthermore, that the Lean supply chain management was not mature in the mining organisation as there was no improvement or at best there was slight improvement in the implementation of the Lean supply chain management. Lastly, although there is a relationship between Lean leadership and Lean supply chain management the more significant relationship was found between Lean concepts and principles as well as skills and competencies with Lean supply chain management. Based on the outcome of the research it can be concluded that the objectives of the study were met.

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## **APPENDIX A RESEARCH QUESTIONNAIRES**

## THE EFFECT OF LEAN LEADERSHIP ON LEAN SUPPLY CHAIN MANAGEMENT

### Instructions

Dear Respondents, you are herewith invited to participate in an academic research study conducted by Noah Msibi a student in the Master of Business Administration at the North West University. The aim of the study is to investigate the effect of lean leadership on lean supply chain management in the organisation. Kindly take note that your name is not required nor is it requested, therefore confidentiality is assured. Also note that your decision to take part is entirely voluntary. The below questionnaires will only take about 15-20 minutes of your time. Your response including others will be used as the main data set for the research project and may be published in an academic journal. The survey questionnaires consist of 6 sections (A, B, C, D, E & F) in which each section contains its instructions. When evaluating the question, please provide the answer from your own perspective as honest as possible. Your participation and cooperation is much appreciated. If you have any queries, please contact the researcher – Mr Noah Msibi at 081 094 2945 or the supervisor – Stephan Van Zyl at 10933468@nwu.ac.za

### Section A: Respondents details

Please indicate your department

Production (Mining) ▼

Please indicate your employment level

Supervisor ▼

Please indicate your employment tenure

5 years and less ▼

### Section B: lean and lean leadership

Lean success factors.

2) Indicate the impact or level of importance of Lean Leadership in Lean Supply Chain Management in the organization (1 = Unimportant, 2 = Slight important, 3 = Important, 4 = Very important, 5 = Critical).

	Unimportant	Slight important	Important	Very important	Critical
1. Top management commitment and support	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Employee early involvement.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Linking lean methods to suppliers.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Linking lean methods to the business strategy.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Cultural change.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. Linking lean to customers (end-users).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Linking lean to human resources.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Behaviours of lean leaders.

	Unimportant	Slight important	Important	Very important	Critical
1. Engaging employees.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Celebrating and recognizing success.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Going to Gemba - the real work floor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Provide clarity of purpose in the organisation.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Listening to employees.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### Lean principles & Concepts.

	Unimportant	Slight important	Important	Very important	Critical
1. Value stream - ensuring that all actions that bring a product from initial vision through implementation provide customer value.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Elimination of waste - waste defined as non-value adding activities.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Just-in-Time - elimination of unnecessary work-in-process to ensure continuous flow of products.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

<http://alchemyhub.co.za/the-effect-of-lean-leadership-on-lean-supply-chain-management>

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11/19/2018

The effect of lean leadership on lean supply chain management. | Alchemy Hub

4. Visual management - use of visual tools and indicators to ensure that activities flow correctly.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
-----------------------------------------------------------------------------------------------------	-----------------------	-----------------------	-----------------------	-----------------------	-----------------------

#### Lean leadership skills and competencies

	Unimportant	Slight important	Important	Very important	Critical
1. Creating a culture of continuous improvement.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Coaching employees.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Communication skills.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Motivation skills.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Monitoring and evaluation.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### Section C: Lean Supply Chain Management

##### Key Performance Indicators & Practices.

3) Indicate the improvement level of the following Key Performance Indicators (KPI's) in the past year in supply chain: Impact level of Lean Supply Chain Management practices (1 = Nothing improved; 2 = Slightly improved; 3 Improved; 4 = Substantially improved; 5 = Highly improved)

	Nothing improved	Slightly improved	Improved	Substantially improved	Highly improved
1. Sustainability - Inventory optimization.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. On-Time supplier payment.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. On -Time resolution of supplier queries.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Small and medium supplier (SMME) Development.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Contract management.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. Catalogue purchases.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Availability of critical production spares.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. Availability of critical safety spares.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. Consignment stock management.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. On site deliveries (re-routing and paperwork)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. After-hour procurement practices.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. Bypassing of supply chain procedures.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### Verification

Please enter any two digits

Example: 12

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[Entries \(RSS\)](#) and [Comments \(RSS\)](#).

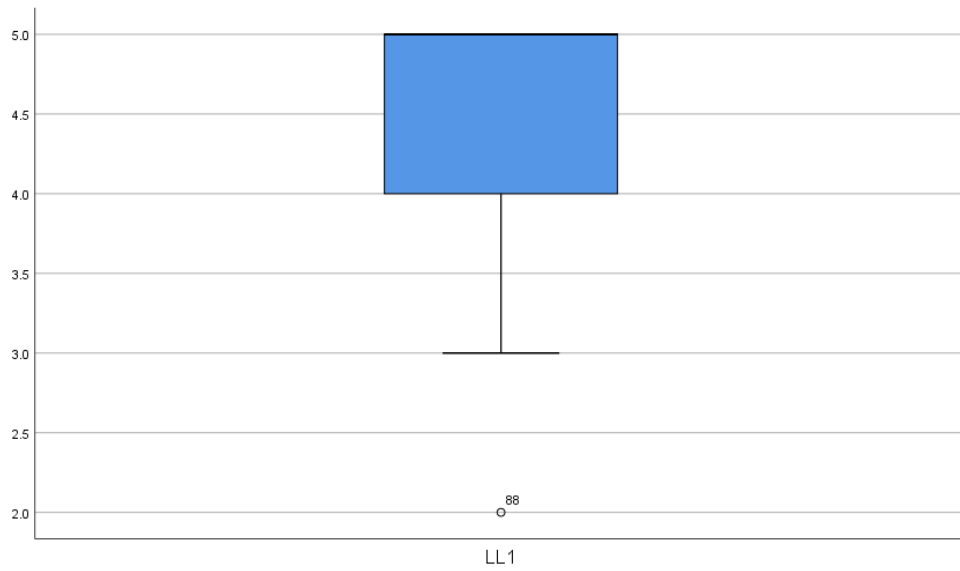
## Appendix B: Missing value analysis

	N	Missing	
		Count	Percent
Please indicate your department	113	0	0,0
Please indicate your employment level	113	0	0,0
Please indicate your employment tenure	113	0	0,0
@1. Top management commitment and support	113	0	0,0
@2. Employee early involvement	113	0	0,0
@3. Linking lean methods to suppliers	113	0	0,0
@4. Linking lean methods to the business strategy	113	0	0,0
@5. Cultural change	108	5	4,4
@6. Linking lean to customers (end-users)	106	7	6,2
@7. Linking lean to human resources	103	10	8,8
@1. Engaging employees	113	0	0,0
@2. Celebrating and recognizing success	111	2	1,8
@3. Going to Gemba (the real work floor)	111	2	1,8
@4. Provide clarity of purpose in the organisation	111	2	1,8
@5. Listening to employees	107	6	5,3
@1. Value stream ensuring that all actions that bring a product from initial to final are value-adding	113	0	0,0
@2. Elimination of waste -waste defined as non-value adding activities	112	1	0,9
@3. Just-In-Time, elimination of unnecessary work-in-process	113	0	0,0
@4. Visual-management use of visual tools and indicators	109	4	3,5
@1. Creating a culture of continuous improvement	113	0	0,0
@2. Coaching employees	113	0	0,0
@3. Communication skills	111	2	1,8
@4. Motivation skills	112	1	0,9
@5. Monitoring and evaluation	111	2	1,8
@1. Sustainability Inventory optimization	113	0	0,0
@2. On-Time supplier payment	112	1	0,9
@3. On-Time resolution of supplier queries	113	0	0,0
@4. Small and medium supplier (SMME) Development	113	0	0,0
@5. Contract management	110	3	2,7
@6. Catalogue purchases	112	1	0,9
@7. Availability of critical to production spares	113	0	0,0
@8. Availability of critical to safety spares	112	1	0,9
@9. Consignment stock management	113	0	0,0
@10. On-site deliveries re-routing and paperwork	113	0	0,0
@11. After-hour procurement practices	111	2	1,8
@12. Bypassing of procurement procedures	109	4	3,5

