An Empirical Study on Employee Perceptions on Lean Six Sigma Programmes in the Services Organisations in Ireland

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ABSTRACT

Lean Six Sigma (LSS) is a business process improvement methodology that aims to increase operational efficiency by improving quality, speed, customer satisfaction and costs (Antony and Laureani, 2012). The main objective of this research was to explore the employee perceptions on LSS initiatives in the services organisations in Ireland. This research gathered information from published literature on LSS to design a survey questionnaire with a scope to investigate employee perceptions on LSS: performance; benefits; factors that affect success and sustainability; and top 10 CSFs. The web based self-report survey questionnaire was sent to 113 employees from two companies in the services sector, who were or have been using LSS, and the response rate was 73%.

Descriptive and statistical testing was conducted in IBM SPSS to analyse the survey data and to compare the employee perceptions between the two companies. Results indicate significant differences between the two companies in the areas of LSS performance and LSS success and sustainability factors. Employees of company1 viewed LSS initiatives as generally successful and sustainable whereas, employees of company2 viewed them as generally unsuccessful and unsustainable. Views of both company employees on LSS benefits were more or less aligned except realisation of cost reduction. A number of key enabling factors for LSS success were found to be lacking in company2 which explained why LSS initiatives were deemed unsuccessful and not sustained. Both company employees ranked: senior management commitment, involvement & support; clear vision & long term strategy; organisation culture; and LSS awareness & training as the top 4 CSFs.

The findings from this research are relevant to the sample population and cannot be generalised to the entire company or the services sector. This study is the first empirical study attempting to assess employee perceptions on LSS initiatives in services organisations and contributes to the existing literature on LSS.

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List of Abbreviations

Abbreviation	Description
BB	Black Belt
CI	Continuous Improvement
CSF	Critical Success Factors
HR	Human Resources
LSS	Lean Six Sigma
MBB	Master Black Belt
TPS	Toyota Production System
DMAIC	Define, Measure, Analyse, Implement, Control
JIT	Just in time
TQM	Total Quality Management
NCI	National College of Ireland

1. Introduction

The purpose of this research is to investigate the employee perceptions on Lean Six Sigma (LSS) initiatives in organisations in the services sector in Ireland.

Due to the ever changing market conditions and economic climate companies globally are under continued pressure to reduce costs and become more efficient (Radnor, 2012). So, companies are increasingly focussing more on their internal operations and processes to achieve efficiencies. Lean Six Sigma (LSS) is a methodology that can help organisations to improve their operational efficiency and effectiveness (Snee, 2010; George, 2003), customer satisfaction and bottom line results (Snee, 2010) by combining the strengths of lean thinking and Six Sigma. In the last 10 to 15 years, LSS has increasingly been adopted by businesses across a wide range of sectors for their business and process improvement efforts.

Previous studies have looked at: the uptake and success factors of LSS in financial services in certain countries like Great Britain, Germany, Switzerland & Austria (Heckl et al, 2010); success factors of LSS implementations in manufacturing and services in UK (Laureani et al., 2012), across different industries in India (Desai et al., 2012), Malaysian automotive industry (Habidin at al., 2013). Several exploratory studies have analysed LSS implementations at specific firms in specific sectors and countries (Delgado et al., 2010; Psychogios et al., 2012; Chakraborty et al., 2012). However, the author did not find evidence

of any published studies that have been conducted in the LSS area at a firm, sector or across multiple sectors level in Ireland to date. Hence, there is scope for such a study and this research aims to fill this through an empirical study on employee perceptions on LSS programmes in the services organisations in Ireland.

Majority of the studies including the ones outlined above which analysed the critical success factors (CSFs) for the LSS implementations only took the viewpoint of either the managers in the firms or LSS certified professionals or employees. So, the findings on CSFs from these studies don't collectively represent the viewpoint of all groups involved in LSS implementations. This research aims to investigate the employee perceptions on the performance, benefits, success and sustainability factors and CSFs of LSS initiatives from the perspectives of all groups involved in LSS programmes (employees, managers and LSS experts) in the organisations.

While there are some conceptual studies offering general guidance on why change efforts fail or LSS efforts and achieved improvements are not sustained (Snee, 2010; Buchanan et al., 2005; Fine et al., 2009); and some studies using qualitative and case study methods to look at the challenges, benefits and experiences from the LSS implementations at individual firms; most empirical studies only focus on identifying what specific or different groups believe as the most important CSFs. So, the literature on LSS lacks empirical studies looking at the perceptions or experiences of employees or various groups on LSS programmes in their organisations. This research attempts to address this gap by

conducting an empirical study on the employee perceptions on the performance, benefits, success and sustainability factors and CSFs of LSS initiatives in services organisations in Ireland to get a more rounded view on all aspects of LSS implementations in organisations from employees' perspective.

This area of research is being undertaken by the researcher as he has a particular interest in LSS and the Business Process Improvement areas. He is employed by a multinational organisation that uses LSS methodology across its multiple business units.

1.1 Research aim

The aim of this research is to carry out an exploratory study on the employee perceptions on LSS initiatives in organisations in the services sector in Ireland. The study attempts to empirically understand the views of the employees with respect to the: performance; benefits; factors that affect success and sustainability; and critical success factors of LSS initiatives specific to their organisation; and also validate these against the published literature. The study aims to gather views of all groups that are involved with LSS initiatives in organisation to obtain the collective views of employees on LSS initiatives in their organisations.

1.2 Significance of research

This study is the first to attempt to empirically investigate the perceptions of various groups collectively who are involved with the LSS initiatives in

organisations on various aspects of the LSS initiatives specific to their organisation. The study will help understand how employees view the LSS initiatives and also help identify the main issue areas acting as barriers to the success and sustainability of LSS initiatives in their organisations. So, the findings from the study could act as a reality check for the senior management in terms of understanding how LSS initiatives are viewed, what areas are performing well and what areas need further improvement in order for the initiatives to be successful and sustainable in the organisation. The study and findings will add to the existing literature and will be of interest to senior management of the companies involved in the study and also other firms in Ireland or elsewhere who are using LSS or looking to implement LSS programmes.

1.3 Research questions

Below four research questions were drafted in order to answer the overall research question and to identify how well the perceptions of employees on LSS initiatives reflect the reality and relate to the literature.

Q1: "How does the perceptions of employees on the performance of LSS initiatives in their organisations compare between company1 and company2?"

Q2: "How does the perceptions of employees on the benefits of LSS initiatives in their organisations compare between company1 and company2?"

Q3: "How does the perceptions of employees on the factors affecting the success and sustainability of LSS initiatives in their organisations compare between company1 and company2?"

Q4: "How does the ranking of Top 10 Critical Success Factors (CSFs) that affect the success of LSS initiatives compare between company1 and company2?

1.4 Thesis Structure / Chapter overview

The paper first discusses the research available on the topic of LSS pertaining to the research topic within the literature review in chapter 2. From there the main research questions for this research will be outlined in chapter 3, followed by the methodology used to address the objectives of the research and research questions in chapter 4. Analysis results from the research conducted specific to the research questions outlined will be discussed in chapter 5. The following chapter 6 will then discuss the key findings related to the research questions and the main areas of learnings from the research. The paper will then finish with conclusions in chapter 7 followed by outlining recommendations for future research in chapter 8.

The following section provides a review of the literature on LSS, its implementations in various sectors, benefits, success factors, sustainability, CSFs and a conclusion on the literature review.

2. Literature Review

The literature review gives an insight into the work and findings already available within the research area (Saunders et al., 2012). The focus and aim of the literature review is to understand the research that has been conducted in the area of Lean Six Sigma (LSS), what the main trends within the literature are and to identify gaps where further research is needed.

While research interest in the LSS area has grown in the last decade or so, the literature is light in terms of variety and depth. The literature features material; proposing conceptual frameworks for LSS implementations, study of LSS implementations at specific firms, critical success factors and challenges faced during LSS implementations, uptake of LSS in different sectors in different countries and others. However, the literature is very light on understanding how firms sustain or can sustain the LSS programmes over a longer period and the future direction of LSS programmes in the services sector.

The following section presents an overview of Lean, Six Sigma (SS) and LSS methodologies, LSS in services, critical factors for the success of LSS implementations, challenges faced during LSS implementations and finally sustainability of LSS programmes.

2.1 Overview of Lean Six Sigma

Lean Six Sigma (LSS) is a business improvement methodology that aims to maximize operational efficiency and effectiveness in by improving speed,

quality, customer satisfaction, and reducing costs. LSS achieves this by merging principles and tools from both Lean and Six Sigma. LSS which was originally devised to reduce waste and improve manufacturing quality is increasingly being adopted by services and other industries due its success in companies like GE, Motorola, Xerox, J&J (Guarraia et al., 2008).

The terms Lean and Six Sigma were first defined and hard coded during 1980s and have followed independent paths since. Lean is a process improvement methodology used to reduce waste and deliver products and services faster, better and at a lower cost. The first applications of lean were recorded in the manufacturing plants of Ford during 1913. Womack and Jones (1996) defined lean as:

> *"a way to specify value, line up value-creating actions in the best sequence, conduct those activities without interruption whenever someone requests them, and perform them more and more effectively. In short, lean thinking is lean because it provides a way to do more and more with less and less – less human effort, less human equipment, less time, and less space – while coming closer and closer to providing customers with exactly what they want."*

Six Sigma (SS) is a data driven process improvement methodology used to reduce defects and process variation to achieve stable and predictable process results. Snee (1999) defined SS as:

"a business strategy that seeks to identify and eliminate causes of errors or defects or failures in business processes by focusing on outputs that are critical to customers."

Though both Lean and Six Sigma were being used for many years, they were not integrated to become LSS or Lean Sigma until the late 1990s and early 2000s (George, 2003). However Naslund (2008) argues that, lean and six sigma are not new methods but are just repackaged versions of previously popular methods; just-in-time (JIT) and total quality management (TQM). Lean Six Sigma uses principles and tools from both to get the best from both methodologies, increasing speed while also increasing accuracy. Today LSS is recognized as: "a business strategy and methodology that increases process performance resulting in enhanced customer satisfaction and improved bottom line results" (Snee, 2010).

2.2 Lean Six Sigma in Services

According to Vargo and Lusch (2004), a framework aimed at improving the efficiency of service organizations must consider the five key characteristics of services: intangibility; inseparability; variability; perishability and lack of ownership. It is incorrect to assume that a model developed for the manufacturing sector can be applied and works in services and unlike in manufacturing, one of the main issues that arise in services is when trying to apply lean principles to intangible products (Arfmann et al., 2014). There is lack

of evidence about the positive effects of lean transformation on service organizations (Burgess, 2013).

Unlike manufacturing, services are different by nature and very often bound by time in terms of the processes that lead to an outcome that benefits a customer. In services organizations, lean comes in as a methodology to reduce waste in terms of time (cycle time, waiting times), resources to allow the process to become more efficient. It requires the examination of the process from the customers' perspective, in order to eliminate the waste and inefficiency. Six Sigma, however, focuses on refining the process to reduce variability, errors (defects) and improve reliability.

A framework for the integration of lean and Six Sigma, consisting of a project organization structure based on Six Sigma black belts (BB), green belts (GB), and champions, extensive training programs and a define, measure, analyse, improve and control (DMAIC) approach, with lean analysis tools and improvement models embedded and concepts/classifications of both lean and Six Sigma combined was proposed by De Koning et al. (2008). This integrated LSS structure has been widely adapted both in manufacturing and services industries.

2.3 LSS Benefits

As LSS combines the power of both lean and six-sigma, it can provide more benefits than using a stand-alone methodology. While different authors have provided different definitions for LSS outlining different benefits, there is wider

acceptance that LSS is a business process improvement methodology capable of providing a range of benefits outlined below.

- Improve operational efficiency and effectiveness (De Koning et al., 2008).
- Increase process efficiency by reducing waste and increase quality by defect reduction (Salah, Rahim and Carretero, 2010).
- Increases process performance resulting in increased customer satisfaction and improved bottom line results (Snee, 2010).
- Improves process efficiency and organisation to be more customer centric (De Koning et al., 2008).

2.4 Factors affecting success and sustainability of LSS

Lean Six Sigma maybe a statistical and managerial implementation to assess and improve the process; however, the success or failure of such implementation depends on the availability and presence of several factors.

2.4.1 Senior Management commitment

Strong Management commitment, involvement and participation is the most important ingredient to the success of LSS (Antony and Banuelas, 2002). Emiliani (1998) suggested that managers might not show the same level of commitment as they demand from workers. It is imperative to have good support from top management to achieve the cultural change required and motivate the employees towards LSS strategy to the business. On the other hand, lack of top

management commitment and involvement is the key contributor to failures (Womack and Jones, 2010). The importance of senior management commitment and participation to the success of LSS has been outlined in many studies (eg. Laureani et al., 2012; Henderson et al., 2000). Furthermore, Pande et al (2000) argued that, without the continuous commitment and support from senior management, the true importance of any change initiative will be in doubt and it will gradually fade away.

2.4.2 Organisation culture

LSS sees every problem, defect or error as an improvement opportunity (Coronado & Antony, 2002). The success of LSS requires a change in the mindset of employees and adjustment of organisation culture to support the change. Culture change is an important pre-requisite for Lean Six Sigma introduction and its success. The company culture must be receptive to change and accept change as a positive. Chakrabarty and Tan (2007) suggested that the company must accept that LSS is a change agent and the company values and culture must adjust accordingly and embrace the change for the change efforts to succeed.

2.4.3 Long term plan and linking to business strategy

Organisations and senior management should consider LSS as a long-term investment. Pande et al (2000) claims that, some quality initiatives also fade out because of company leaders loosing focus. To overcome this, leaders and top

management should ensure that the LSS initiative is and remains a momentum for process improvement and must be sustained over the long term.

2.4.4 Communication

According to Antony et al (2002), initiatives like LSS require the people within the organisation at all levels to have the right attitude and mindset. Employees within the organisation must be made aware of the need for change. They continue to claim that, organisations that have been successful at managing change have recognised that increased and sustained communication, education and motivation the best way to tackle resistance to change. To overcome the fear of change, it is critical to establish a clear communication plan and channels to educate employees as to the need for LSS and how it will benefit the organisation and motivate employees to overcome resistance (Antony et al., 2002).

2.4.5 Training

Training plays a crucial role in the success of LSS. According to Antony et al (2002), it is important to communicate the 'why' and 'how' of LSS and train employees on LSS methodology and tools. However, they suggest that the training should be structured in such way that it is relevant to employees' everyday jobs. Psychogios et al (2012) argued that, LSS training requires a significant investment and could potentially become a barrier for sustaining LSS efforts.

2.4.6 Narrow view of LSS

Many people and organisations view LSS is a mere set of tools and techniques to solve problems. This very narrow view of LSS could be the single biggest contributing factor for LSS failures in organisations (Flinchbaugh and Carlino, 2006).

2.4.7 Sustainability factors

Many institutions have had success using LSS programs to deliver short-term improvements, but sustaining the change over a longer term is often more difficult. According to a survey by Industry Week only two percent of companies with lean programs reached their anticipated targets while 74 percent were not making good progress (Pay, 2008). Naslund (2008) suggests that companies abandon the change efforts if the method does not seem to provide clear evidence of expected results in terms of performance. Taking a holistic improvement approach and moving from a sole focus of improving project by project to a continuous improvement (CI) culture will take organisations a long way in sustaining the improvement efforts and culture over a long term (Snee, 2010). Alken et al., (2011) suggest that employing a well-informed approach to engage employees in the process of change can become an enabler for long term success and sustainable competitive advantage. Snee (2010) claims that many organisations only start to focus on sustaining the improvements only after improvements have been achieved and suggest that organizations must focus on sustainability at a strategic level before starting the implementation. While many authors offer guidance on how organisations can sustain change or improvement efforts, there is a lack of evidence based studies exploring if and how

organisations are actually sustaining the improvements or understand why, if they are not.

2.5 Critical Success Factors (CSFs) for LSS Programmes

The concept of identifying CSFs as a basis for determining the information needs of managers was illustrated by Rockart (1979). According to Rungasamy et al. (2002), critical success factors are those factors essential to the success of any technique or program, in the sense that, if objectives associated with the factors are not achieved, the application of the program will perhaps fail catastrophically.

The key factors for the effective implementation of Six Sigma programs in UK companies was analysed by Antony and Banuelas (2002), which were further refined in a study by Coronado and Antony (2002) as: management commitment and involvement; linking Six Sigma to business strategy; understanding of SS methodology, tools, and techniques; project selection, reviews and tracking; cultural change; organizational infrastructure; linking Six Sigma to customers; project management skills; training. Pande et al. (2000) added leadership commitment as one of the important CSFs, while the importance of organizational culture and infrastructure was highlighted by Zu et al. (2010).

Kwak et al., (2006) summarised the CSFs in four main areas: management involvement and organizational commitment; continuous education and training; encouraging and accepting cultural change; project selection, management control & skills. Whereas Achanga et al. (2006) identified

leadership and management, organizational culture, finance, skills and expertise as CSFs for SS implementations, the importance of linking LSS to the overall business strategy was highlighted by Dale (2000). While Ingle and Roe (2001) identified the prioritization of projects as a CSF, the need for tracking and review of improvement projects was highlighted from Martens (2001). Other CSFs such as: understanding of the tools, identifying selection of team members, linking Six Sigma to customers and accountability were added to the literature by Antony (2006). Henderson and Evans (2000) added linking Six Sigma to human resources based actions like rewards, promotions etc., to the list of CSFs. The CSFs identified above and published in many papers are for Lean Six Sigma and LSS implementations though there is a dearth of literature on CSFs for LSS implementations (Laureani et al, 2012).

The study conducted by Laureani et al., (2012) with manufacturing and service companies in UK identified management commitment, cultural change, linking Lean Six Sigma to business strategy and leadership styles as the most important and linking Six Sigma to HR rewards and extending Lean Six Sigma to supply chain as the least important CSFs for LSS implementations. They suggest that identification of leadership styles as one of the most important CSFs and its relatively smaller coverage in LSS literature could be a potential area for further research.

Psychogios et al., (2012) used a multi-factor application approach to conduct an exploratory study of LSS implementation in two telecommunications firms and conclude that: top management involvement & support; quality-driven

organizational culture; top down & bottom up project selection; quality-driven training; customer satisfaction, prior implementation of other quality improvement programs and supportive performance management & IT systems as the most important CSFs and lack of awareness of LSS, lack of strategic orientation as inhibiting factors. They suggest that further research is required to confirm on the multi-factor application approach used in their study and future research could explore the perspectives of front line employees as well and not just the managers. This research aims to address this by taking perspectives of employees, managers and LSS experts.

Manville (2012) studied the CSFs of SS implementation in a single firm from the middle management perspective and concluded that: senior management commitment, support and enthusiasm; linking LSS to business strategy; and linking LSS to customer were deemed most important. They also suggest that future of LSS within the firm studied depend on the extent to which middle managers are given responsibility for solution creation and strategy formulation by senior management and propose future research could explore the impact of organisational culture and structure on strategy development.