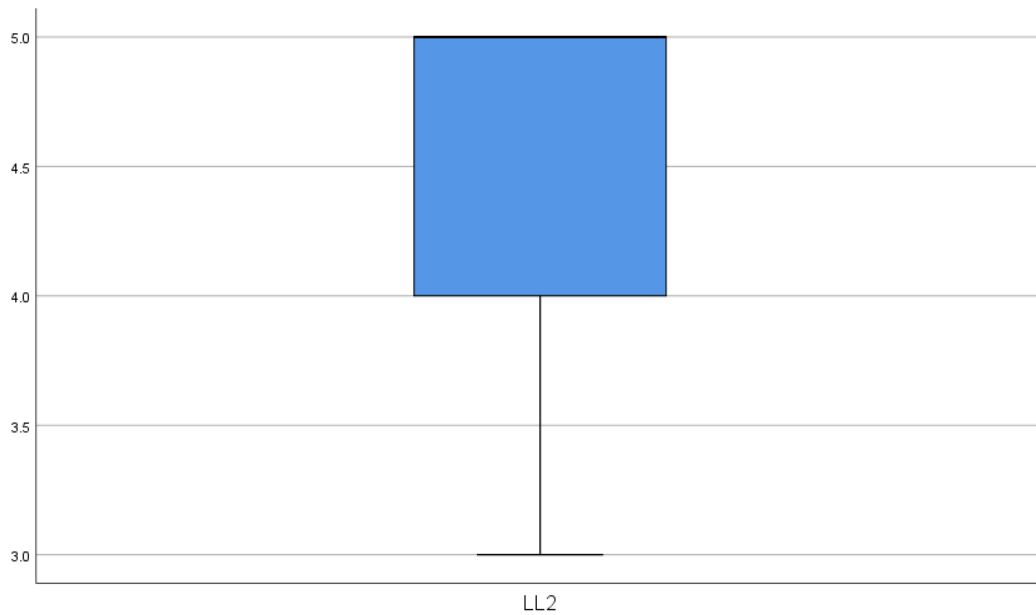
a. Number of cases outside the range ( $Q1 - 1.5 \cdot IQR$ ,  $Q3 + 1.5 \cdot IQR$ ).