A survey of 3264 employees from different hierarchical levels across financial services companies in Germany conducted by Leyer and Moormann (2014) to study "how lean are financial services companies in Germany" found that, there is only a moderate lean thinking in financial services companies. They observed a "lean fata morgana" whereby employees in general think they are leaner than their actual behaviour discloses. They also noted scope for future research on

differences of perceptions between managers and team members or employees and conducting similar studies in different service sectors.

There have been similar studies to analyse the CSFs and LSS implementations in different sectors and countries: financial services in Great Britain, Germany, Switzerland & Austria (Heckl et al, 2010); manufacturing and services in UK (Laureani et al., 2012); different industries in India (Desai et al., 2012); automotive industry in Malaysia (Habidin at al., 2013); financial services in Portugal (Delgado et al., 2010); services sector in Singapore (Chakraborty et al., 2012); telecommunications sector (Psychogios et al., 2012). However, no studies have been conducted in any sector in Ireland to explore and understand the LSS implementations. This research aims to fill this gap by studying the LSS implementation at two firms in the services sector in Ireland.

So, the literature offers fairly similar and general CSFs for lean, six sigma and LSS methods and implementations (Naslund, 2008). Undoubtedly certain factors from the CSFs identified from the literature above will contribute more to an effective and successful LSS implementation. This research will seek to test the validity of these assertions by determining which of the identified CSFs are considered to be of greatest importance by employees, management and LSS experts within the two companies identified for the study.

2.6 Conclusion

In summary it is evident from the literature that there are various factors that affect the success and sustainability of LSS programmes. Generalisation of

which CSFs will have more impact on the success of LSS implementations across different sectors is not made because of the scope and limitations of the studies carried out so far. Based on the previous studies, some factors like senior management commitment, involvement and support; organisation culture; effective communication; and awareness & training were found to play a more important role in the success of LSS. The literature also suggests that organisations should consider LSS as a long term strategy rather than embarking on LSS efforts to achieve short term goals. The literature also emphasises the need for organisations to integrate their LSS efforts in the continuous improvement culture in order to sustain the LSS efforts and improvements. No studies have analysed CSFs from the perspectives of all key stakeholders (Management, LSS experts and employees) involved with LSS programs. Most of the empirical studies have only looked at assessing the CSFs to establish which CSFs are considered most important. The author did not find evidence of any studies carried out in the LSS area in Ireland. So, there is scope for such a study and this research attempts to address this through an exploratory study of LSS implementation at two firms in services sector in Ireland. The following section discusses the research objective and the main research questions.

3. Research Questions

The overall objective of this research is to investigate the perceptions of employees from the two organisations in the services sector in Ireland on the performance, benefits, success and sustainability factors and CSFs of LSS initiatives in their organisations. The study attempts to achieve this through an empirical study to fill the gap identified in the literature review.

The study focusses on two multinational companies in the services in Ireland that have been or were using the LSS initiatives. Off the two, company1 has been using LSS for around 10 years, whereas company2 was using LSS initiatives for around 4 years. This research attempts to investigate the employee perceptions from these two companies on various aspects of LSS initiatives in their organisation to understand if the perceptions differ between the two, if so in what areas and why? To help achieve this objective, this paper focuses on the following research questions.

3.1 Research Questions

Research Question 1

Q1: "How does the perceptions of employees on the performance of LSS initiatives in their organisations compare between company1 and company2?"

Research Question 2

Q2: "How does the perceptions of employees on the benefits of LSS initiatives in their organisations compare between company1 and company2?"

Research Question 3

Q3: "How does the perceptions of employees on the factors affecting the success and sustainability of LSS initiatives in their organisations compare between company1 and company2?"

Research Question 4

Q4: "How does the ranking of Top 10 Critical Success Factors (CSFs) that affect the success of LSS initiatives compare between company1 and company2?

4. Research Methodology

4.1 Research philosophy

According to Blumberg, Cooper & Schindler (2008), a research philosophy is a belief about how research should be conducted and how research reasoning (theory) and observations (data or information) are related to each other. Positivism and interpretivism are the two most distinguished research philosophies; and ontology (concerned with nature of reality) and epistemology

(concerned with acceptable knowledge) are the two main ways of thinking about research philosophy (Blumberg et al., 2008).

Being objective and external to resources is the only one reality according to the ontological perspective positivists. But on the contrary, since every individual has their own sense of reality, interpretivists claim that reality is socially constructed and is subjective (Collis & Hussey, 2009).

Positivists claim from a epistemological perspective that only phenomena that can be observed and measured can be considered as knowledge, and a researcher remains distant and objective. (Blumberg et al., 2008; Collis et al., 2009).

4.2 Research approach

In this section, the approach used to conduct the research is discussed (Quinlan, 2011). Details are provided on the approach that was taken in the research to gather valuable data from employees, managers and LSS experts on LSS initiatives in their organisations. After reviewing the literature on LSS, the researcher found that the positivism paradigm using a quantitative method seemed to be the most appropriate approach for collecting data to meet the objectives of the research. This approach is consistent with previous empirical research conducted by majority of researchers (e.g. Antony and Laureani, 2012; Sharma and Chetiya, 2012; Habidin and Yusof, 2013; Antony, Antony and Kumar, 2007; Heckl, Moormann and Rosemann, 2010) in the area of LSS. Based on these findings and together with author's own preference towards the positivism approach, quantitative methods were used for this research and data collection.

Quantitative research aims to gather data into numerical values to undertake statistical analysis of the problem, whereas qualitative research aims to gather data in more abstract and in a non-numerical form. Positivists believe in the notion of absolute truth and that knowledge is derived from experiences and facts obtained through observation and objective systems of measurement (Chalmers, 2013). According to Benz and Newman (2008), quantitative approach is usually used when one begins with a theory or hypotheses and test for confirmation or disconfirmation of that theory or hypotheses. However, qualitative approach can be used when observing or interpreting reality with the aim of developing an explanation or theory of what was experienced. According to QRAC (Qualitative Research Consultants Association, 2014) the process of qualitative research is exploratory by definition, and can be used when the answers are not exactly known. In addition, it allows the researcher to investigate particular areas of interest as the data collection occurs, and some semi-structured freedom to change direction over the course of an interview; to ask further questions that would not normally be possible through a survey. So, both qualitative and quantitative research methods clearly differ how data is collected, analysed and interpreted.

Quantitative research is associated with positivism using structured data collection methods, and deductive research approaches focusing on using data to test theory (Saunders et al., 2012). The objective of the literature review was to identify theory, which was then treated by the researcher as a set of variables that could be measured and observed (Collis et al., 2009). Data related to the variables were collected by the author in order to provide empirical evidence.

Theoretical framework acted as a base for formulating the research questions which were assessed against the collected empirical evidence (Fisher, 2007).

4.3 Sampling

The main objective of sampling is to choose a subset of individuals from a population in order to estimate the characteristics of the whole population (Fisher, 2007). Saunders et al (2012) suggest that, using sampling generates findings that are representative of the whole population when choosing a quantitative research method such as questionnaires. In non-probability sampling techniques, a sample size will depend on the study objectives and research questions as the generalisation is made about the theory and not about the population (Saunders et al., 2012). Different types of non-probability sampling techniques such as: snowball sampling; quota sampling; and purposive or convenience sampling can be used (Fisher, 2007).

For this research a convenient sampling method was used meaning, individuals who were easiest to include were selected to participate in the research (Saunders et al., 2012). In this case, two multinational companies in the services sector in Ireland that are or were using LSS initiatives and known to the researcher were selected and employees form these two companies who have participated or involved in the LSS initiatives were selected and invited to participate in the study. While Bryman and Bell (2007) argue that, though convenience sampling is the cheapest and easiest to conduct and can provide interesting data, it is the least reliable design due to limitations in generalisability and lack of ability to

ensure precision; it can still be a useful technique as it is used to test ideas about a subject of interest (Blumberg et al., 2008). It is important to note that findings from this study are relevant to the sample population, and may not be relevant to the total population of employees in the two organisations selected for the study or employees of other organisations in the services sector either in Ireland or elsewhere.

4.4 Participants

Employees from two multinational companies in the services sector in Ireland who have participated or involved in the LSS initiatives in their organisation were selected as the participants for the study. The researcher used his contacts at both firms to send the survey questionnaire to only those who meet these criteria. Those partaking included employees who have: participated in LSS training only; participated in LSS projects; lead/managed LSS projects; coached and trained employees in LSS (LSS experts who are BB/MBB); and LSS champion/project sponsors. The rationale behind this selection was to obtain a collective view from all different groups who are normally involved with LSS initiatives in organisations.

The sample of 83 participants was comprised of 38 from company1 (46%) of which 20 were female (53%) and 18 were male (47%) and 45 from company2 (54%) of which 25 were female (56%) and 20 were male (44%). The participant's age ranged from 18 to 55 years. Number of years participants have been working in the organisation ranged from 2 to 10+ years for company1 and

4 to 10+ years for company2. Of 38 participants from company1, 5 stated that they participated in LSS training only (13%), 7 stated that they participated in LSS projects (18%), 15 stated that they lead/managed one or more LSS projects (40%), 5 stated that they coached and trained employees in LSS (13%, LSS Experts BB/MBB), and 6 stated that they sponsored LSS projects (16%, LSS Champions). Of 45 participants from company2, 7 stated that they participated in LSS training only (16%), 11 stated that they participated in LSS projects (24%), 19 stated that they lead/managed one or more LSS projects (42%), 3 stated that they coached and trained employees in LSS (7%, LSS Experts BB/MBB), and 5 stated that they sponsored LSS projects (11%, LSS Champions).

Figure 1 below shows the breakdown of participants by gender and by company and **Figure 2** shows the breakdown of participants by their type of involvement in LSS initiatives and by company.

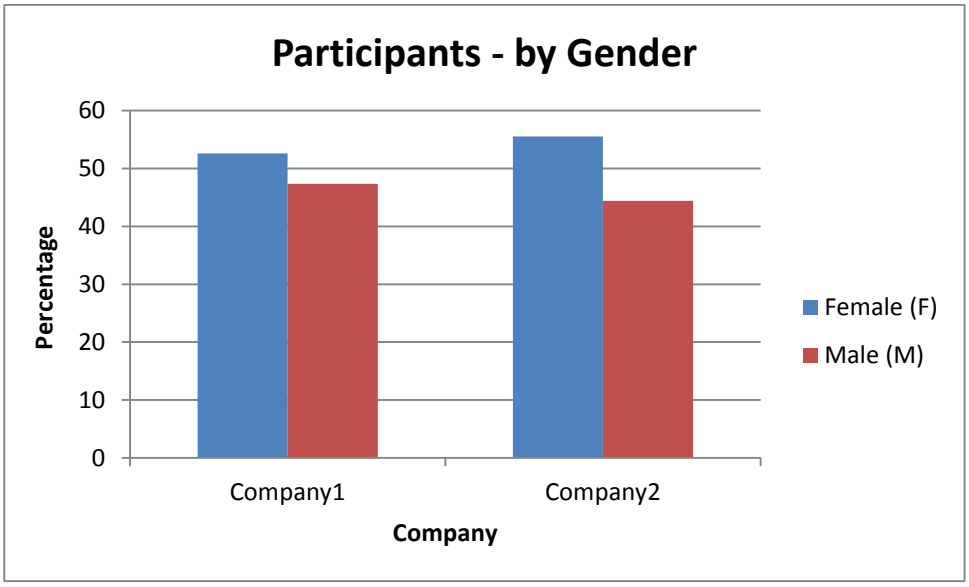

Figure 1: Participants by Gender/Company

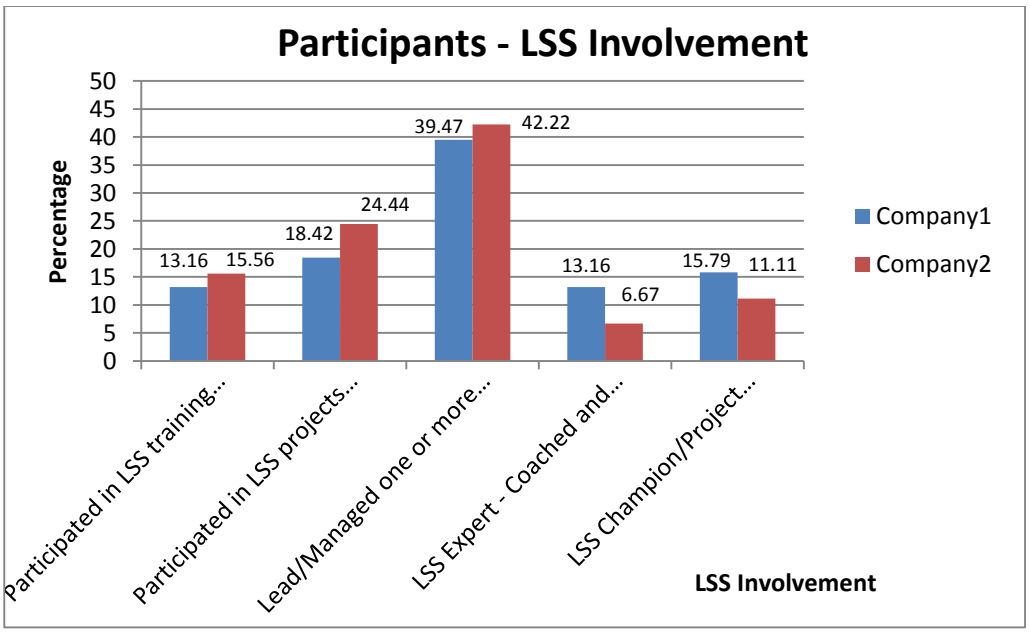

Figure 2: Participants by LSS Involvement Type/Company

4.5 Research strategies

It is imperative for the researcher to have an understanding of the research methodology to be adopted in order to meet the objectives of the study. Different strategies are used in management and business research, and choosing an appropriate strategy or a mixture of strategies depends on the researcher's objectives and questions (Saunders et al., 2012). In this study, the explorative survey research strategy was chosen and quantitative research was conducted through a self-completion questionnaire in order to explore the perceptions of employees on LSS initiatives in their organisations. Selection of this research strategy was motivated by the desire to derive a collective representative view of employees from each organisation. Surveys have been an important and

popular data collection method in lean six sigma and management research fields to statistically validate research hypotheses or research questions (Antony et al., 2007). The method was chosen due to the advantage that the designed questionnaire can be sent to a large number of participants in a limited time.

The importance of reliability and internal validity of a questionnaire was stressed by Saunders et al (2012), as a valid questionnaire enables collecting data that measures the investigated concepts, whereas a reliable questionnaire allows data to be collected consistently. Cronbach's alpha is one of the popular and widely accepted method for measuring the internal consistency of responses to a set of questions (Mitchell, 1996) and a minimum internal consistency threshold of Cronbach's alpha 0.7 is required for reliable responses in research (Hair et al., 2010). However, validity is equally important as it states whether the evidence presented justifies the claims of the study (Fisher, 2007). Saunders et al (2012) argue that, without an internal validity, even when a questionnaire is reliable, it will not be able to answer the research question. All questionnaire scales used in this study were tested for reliability and were found reliable with Cronbach's alpha values above 0.8.

4.6 Strengths and weaknesses of questionnaires

According to Fowler (2002), a questionnaire is a highly structured data collection method that can be used to obtain information about a person's perceptions, feelings, motivations, beliefs, anticipation, or future plans. This

method offers the advantage that the respondents are asked the same set of questions in a predetermined order, thus enabling analysis of the results by statistical methods (Antony et al., 2007). Saunders et al. (2012) argue that questionnaires are the most widely used technique within the survey research strategy and the most popular method of data collection in quantitative research, as they enable the collection of responses from a large sample in a fast, efficient way at a relatively low cost. The study used an on-line questionnaire that was completed by participants without the presence of the researcher. The on-line questionnaire used in the study allowed anonymity, which according to Rubin and Bobbie (2010) encourages genuine and honest responses.

According to Bell (2010), producing a good questionnaire is a difficult process, as it would need to facilitate the collection of accurate data that answers the research questions and enable the researchers to achieve the study objectives. Saunders et al (2012) believe that, the difficulty and the time needed to design, along with ensuring its validity and reliability are the main weaknesses of a questionnaire. Also, high reliability and validity are required to minimise research errors associated with questionnaire. All questionnaire scales used in this study were tested for reliability and were found reliable with Cronbach's alpha values above 0.8. Saunders et al (2012) argued that a pilot testing should be conducted in order to: ensure that data collected answers the research question; and assess the validity and reliability of a questionnaire. The questionnaire used in this study was pilot tested by the author before commencing the main study as suggested by Saunders et all (2012).

4.7 Pilot study

A pilot study was conducted prior to distributing the online questionnaire to the targeted research sample. The aim of the pilot study was to refine the questionnaire to avoid problems in answering the questions by participants, and to avoid problems in recording data (Saunders et al., 2012). The survey questionnaire for this study was pilot tested with 5 of author's colleagues to help establish partakers' understanding of the questions, any problems in answering, attractiveness of the layout, clarity of the instructions, and approximate time needed to complete the questionnaire (Fink, 2009). Participants of pilot study were requested to share their views on the content and design of the questionnaire and also to provide any suggestions. All the feedback and suggestions provided was considered and minor amendments were made to remove certain repetitions and to the layout of the survey. The Likert scale was increased from 5 to 7 point scale to allow for partial agreement or disagreement on the questions. Also, the below two close ended questions were added based on the suggestions received from participants of the pilot study.

1. Do you currently use/intend to use LSS methodology or tools for process improvement efforts irrespective of LSS being successful or sustained at organisation level?
2. The organisation will benefit more by continuing and sustaining LSS initiatives.

4.8 The Survey questionnaire

This research was based on the data collected from a web based self-report survey questionnaire made up of multiple sections and questions. The survey was designed to obtain answers to the specific research questions outlined in chapter 3. A major design consideration while designing a questionnaire is the response format as this will alter the type and wording of the questions and also the type of analysis that the researcher wants to perform (Fowler, 2002). Close-ended question format was chosen for this study as this would enable the data to be in a format quantifiable form ensuring that statistical analysis can be conducted. Moreover, it is: easy to complete; fast; enables automated data entry; facilitates data analysis; and summary of data (Saunders et al., 2012; Fowler, 2002). The Likert scale and ranking were used within this format to obtain answers from participants. Neuman (2003) claims that, the Likert scale would provide a more precise measure than true/false or yes/no items and is fast and easy to complete.

4.8.1 Survey Questionnaire Development

Secondary data from extensive literature review was used to develop the survey questionnaire to gather data as required for the study. The questionnaire developed was reviewed by two LSS experts (MBB holders) to ensure the appropriateness of the design, format and flow of questions in the survey to the objective of the study. Minor amendments were made as per the feedback and suggestions received from the LSS experts to finalise the questionnaire.

The LimeSurvey web based application hosted at NCI was used to create and conduct the on-line survey. The web based survey questionnaire used for this research contained an introduction outlining the reason for this research, emphasising anonymity and confidentiality of the participants, and the voluntary nature of participation. Participants were advised on the number of sections and total number of questions in the survey, and completion of the survey should take no longer than 10 to 15 minutes. This was confirmed during the pilot study. The survey questionnaire is attached in Appendix I.