## Appendix C Box plots for outliers

### LL1

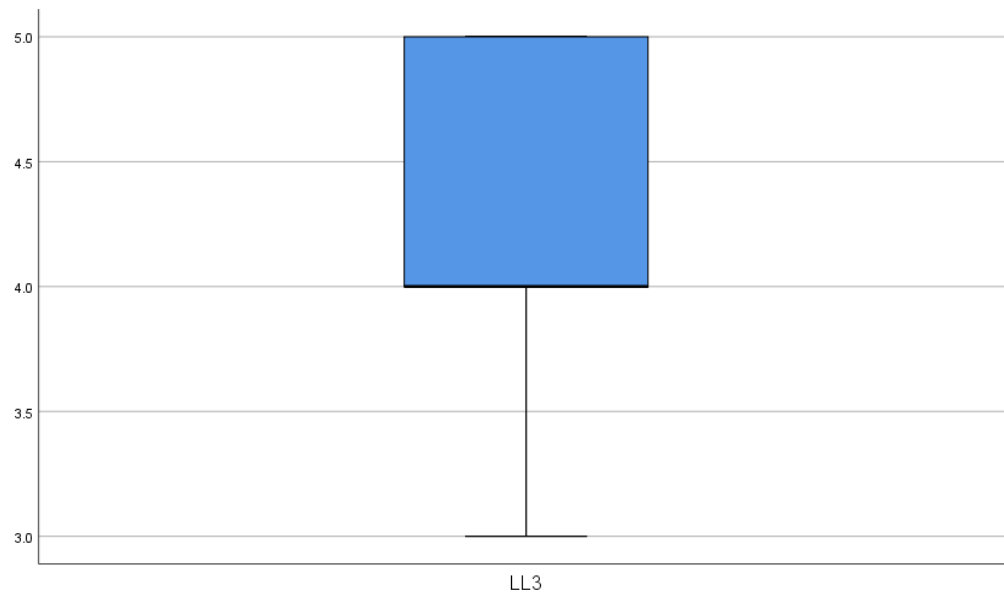


### LL2

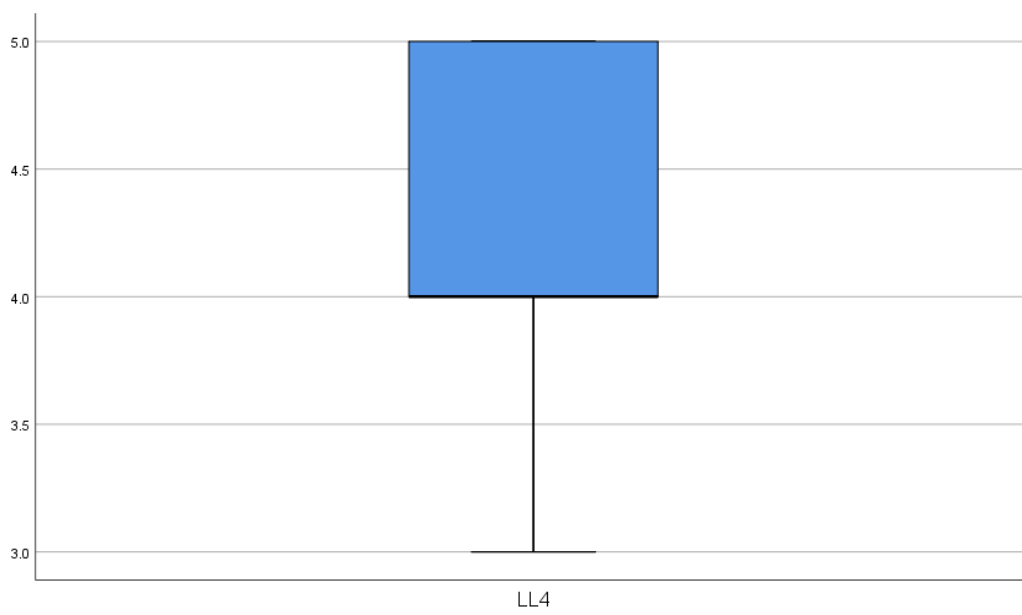




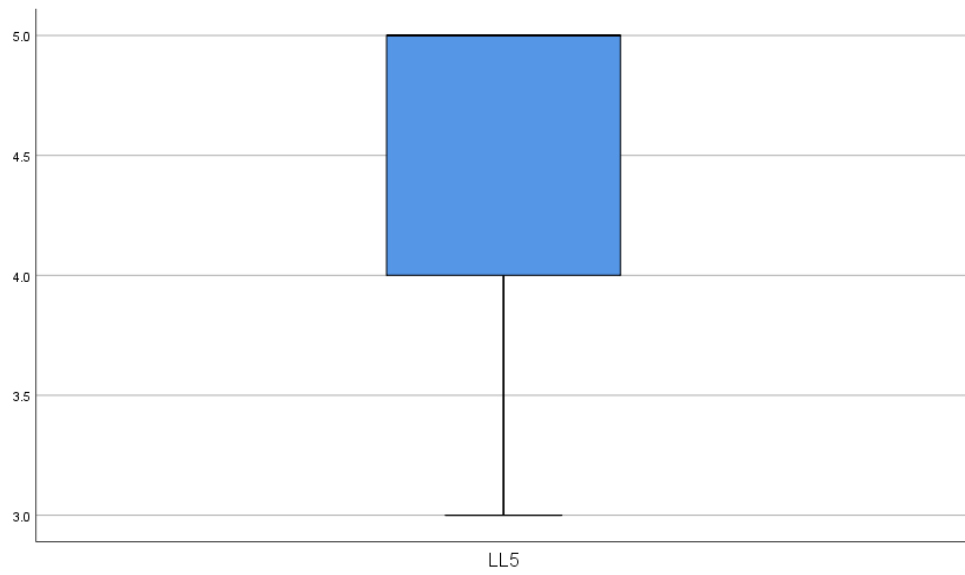
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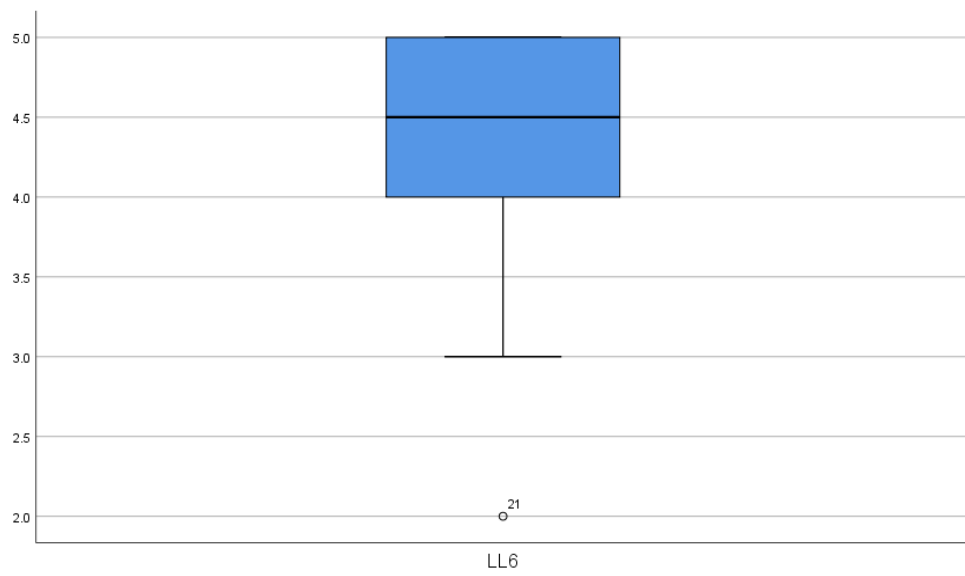
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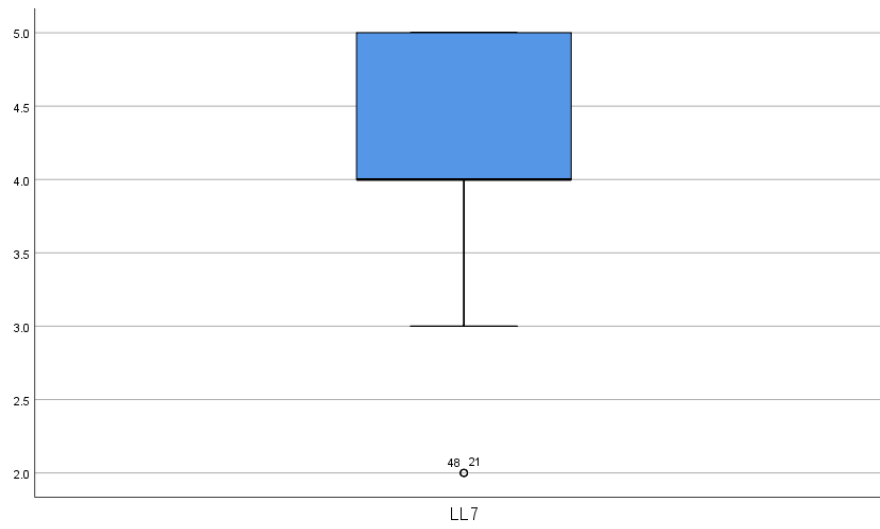
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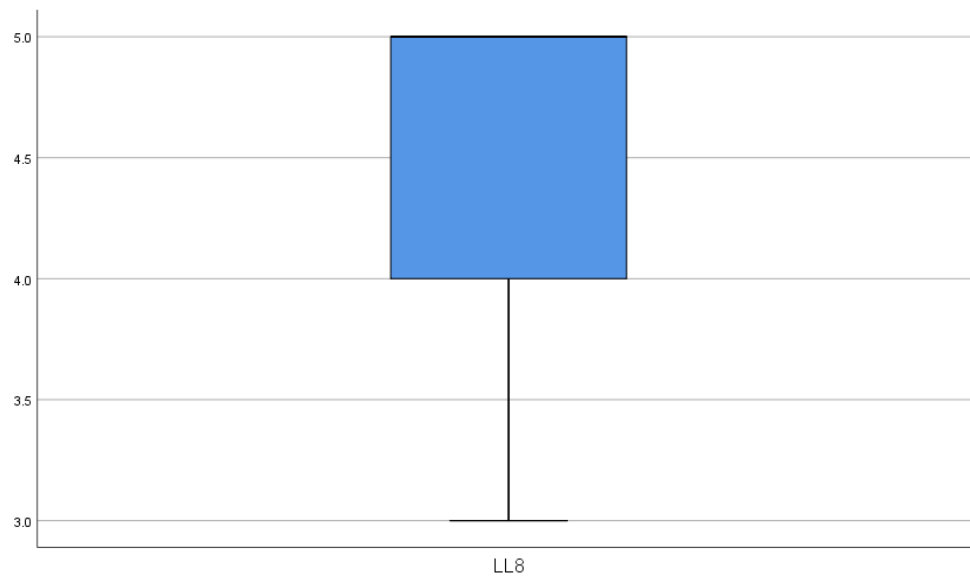
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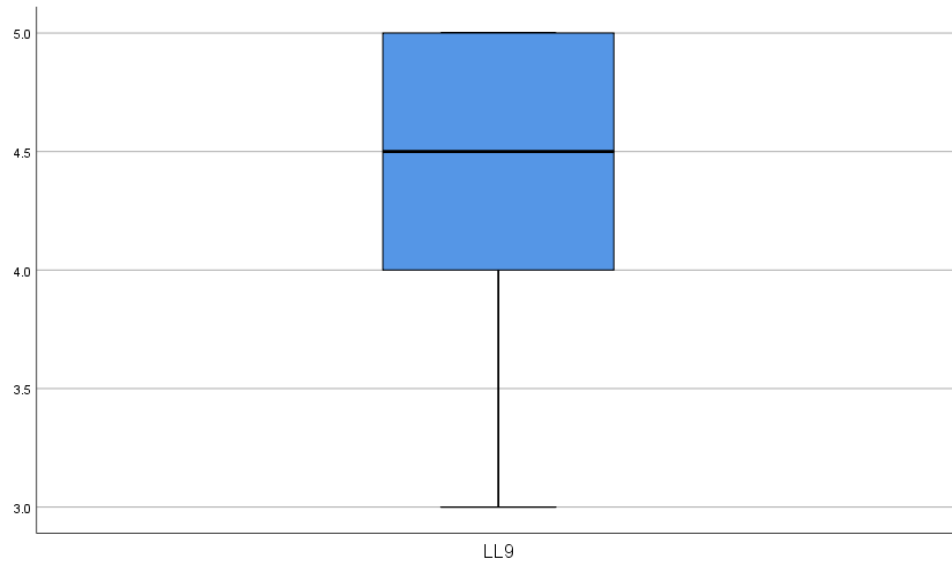
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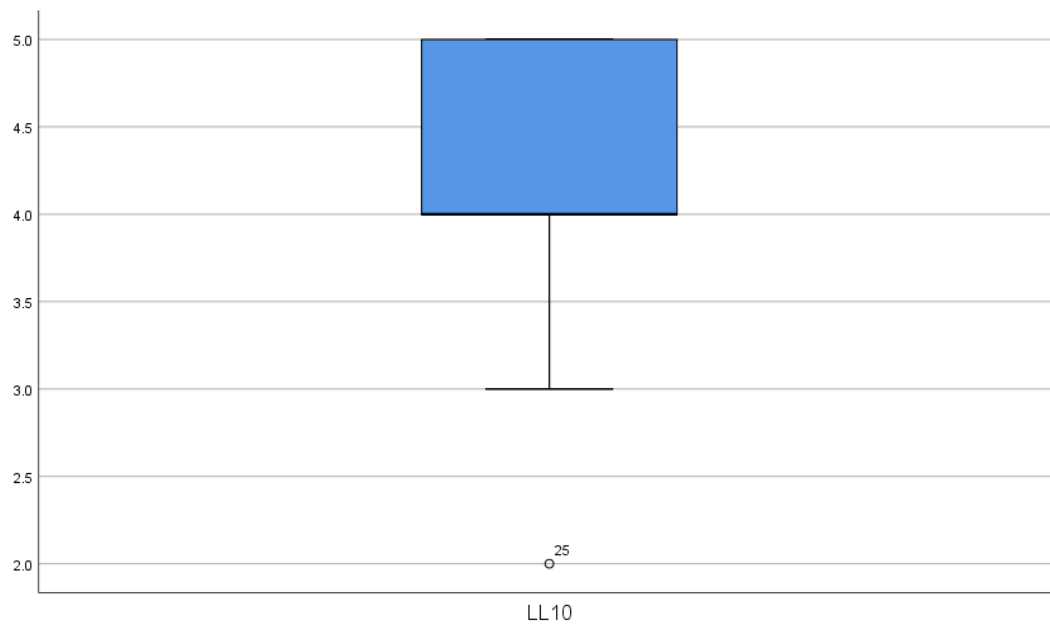
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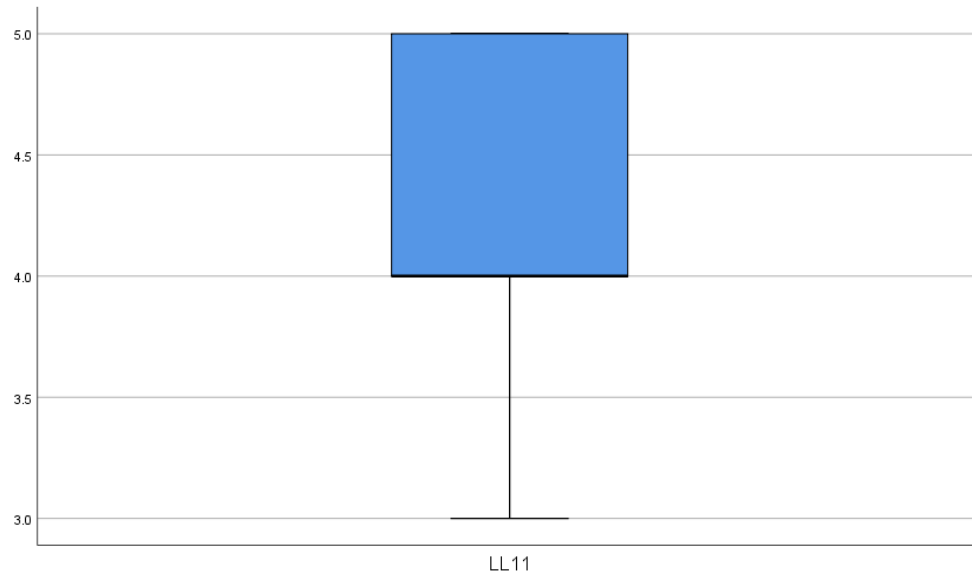
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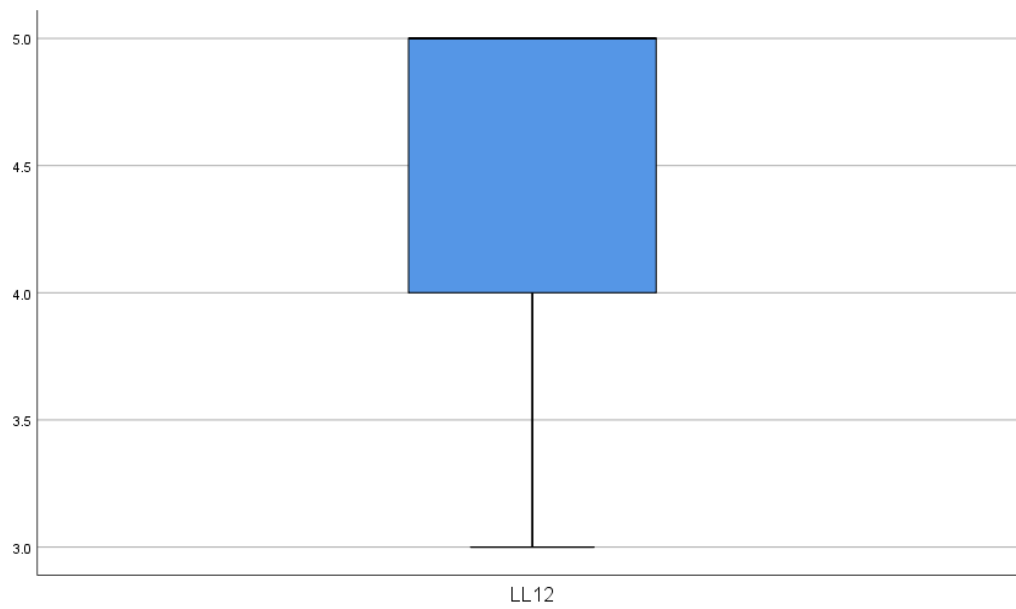
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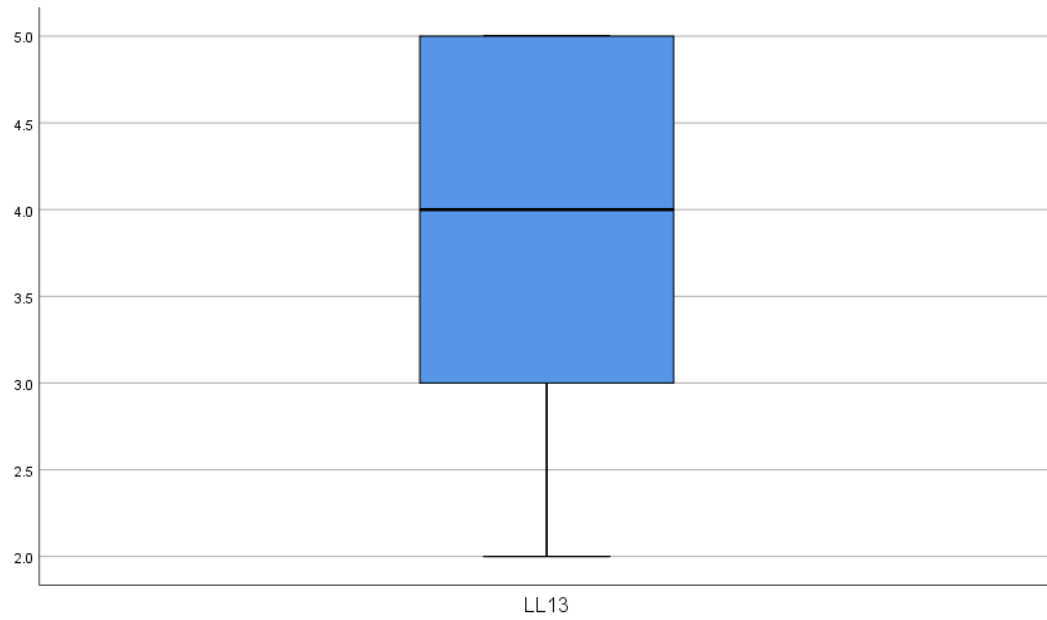