The questionnaire consists of five sections: 1) General questionnaire; 2) LSS initiatives summary 3) LSS benefits; 4) LSS success and sustainability factors and 5) LSS critical success factors (CSFs) ranking.

4.8.2 General questionnaire

This section of the survey contained close-ended demographic questions to obtain specific information about the respondents and the organisation. Participants were asked questions including their gender, age group, number of years working for the organisation, and their type of involvement with LSS initiatives in their organisation. Questions specific to the organisation were also asked including number of years organisation has been/was using LSS methodology, if LSS expertise is based in-house or provided by a third party vendor, and number of dedicated full time LSS expert resources in the organisation. These demographic questions were asked to understand the characteristics of the sample and obtain information about the participants.

4.8.3 LSS Initiatives Summary

This section of the survey contains specific questions targeted to obtain employee perceptions regarding the performance of LSS initiatives in their organisation. Questions were in the form of clear and concise statements and related to: process improvement is given high importance; LSS initiatives are/were successful; LSS initiatives have been/will be sustained; LSS initiatives have provided expected level of benefits; You use LSS methodology and/or tools irrespective of its' success and sustainability at organisation level; and Organisation would have/will benefit more by continuing and sustaining LSS initiatives. Participants were asked to specify the degree to which they agree with these six items using a 7-point Likert scale that ranged from 1 = strongly disagree to 7 = strongly agree. High scores were indicative of performance of LSS initiatives in the organisation being positive and viewed favourably by employees.

4.8.4 LSS Benefits

This section of the survey contains specific questions targeted to obtain employee perceptions regarding the benefits of LSS initiatives in their organisation. Questions were in the form of clear and concise statements relating to LSS initiatives resulting in: increased process efficiency; effective in reducing waste; considerable reduction in process lead/cycle times; considerable cost reduction; increased customer focus; efficient utilization of resources; increased quality; increased employee productivity; increased customer satisfaction; and

considerable operational and financial gains. Participants were asked to specify the degree to which they agree with these ten items using a 7-point Likert scale that ranged from 1 = strongly disagree to 7 = strongly agree. High scores were indicative of benefits of LSS initiatives in the organisation being positive and viewed favourably by employees.

4.8.5 LSS Success & sustainability factors

This section of the survey contains specific questions targeted to obtain employee perceptions regarding the factors that affect the success and sustainability of LSS initiatives in their organisation. Questions were in the form of clear and concise statements and related to: senior management commitment & involvement; clear vision & long term strategy for LSS initiatives; need for introducing LSS clearly established from start; adequate LSS training; LSS project selection and prioritisation; strong link between LSS initiatives and strategic objectives of company; provision of adequate resources; organisation culture embraces and supports change; effective communication; encouragement and support for employees; realistic goals and timelines; pressure to deliver results; high level of employee engagement; methodology too extensive and time consuming; view LSS as mere set of tools and techniques to solve problems; high level of LSS awareness and its benefits; process for tracking and measuring performance of LSS initiatives; selection process of candidates for LSS training fair and effective; availability of LSS expert help and coaching; HR rewards and recognition system linking to LSS initiatives; open culture and team autonomy; high implementation and training costs

affecting success and sustainability; established continuous improvement culture; and LSS initiatives well integrated into CI culture. Participants were asked to specify the degree to which they agree with these ten items using a 7-point Likert scale that ranged from 1 = strongly disagree to 7 = strongly agree.

4.8.6 LSS Critical Success Factors (CSFs) Ranking

This section of the survey was aimed at gauging employee views on what they believe to be the top 10 critical success factors in terms of their importance to the success and sustainability of LSS initiatives. The section contains one question with 10 CSFs listed, that are drawn from the literature review. Participants were asked to rank the 10 CSFs in the decreasing order of importance (i.e. most important CSF at the top – Rank 1 to least important at the bottom – Rank 10).

4.9 Ethical considerations

Senior management of both companies selected for the research were assured that the company names will remain confidential and will not be made public. All participants were advised that their participation in the survey was voluntary. Participants were also assured that their own identity together with the name of the organisations they work for will remain confidential. Names of the organisations that the author approached and selected for this study may only be revealed during the presentation of the thesis to the examiners, if required; other than this, information will not be stated in this paper, it will not be revealed to

anyone else and will not be made available to the public. All partakers were also advised that a copy of the collected results can be provided on request.

4.10 Distribution methods

There are a number of different distribution methods each associated with different strengths, weaknesses and costs such as distribution: on-line; by post; by face-to-face; by email; and individual or group distribution (Fisher, 2007). In this study selected individuals were introduced and invited to participate in the survey by email, outlining the rationale behind the study. The link to the online survey questionnaire was also included in the email. Two separate survey links were setup with the same questionnaire content and each separate link was sent to employees of company1 and company2 in order to identify the separate data sets for later analysis. The researcher used his contact at both organisations selected for the study to identify and distribute the email to the target participants. The online survey was activated to receive responses in July 2015. A follow up procedure was followed and reminder emails were sent after 5 days, and then 10 days to increase the response rate (Saunders et al, 2012). 54 employees from company1 and 59 employees from company2 were invited to participate in the online survey of which 38 (70%) employees from company1 and 45 (76%) employees completed the survey, resulting in an overall response rate of 73%.

4.11 Error and bias

Firstly, there is a risk of bias in this research as the interviewer works in one of the firms selected for this study. There are two main types of errors that can occur in survey based methods: non-sampling error such as low response rates; and sampling error related to the sample size (McNabb, 2013). Both these errors may have occurred in this study, and should be considered during the data analysis. 54 employees from company1 and 59 employees from company2 were invited to participate in the online survey of which 38 (70%) employees from company1 and 45 (76%) employees completed the survey. This gave an overall response rate of 73%. So, a non-sampling error may have occurred due to the low response rate. According to McNabb (2013), sampling error also referred to as random error decreases when the sample size increases. The size of the sample in this study was 83 participants, so sampling errors should be considered.

As characteristics of the individuals who volunteered to participate in the study could differ from the individuals who did not wish to participate in the study, response bias should be considered (Groves & Peytcheva, 2008). Others factors such as different interpretation of questions, distraction of participants while completing the survey or questionnaire, fatigue and existence some extraneous factors may have impacted the results, so these also should be considered during data analyses (Bryman et al., 2007).

4.12 Method of quantitative data analysis

Data collected through the online survey responses was quantitatively analysed using IBM Statistical Package for Social Sciences (SPSS) version 21. Both descriptive and inferential statistical analyses were conducted using SPSS. Once the survey data collection was complete, all the survey data was exported from the online survey tool in to an Excel format file. The data obtained from the questionnaire was then transformed into a format that is compatible with IBM SPSS. This involved allocating a numerical code to each response in the excel file before transferring the data to IBM SPSS. An error check was conducted after importing the transformed data into SPSS to indicate any missing values. Coded responses were reverse-coded. Composite total scale scores were computed to obtain LSS Initiatives Summary, LSS Benefits and LSS Success and Sustain Factors scale variables. Reliability analysis was performed on items in each scale to determine the Cronbach's alpha values for each scale. Descriptive and normality test was then conducted on each scale to ascertain if the distributions were normal or non-normal. Non-parametric, 2 independent samples test was then performed on each scale to determine existence of any significant differences between the two groups (companies). The Non-parametric, 2 independent samples test was also performed on each item in the scale to determine existence of any significant differences with respect to individual items between the two groups (companies).

4.13 Limitations

The methodology used for this research has a number of limitations. The study used only quantitative methods through a self-report survey questionnaire and hence is open for single source bias (Eisenhardt, 1989). Only employees who have participated in LSS initiatives from the two companies were selected to participate in the on-line survey. Hence, the findings from this study are relevant only to the sample population and do not represent the collective viewpoint of all the employees from the two companies. Also, the survey results were open to the interpretation and bias of the researcher. The research was based on two companies in the services sector and hence the generalisation of results may be questionable or may not be possible.

4.14 Summary of methodology

To answer the research question of investigating the employee perceptions on LSS initiatives in services organisations, the quantitative research methods were chosen in line with previous empirical research conducted in this field (e.g. Antony and Laureani, 2012; Sharma and Chetiya, 2012; Habidin and Yusof, 2013; Antony, Antony and Kumar, 2007; Heckl, Moormann and Rosemann, 2010). A self-administered survey questionnaire was designed based on the literature review and a web based survey was conducted with the sampled employees from the two companies in the services sector identified for the study. Data collected from the on-line survey was analysed by conducting descriptive and inferential statistical tests in IBM SPSS software. No ethical issues or considerations

needed to be accounted for as the on-line survey conducted provided anonymity for participants and names of the companies involved in the study are to remain confidential.

5. Findings

5.1 Introduction

The survey (Appendix I) responses from employees of both company1 and company2 were gathered and analysed to attempt to answer the research questions set out in chapter 3.

The survey was sent to 54 employees in company1 and 59 employees in company2. 38 employees (70%) from company1 and 45 employees (76%) from company2 responded to the survey. This section analyses the findings from the responses received in this survey.

5.2 Descriptive Statistics

Prior to conducting any testing, preliminary analyses were carried out to measure reliability of each variable, and to obtain the basic summary calculations for the sample. Also, checking for any violations of the assumptions underlying each test were completed by conducting descriptive statistics (Pallant, 2013). The

reason for conducting the reliability analysis for each scale was to assess the internal reliability of each scale for the study sample. According to Hair et al (2010), Cronbach's alpha value above 0.7 is considered acceptable, and a value above 0.8 is a preferable measure of internal consistency. In this study, Cronbach's alpha coefficients for each scale were above 0.8. A listing of the questionnaire scales used in the study and their Cronbach's alpha results for company1 and company2 is provided in **Table 2** below.