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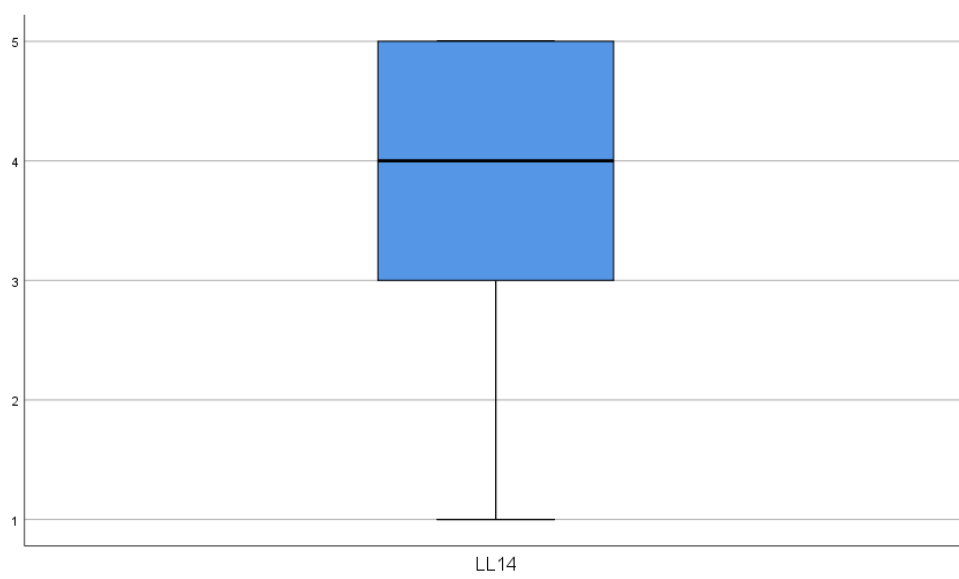
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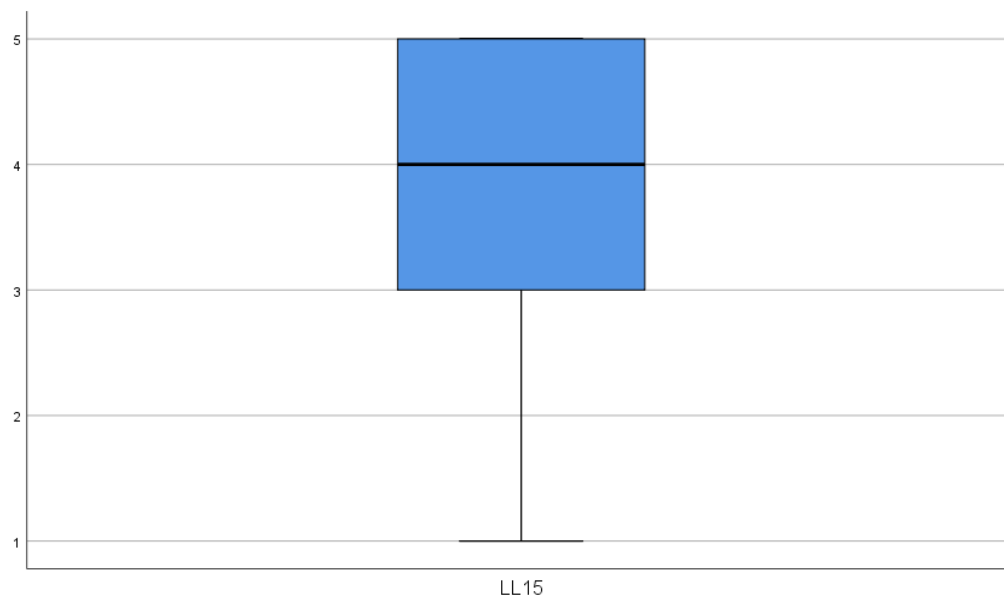
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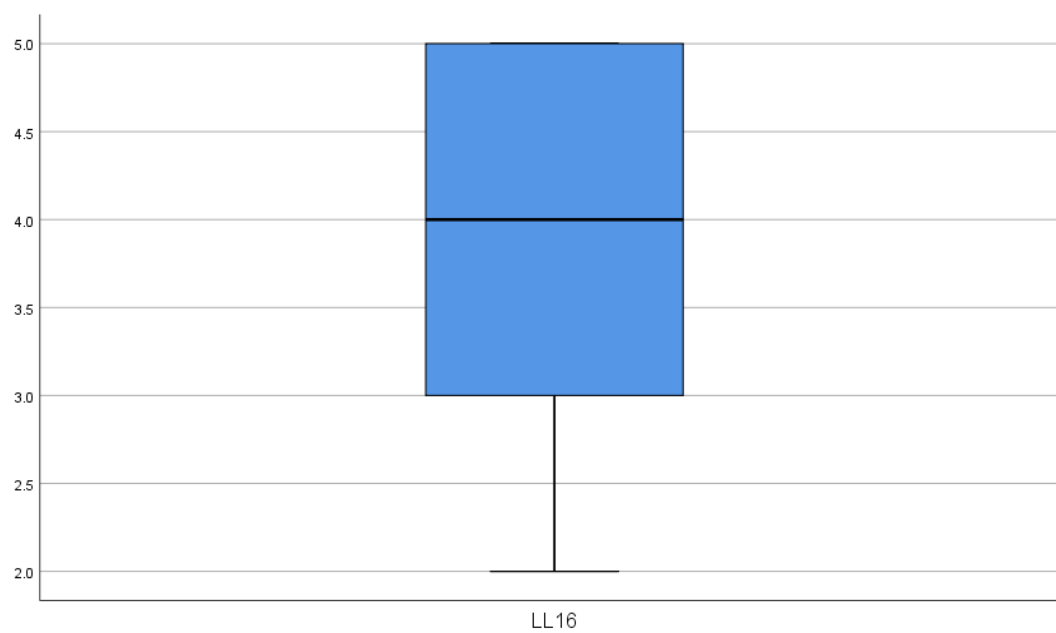
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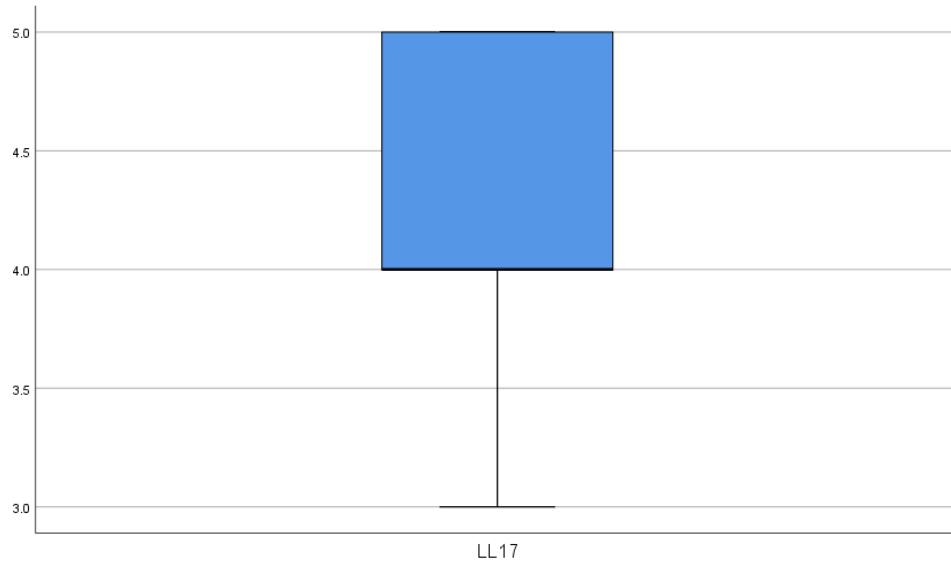
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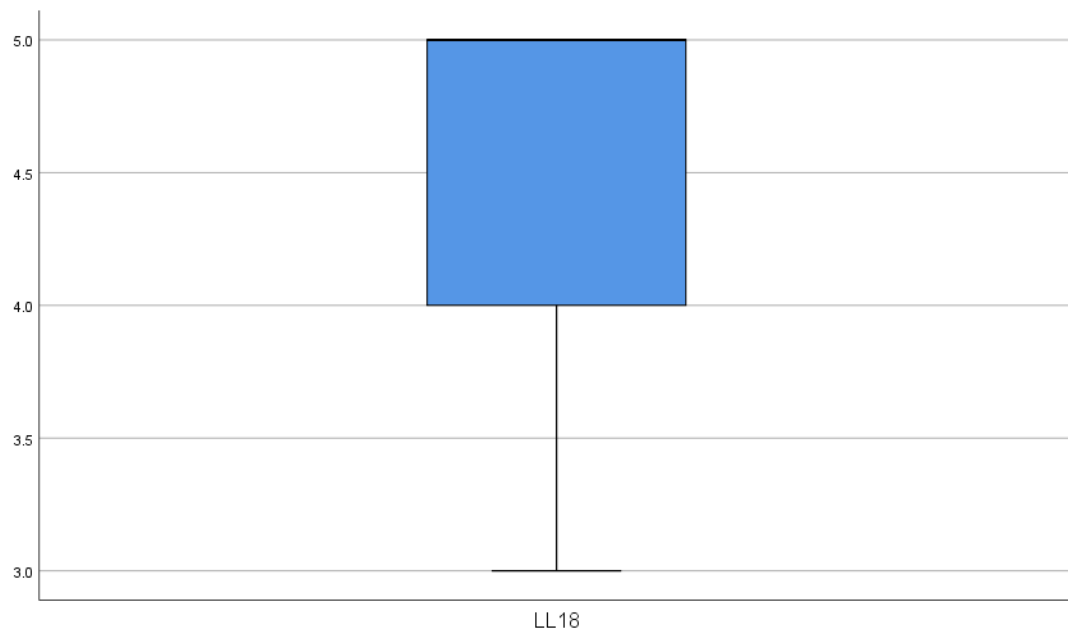
## LL16



## LL17

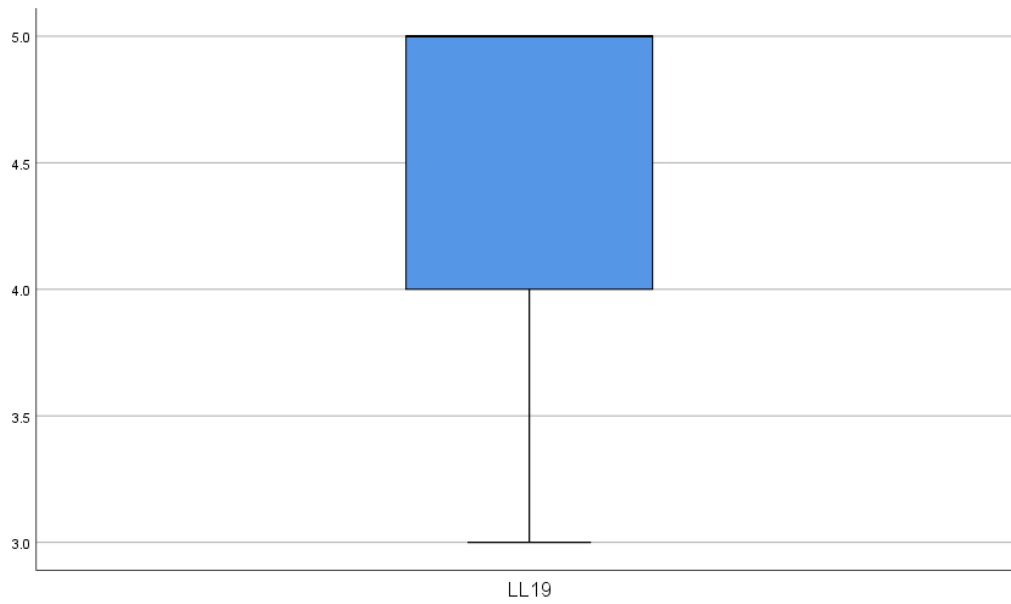


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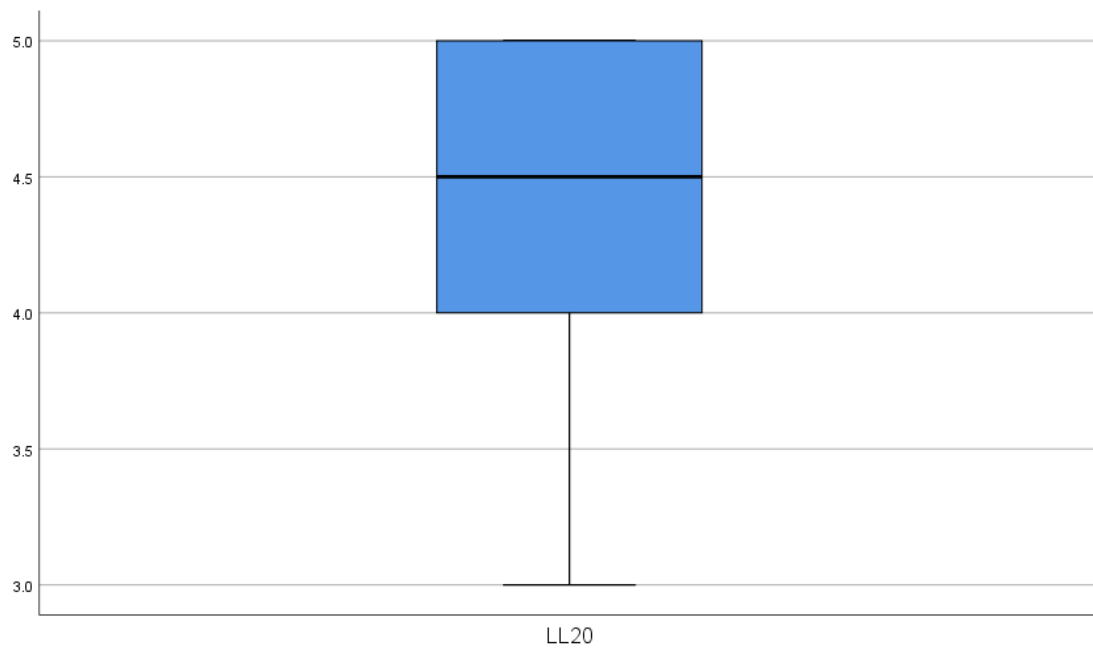




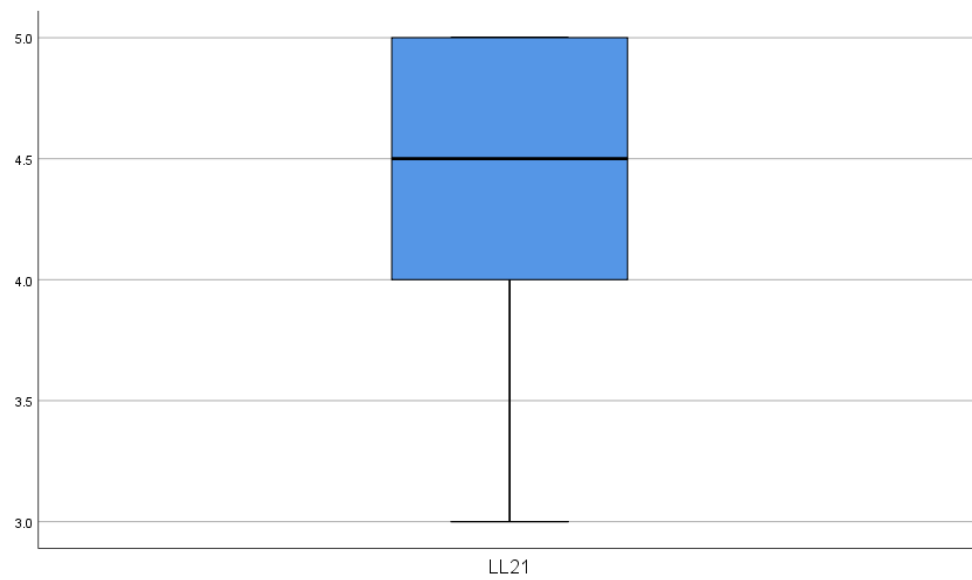
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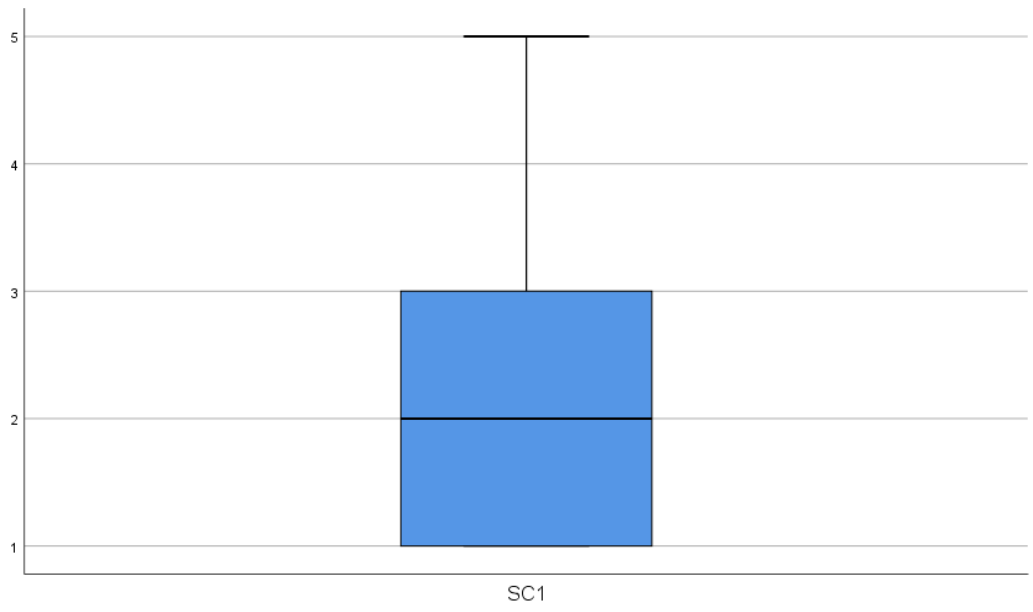
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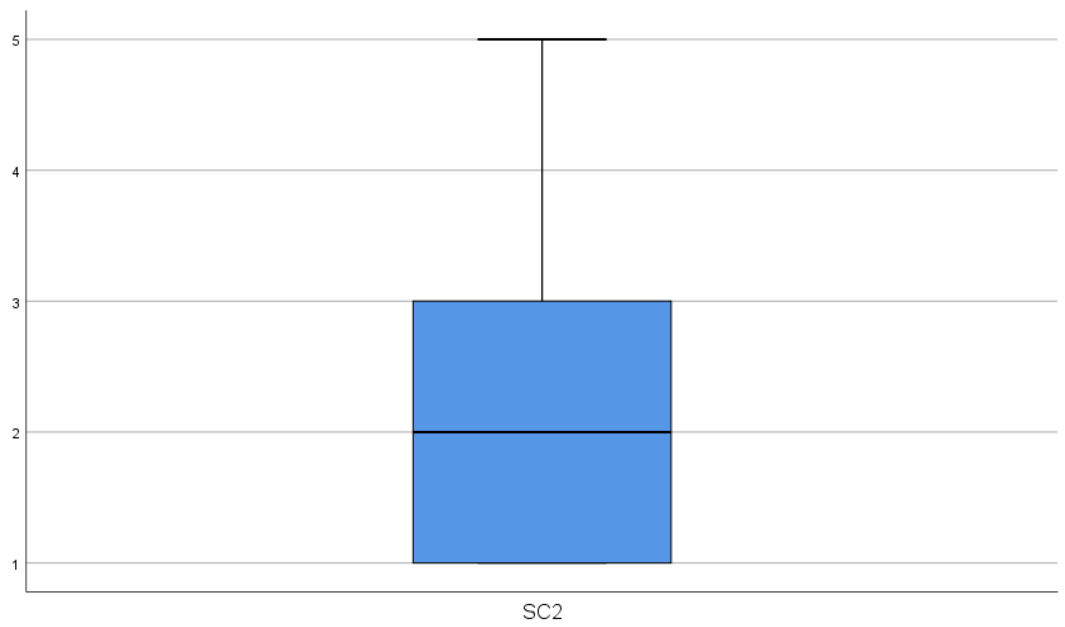
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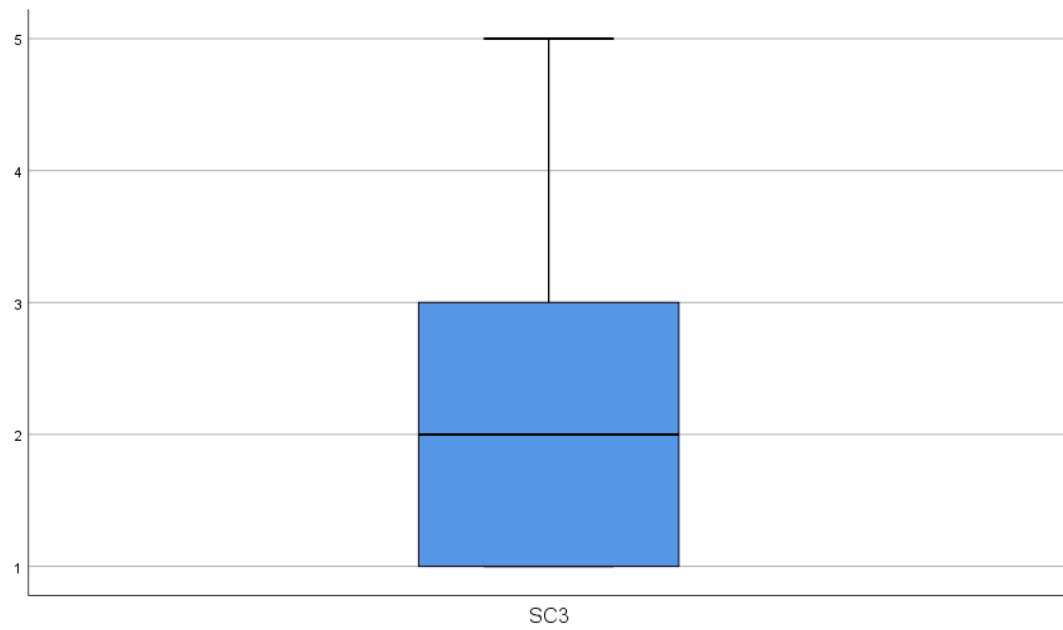
**SC1**