Scale	Number of Items	Cronbach's alpha	
		Company1	Company2
LSS Initiatives Employee Perceptions	6	0.83	0.808
LSS Benefits Employee Perceptions	10	0.937	0.928
LSS SS Factors Employee Perceptions	25	0.928	0.935

Table 1: Cronbach's alpha for survey questionnaire scales

5.3 Characteristics of the sample population

Descriptive statistics were carried out to obtain the characteristics of the sample population (Pallant, 2013). The characteristics of the sample population have been provided in section 4.4 of chapter 4.

5.4 LSS Initiatives Summary – Employee perceptions

This section attempts to answer the below research question by analysing and presenting the results of the General Questionnaire responses from the survey.

Q1: How does the perceptions of employees on the performance of LSS initiatives in their organisations compare between company1 and company2?

In relation to if any other process improvement methodologies are used in the organisation, 29% of participants from company1 stated that their organisation does use other process improvement methodologies, 63% stated that their organisation does not any other process improvement methodologies and 8% stated that they didn't know if their organisation uses any other process improvement technologies. Whereas from company2, 71% stated that their organisation does use other process improvement methodologies, 5% stated that their organisation does not any other process improvement methodologies and 24% stated that they didn't know if their organisation uses any other process improvement technologies. **Figure 2** below graphically depicts the results.

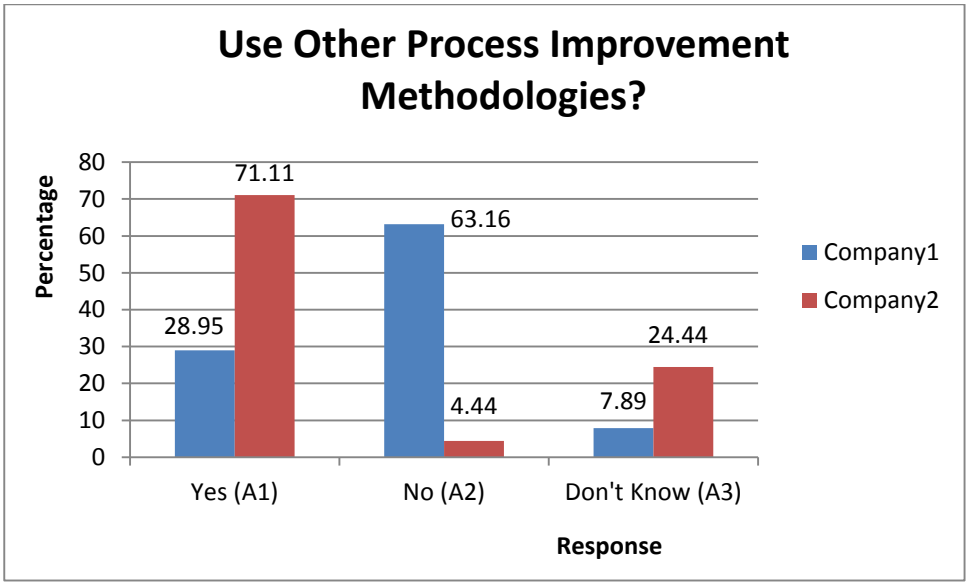

Figure 3: Any other process improvement methodologies used in the organisation?

In relation to if LSS was the preferred methodology for process improvements in the organisation, 100% of participants from company1 stated that LSS is the preferred process improvement methodology in their organisation. Whereas from company2, 42% of participants stated that LSS is the preferred process improvement methodology, 53% stated that LSS is not the preferred process improvement methodology and 5% didn't know if LSS is the preferred process improvement methodology. **Figure 3** below graphically depicts the results.

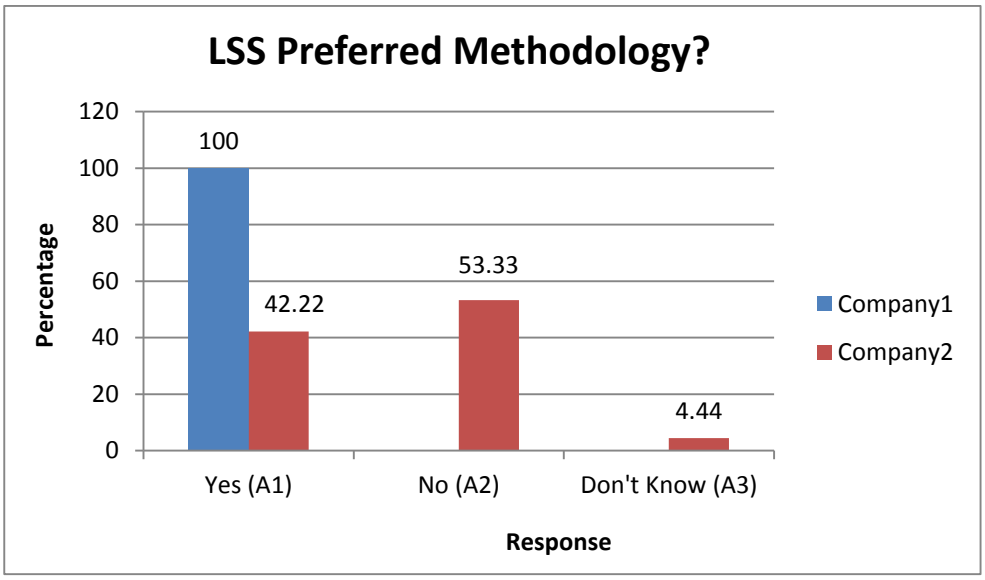

Figure 4: Is LSS the preferred process improvement methodology?

5.4.1 LSS Initiatives Summary Scale Reliability Results

This section presents the results of a reliability analysis conducted on the LSS Initiatives Summary Scale variable for company1 and company2. The results are presented in tables below with **Table 3** presenting the case summary and **Table 4** presenting the Reliability results. 38 valid cases were considered and a Cronbach's Alpha value of **0.830** was identified for company1 and 45 valid cases

were considered and a Cronbach's Alpha value of **0.808** was identified for company2 for the LSS Initiatives Summary Scale that consisted of 6 items.

Case Processing Summary

Company			N	%
Company1	Cases	Valid	38	100.0
		Excluded[a]	0	.0
		Total	38	100.0
Company2	Cases	Valid	45	100.0
		Excluded[a]	0	.0
		Total	45	100.0

a. Listwise deletion based on all variables in the procedure.

Table 2: LSS Initiatives Summary Scale Case Summary

Reliability Statistics

Company	Cronbach's Alpha	N of Items
Company1	.830	6
Company2	.808	6

Table 3: LSS Initiatives Scale Reliability

5.4.2 LSS Initiatives Employee Perceptions Differences

The study involved a total of 83 employees of which 38 were from company1 and 45 were from company2. A case summary is presented in **Table 4** and Histograms of the distributions of LSS initiatives employee perceptions scale responses for both company1 and company2 are shown in **Figure 5** and **Figure 6** respectively in Appendix II. All associated descriptive statistics for both company1 and company2 are shown in **Table 5** in Appendix II.

The results of Tests of Normality are presented in **Table 6** below. As the sample sizes for both company1 and company2 are less than 2000, we rely on the results of the Shapiro-Wilk's test of normality for inferring the presence or absence of normality in both the company1 and company2 sample distributions. With the Shapiro-Wilk's test of normality, the null hypothesis associated assumes

normality of the sample under consideration (**p > 0.05**). The results indicate significant deviations from normality for company1 (**$W_{COMPANY1}$ = 0.886, df = 38, p = 0.001**), and no deviations from normality for company2 (**$W_{COMPANY2}$ = 0.971, df = 45, p = 0.307**).

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Company	Statistic	df	Sig.	Statistic	df	Sig.
LSSInitiativesSummaryScale	Company1	.180	38	.003	.886	38	.001
	Company2	.089	45	.200*	.971	45	.307

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 6: LSS Initiatives Summary Normality Results

Due to identified deviations in normality between sample distributions of company1 and company2, the Mann-Whitney U test was relied upon to test if there exists significant differences in perceptions of employees on LSS initiatives between company1 and company2. In particular, the Mann-Whitney U test tests for differences in mean ranks of both groups. The null hypothesis associated with the Mann-Whitney U test being one of no difference between mean ranks (**p > 0.05**). The results of this test are shown in **Tables 7** and **8**. The results of the Mann-Whitney U test indicate that there exists significant differences between the perceptions of employees on LSS initiatives from company1 (**Mean Rank = 50.21**) compared to perceptions of employees from company2 (**Mean Rank = 35.07**), (**U = 543.0, p = 0.004**).

Ranks

	Company	N	Mean Rank	Sum of Ranks
LSSInitiativesSummaryScale	Company1	38	50.21	1908.00
	Company2	45	35.07	1578.00
	Total	83		

Table 7: Mann-Whitney Test Mean Ranks

Test Statistics[a]

	LSSInitiativesSummaryScale
Mann-Whitney U	543.000
Wilcoxon W	1578.000
Z	-2.863
Asymp. Sig. (2-tailed)	.004

a. Grouping Variable: Company

Table 8: Mann-Whitney Test Statistics

5.4.3 LSS Initiatives Summary Differences by Items

In order to further explore the perceptions of employees with respect to each individual question in the LSS initiatives Summary scale and to ascertain where the perceptions significantly differed between company1 and company2, the Mann-Whitney U test was performed on all the 6 items in the scale by having company as the grouping variable. The ranks results of this test are shown in **Table 9** in Appendix II and the test statistics are shown below in **Table 10**.