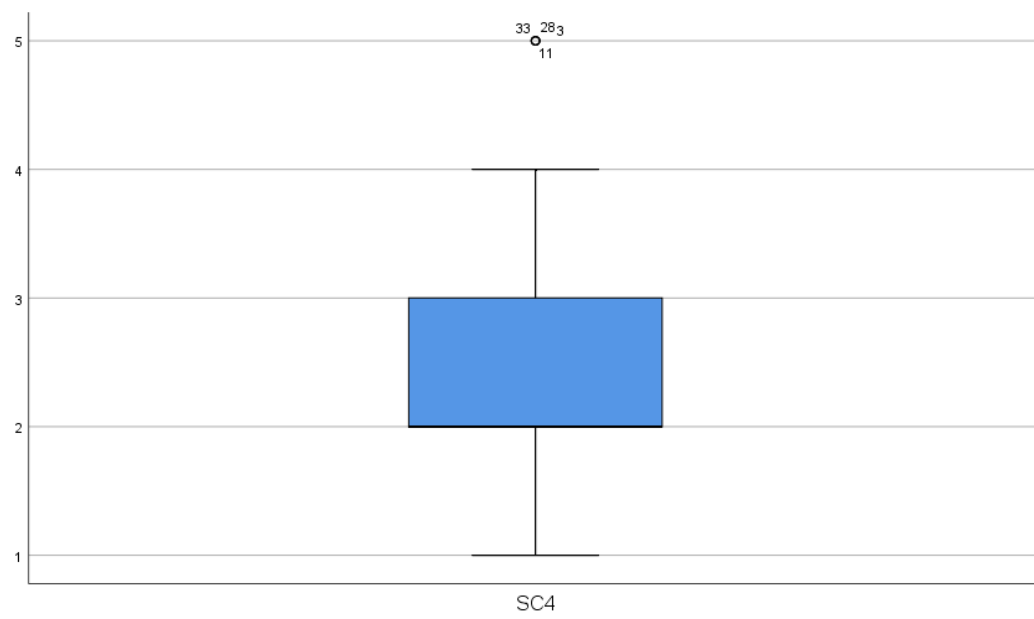
## SC2



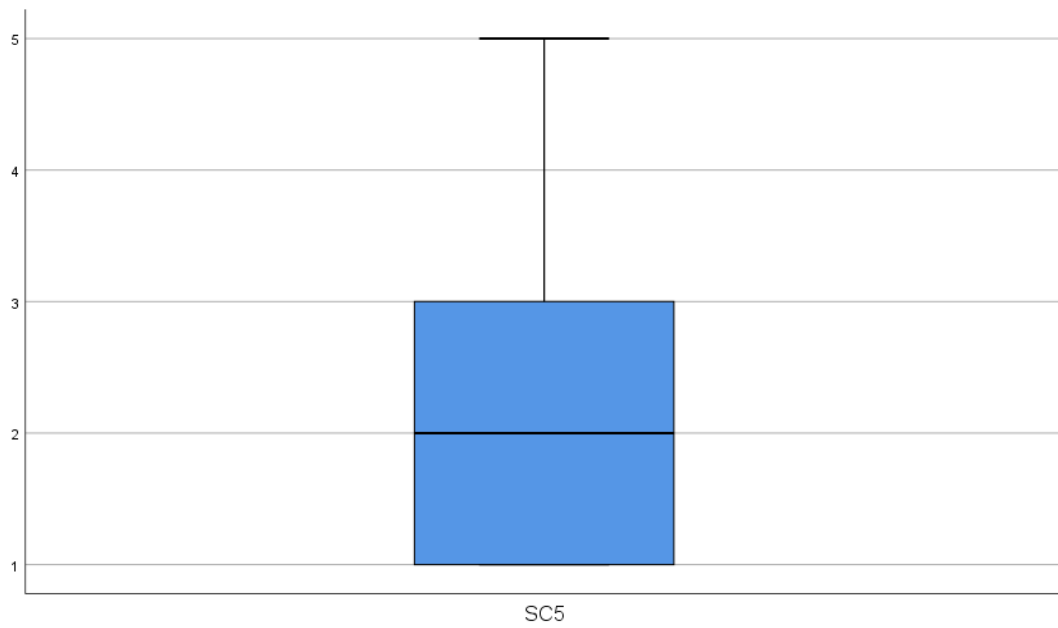
### SC3



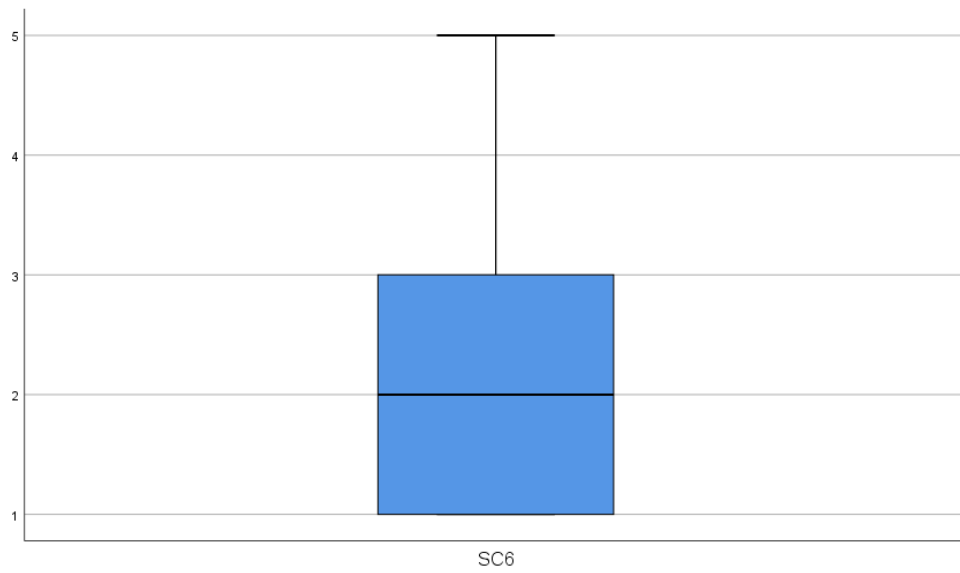
### SC4



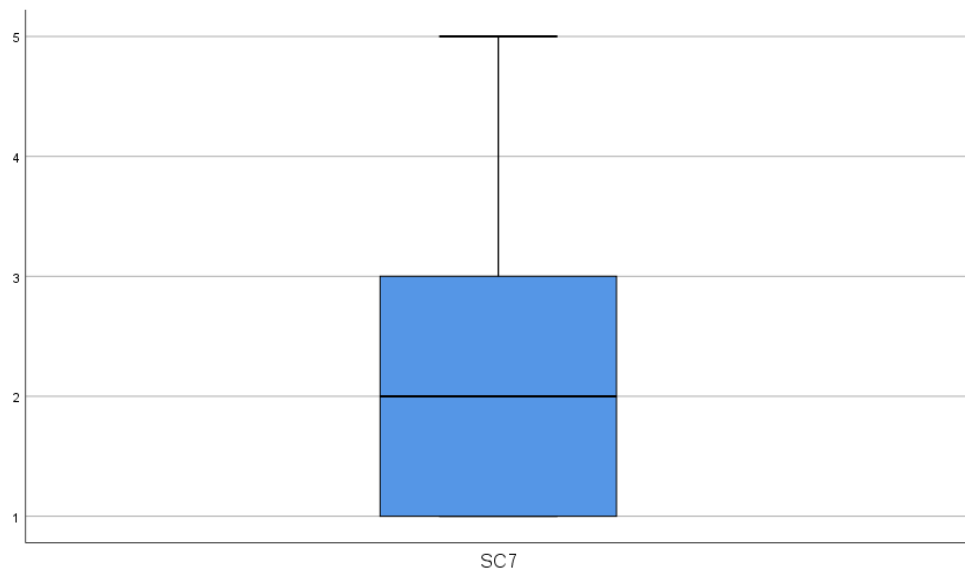
## SC5



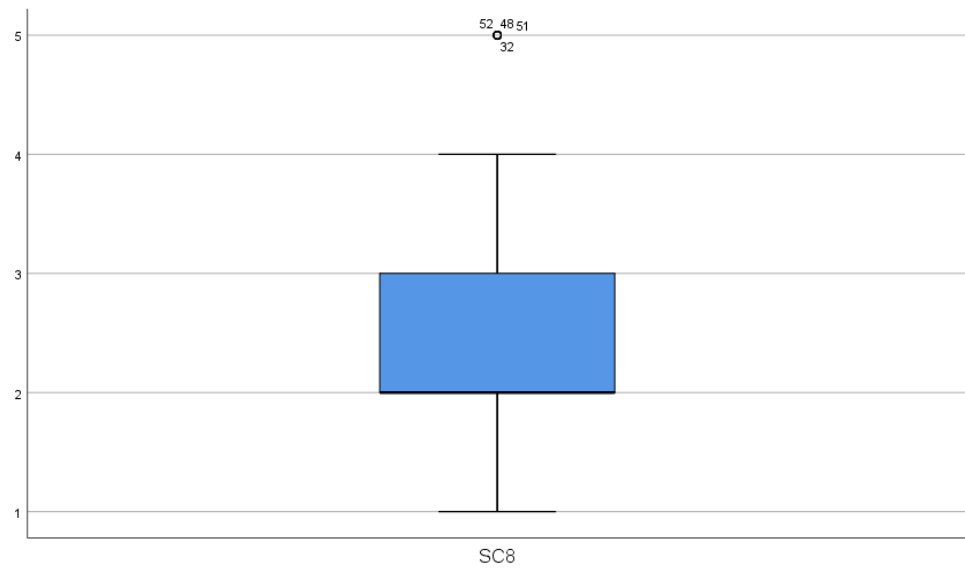