Test Statistics[a]

	SEPITM1	SEPITM2	SEPITM3	SEPITM4	SEPITM5	SEPITM6
Mann-Whitney U	749.000	601.000	569.500	747.000	826.000	755.000
Wilcoxon W	1784.000	1636.000	1604.500	1782.000	1861.000	1790.000
Z	-1.139	-2.505	-2.689	-1.077	-.282	-.983
Asymp. Sig. (2-tailed)	.255	.012	.007	.281	.778	.325

a. Grouping Variable: Company

Table 10: Mann-Whitney Test Statistics for scale items

The results of the Mann-Whitney U test for each item in the scale indicate that there exist significant differences between perceptions of employees of company1 and company2 in the two areas outlined below.

- SEPITM2 (LSS Successful in the organisation) – Company1 (**Mean Rank = 48.68**), Company2 (**Mean Rank = 36.36**), (**U = 601.0, p = 0.012**).
- SEPITM3 (LSS Sustained in the organisation) – Company1 (**Mean Rank = 49.51**), Company2 (**Mean Rank = 35.66**), (**U = 569.5, p = 0.007**).

The results of the Mann-Whitney U test are summarised for each item along with the mean rank for company1, company2 and Asymp Sig (2-tailed) value in **Table 11** below.

LSS Initiatives Scale Item	Item Description	Mean Rank		Mann-Whitney Asymp. Sig. (2-Tailed)
		Mean Rank-Company1	Mean Rank-Company2	
SEPITM1	Process Improvement	44.79	39.64	0.255
SEPITM2	LSS Successful	48.68	36.36	**0.012***
SEPITM3	LSS Sustained	49.51	35.66	**0.007***
SEPITM4	Expected Benefits Met	44.84	39.6	0.281
SEPITM5	LSS Use/Practice	42.76	41.36	0.778
SEPITM6	Continue & Sustain LSS	44.63	39.78	0.325

Table 11: Summary of Mann-Whitney Test Results **(* p < 0.05)**

In addition to the statistical testing, **Figure 7** below visually demonstrates the differences in mean ranks for each item and existence of significant differences in the areas of LSS Successful and LSS Sustained between company1 and company2.

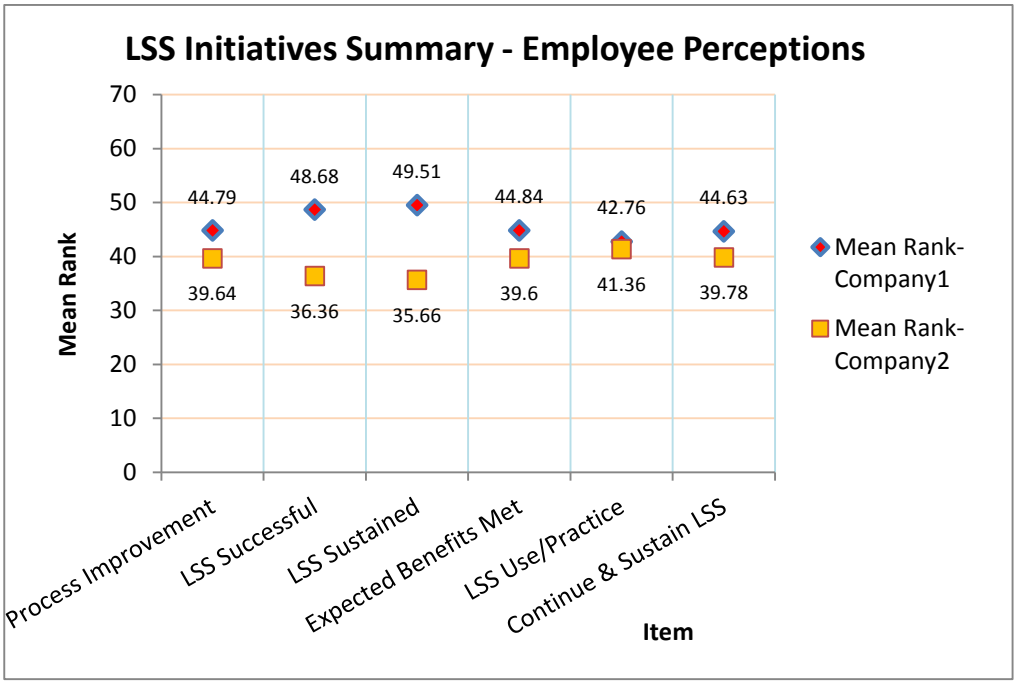

Figure 7: LSS Initiatives Summary – Mean Ranks comparison for Scale Items

The results suggest that, the views of employees from company1 were more positive across all areas for the performance of LSS initiatives in their organisation compared to employees from company2. Below interpretations can be made from the results.

- Employees of company1 were more or less in agreement with: process improvement is given high importance; LSS initiatives have been successful; LSS initiatives have been and will be sustained; expected benefits were met from the LSS initiatives; currently use and intend to continue to use LSS methodology and tools in process improvements; and organisation will benefit more by continuing and sustaining LSS initiatives.

- Whereas employees of company2 were more or less in disagreement with: LSS initiatives have been successful; LSS initiatives have been and will be sustained; and less in agreement with: process improvement is given high importance; expected benefits were met from the LSS initiatives; and organisation will benefit more by continuing and sustaining LSS initiatives.

- It is important to note that, employees of both company1 and company2 were more or less in agreement with: they currently use and intend to continue to use LSS methodology and tools in process improvements irrespective of whether the LSS initiatives are successful or sustained at an organisational level.

5.5 LSS Benefits – Employee Perceptions

This section attempts to answer the below research question by analysing and presenting the results of the LSS benefits section responses from the survey.

Q2: How does the perceptions of employees on the benefits of LSS initiatives in their organisations compare between company1 and company2?

5.5.1 LSS Benefits Employee Perceptions Scale Reliability Results

This section presents the results of a reliability analysis conducted on the LSS Benefits Employee Perceptions Scale variable for company1 and company2. The results are presented in tables below with **Table 12** presenting the case summary

and **Table 13** presenting the Reliability results. 38 valid cases were considered and a Cronbach's Alpha value of **0.937** was identified for company1 and 45 valid cases were considered and a Cronbach's Alpha value of **0.928** was identified for company2 for the LSS Benefits employee perceptions Scale that consisted of 10 items.

Case Processing Summary

Company			N	%
Company1	Cases	Valid	38	100.0
		Excluded[a]	0	.0
		Total	38	100.0
Company2	Cases	Valid	45	100.0
		Excluded[a]	0	.0
		Total	45	100.0

a. Listwise deletion based on all variables in the procedure.

Table 12: LSS Benefits Scale Case Summary

Reliability Statistics

Company	Cronbach's Alpha	N of Items
Company1	.937	10
Company2	.928	10

Table 13: LSS Benefits Scale Reliability

5.5.2 LSS Benefits Employee Perceptions Differences

The study involved a total of 83 employees of which 38 were from company1 and 45 were from company2. A case summary is presented in **Table 14** and Histograms of the distributions of LSS Benefits employee perceptions scale responses for both company1 and company2 are shown in **Figure 8** and **Figure 9** respectively in Appendix II. All associated descriptive statistics for both company1 and company2 are shown in **Table 15** in Appendix II.

The results of Tests of Normality are presented in **Table 16** below. As the sample sizes for both company1 and company2 are less than 2000, we rely on the results of the Shapiro-Wilk's test of normality for inferring the presence or absence of

normality in both the company1 and company2 sample distributions. With the Shapiro-Wilk's test of normality, the null hypothesis associated assumes normality of the sample under consideration (**p > 0.05**). The results indicate significant deviations from normality for both company1 (**$W_{COMPANY1}$ = 0.775, df = 38, p = 0.000**), and for company2 (**$W_{COMPANY2}$ = 0.917, df = 45, p = 0.003**).

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Company	Statistic	df	Sig.	Statistic	df	Sig.
LSSBenefitsScale	Company1	.235	38	.000	.775	38	.000
	Company2	.163	45	.004	.917	45	.003

a. Lilliefors Significance Correction

Table 16: LSS Benefits employee perceptions Normality Results

Due to identified deviations in normality between sample distributions of company1 and company2, the Mann-Whitney U test was relied upon to test if there exists significant differences in perceptions of employees on LSS Benefits between company1 and company2. In particular, the Mann-Whitney U test tests for differences in mean ranks of both groups. The null hypothesis associated with the Mann-Whitney U test being one of no difference between mean ranks (**p > 0.05**). The results of this test are shown in **Tables 17** and **18**. The results of the Mann-Whitney U test indicate that no significant differences exists between the perceptions of employees on LSS benefits from company1 (**Mean Rank = 38.47**) compared to perceptions of employees from company2 (**Mean Rank = 44.98**), (**U = 721.0, p = 0.219**).

Ranks

	Company	N	Mean Rank	Sum of Ranks
LSSBenefitsScale	Company1	38	38.47	1462.00
	Company2	45	44.98	2024.00
	Total	83		

Table 17: Mann-Whitney Test Mean Ranks

Test Statistics[a]

	LSSBenefitsScale
Mann-Whitney U	721.000
Wilcoxon W	1462.000
Z	-1.230
Asymp. Sig. (2-tailed)	.219

a. Grouping Variable: Company

Table 18: Mann-Whitney Test Statistics

5.5.3 LSS Benefits Differences by Items

In order to further explore the perceptions of employees with respect to each individual question in the LSS Benefits scale and to ascertain where the perceptions significantly differed between company1 and company2, the Mann-Whitney U test was performed on all the 10 items in the scale by having company as the grouping variable. The ranks results of this test are shown in **Table 19** in Appendix II and the test statistics are shown below in **Table 20**.