## SC6



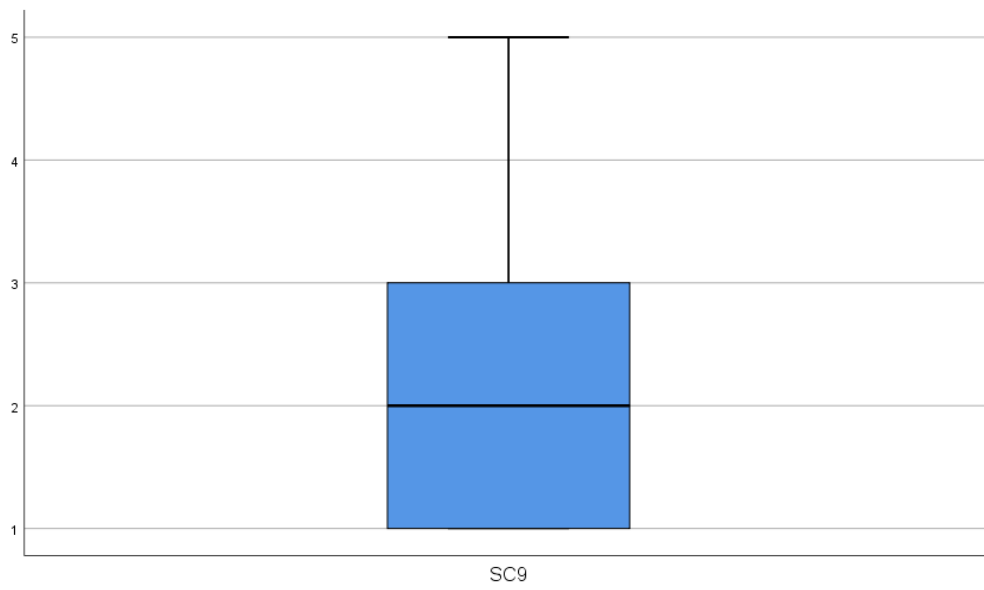
## SC7



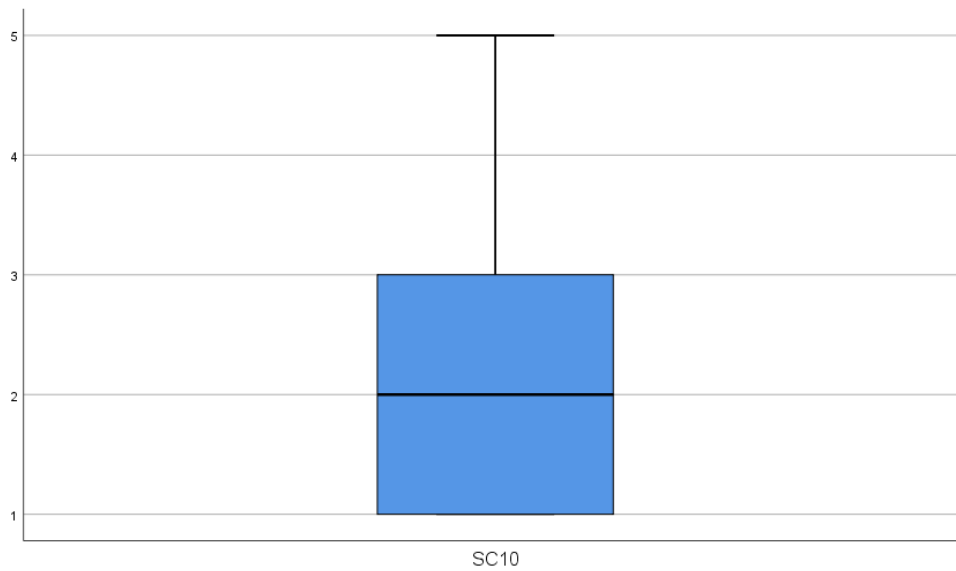
**SC8**



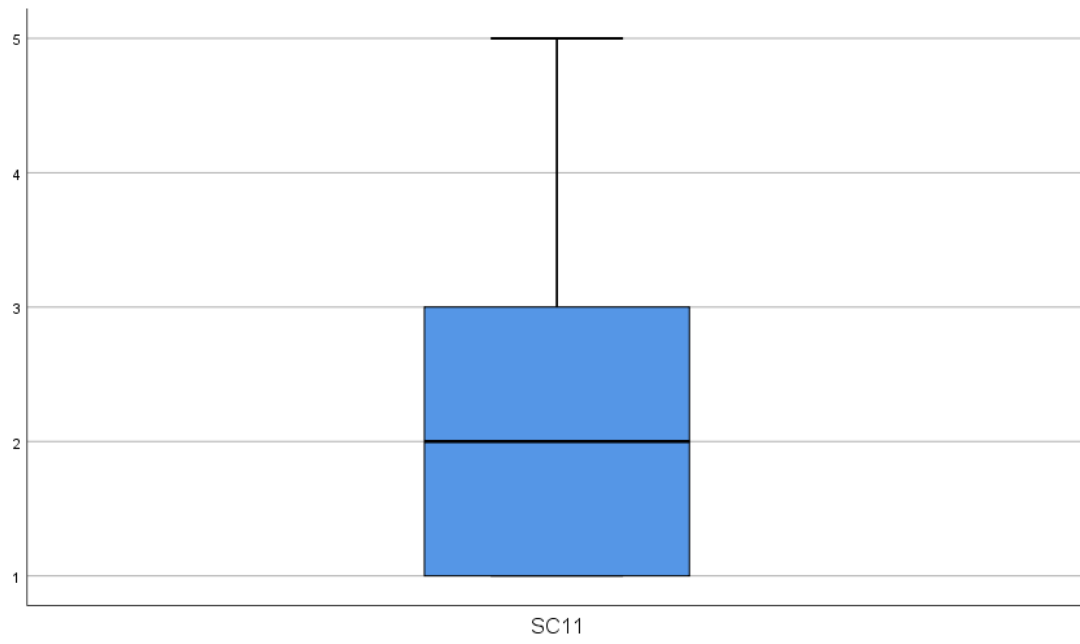
**SC9**



**SC10**



**SC11**



## SC12