Test Statistics[a]

	BITM1	BITM2	BITM3	BITM4	BITM5	BITM6	BITM7	BITM8	BITM9	BITM10
Mann-Whitney U	770.500	837.000	699.500	652.500	778.500	716.000	816.500	767.000	701.000	682.000
Wilcoxon W	1511.500	1872.000	1440.500	1393.500	1519.500	1457.000	1557.500	1802.000	1442.000	1423.000
Z	-.923	-.186	-1.637	-2.020	-.902	-1.473	-.540	-1.042	-1.615	-1.737
Asymp. Sig. (2-tailed)	.356	.853	.102	.043	.367	.141	.589	.297	.106	.082

a. Grouping Variable: Company

Table 20: LSS Benefits Scale Items Mann-Whitney Test Statistics

The results of the Mann-Whitney U test for each item in the scale indicate that there exist significant differences between perceptions of employees of company1 and Company2 in one area outlined below.

- BITM4 (Cost reduction) – Company1 (**Mean Rank = 36.67**), Company2 (**Mean Rank = 46.5**), (**U = 652.5, p = 0.043**).

The results of the Mann-Whitney U test are summarised for each item along with the mean rank for company1, company2 and Asymp Sig (2-tailed) value in **Table 22** below.

LSS Benefits Scale Item	Item Description	Mean Rank		Mann-Whitney Asymp. Sig. (2-Tailed)
		Company1	Company2	
BITM1	Increased Process efficiency	39.78	43.88	0.356
BITM2	Effective in reducing waste	42.47	41.6	0.853
BITM3	Reducing process Lead/Cycle Times	37.91	45.46	0.102
BITM4	Considerable cost reduction	36.67	46.5	**0.043***
BITM5	Increased Customer focus	39.99	43.7	0.367
BITM6	Efficient resource utilization	38.34	45.09	0.141
BITM7	Increased quality	40.99	42.86	0.589
BITM8	Increased employee productivity	44.32	40.04	0.297
BITM9	Increased customer satisfaction	37.95	45.42	0.106
BITM10	Considerable Operational & financial gains	37.45	45.84	0.082

Table 21: Summary of Mann-Whitney Test Results **(* p < 0.05)**

In addition to the statistical testing, **Figure 10** below visually demonstrates the comparison of employee perceptions based on mean ranks for each item and existence of significant differences in the areas of Cost reduction between company1 and company2.

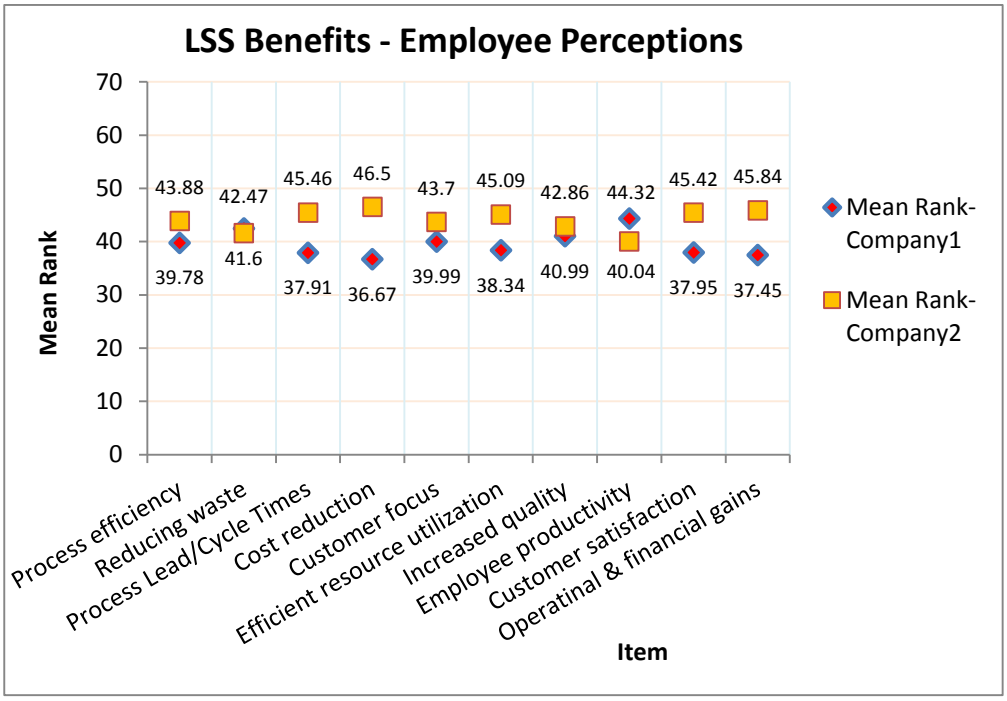

Figure 10: LSS Benefits– Mean Ranks comparison of Scale Items

The results suggest that, the views of employees from company2 were a little more upbeat across most areas of LSS benefits to the organisation compared to the views of employees from company2. Below points can be noted from the results.

- Employees of both company1 and company2 are more or less on agreement that LSS initiatives have resulted in: increased process efficiency; waste reduction; increased customer focus; increased quality; and increased employee productivity.
- There is more belief by employees of company2 than employees of company1 that LSS initiatives have resulted in: considerable reduction in process lead/cycle times; considerable cost reduction; resulting in

efficient utilization of resources; customer satisfaction; and results in considerable operational & financial gains.

- Employees of company1 were less in agreement with LSS initiatives resulting in significant cost reductions compared to company2 whose views were slightly more positive.

5.6 LSS Success and Sustainability Factors

This section attempts to answer the below research question by analysing and presenting the results of the LSS Success and Sustainability factors section responses from the survey.

Q3: How does the perceptions of employees on the factors affecting the success and sustainability of LSS initiatives in their organisations compare between company1 and company2?

5.6.1 LSS Success and Sustainability Factors Scale Reliability Results

This section presents the results of a reliability analysis conducted on the LSS Success and Sustainability Employee Perceptions Scale variable for company1 and company2. The results are presented in tables below with **Table 22** presenting the case summary and **Table 23** presenting the Reliability results. 38 valid cases were considered and a Cronbach's Alpha value of **0.928** was identified for company1 and 45 valid cases were considered and a Cronbach's Alpha value of **0.935** was identified for company2 for the LSS Success and Sustainability Employee Perceptions Scale that consisted of 25 items.

Case Processing Summary

Company			N	%
Company1	Cases	Valid	38	100.0
		Excluded[a]	0	.0
		Total	38	100.0
Company2	Cases	Valid	45	100.0
		Excluded[a]	0	.0
		Total	45	100.0

a. Listwise deletion based on all variables in the procedure.

Table 22: LSS Success and Sustain Factors Scale Case Summary

Reliability Statistics

Company	Cronbach's Alpha	N of Items
Company1	.928	25
Company2	.935	25

Table 23: LSS Success and Sustain Factors Scale Reliability

5.6.2 LSS Success and Sustainability Factors Differences

The study involved a total of 83 employees of which 38 were from company1 and 45 were from company2. A case summary is presented in **Table 24** and Histograms of the distributions of LSS Success and Sustainability factors scale responses for both company1 and company2 are shown in **Figure 11** and **Figure 12** respectively in Appendix II. All associated descriptive statistics for both company1 and company2 are shown in **Table 25** in Appendix II.

The results of Tests of Normality are presented in **Table 26** below. As the sample sizes for both company1 and company2 are less than 2000, we rely on the results of the Shapiro-Wilk's test of normality for inferring the presence or absence of normality in both the company1 and company2 sample distributions. With the Shapiro-Wilk's test of normality, the null hypothesis associated assumes normality of the sample under consideration (**$p > 0.05$**). The results indicate significant deviations from normality for company1 (**$W_{COMPANY1} = 0.727$, $df = 38$, $p = 0.000$**), and no deviations from normality for company2 (**$W_{COMPANY2} = 0.972$, $df = 45$, $p = 0.355$**).

Tests of Normality

		Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Company	Statistic	df	Sig.	Statistic	df	Sig.
LSSSuccessSustainFactorsScale	Company1	.231	38	.000	.727	38	.000
	Company2	.098	45	.200*	.972	45	.355

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 26: LSS Success and Sustainability Factors Normality Results

Due to identified deviations in normality between sample distributions of company1 and company2, the Mann-Whitney U test was relied upon to test if there exists significant differences in perceptions of employees on LSS Success and Sustainability factors between company1 and company2. In particular, the Mann-Whitney U test tests for differences in mean ranks of both groups. The null hypothesis associated with the Mann-Whitney U test being one of no difference between mean ranks (**p > 0.05**). The results of this test are shown in **Tables 27** and **28**. The results of the Mann-Whitney U test indicate that there exists significant differences between the perceptions of employees on LSS success and sustainability factors from company1 (**Mean Rank = 52.64**) compared to perceptions of employees from company2 (**Mean Rank = 33.01**), (**U = 450.500, p = 0.000**).

Ranks

	Company	N	Mean Rank	Sum of Ranks
LSSSuccessSustainFactorsScale	Company1	38	52.64	2000.50
	Company2	45	33.01	1485.50
	Total	83		

Table 27: Mann-Whitney Test Mean Ranks

Test Statistics[a]

	LSSSuccessSustainFactorsScale
Mann-Whitney U	450.500
Wilcoxon W	1485.500
Z	-3.699
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: Company

Table 28: Mann-Whitney Test Statistics

5.6.3 LSS Success and Sustainability Factors Differences by Items

In order to further explore the perceptions of employees with respect to each individual question in the LSS Success and Sustain Factors scale and to ascertain where the perceptions significantly differed between company1 and company2, the Mann-Whitney U test was performed on all the 25 items in the scale by having company as the grouping variable. The ranks results of this test are shown in **Table 29** and test statistics are shown in **Table 30 in** Appendix II.

The results of the Mann-Whitney U test are summarised for each item along with the mean rank for company1, company2 and Asymp Sig (2-tailed) value in **Table 31** below. The results indicate that there exist significant differences between perceptions of employees of company1 and Company2 in the areas highlighted in **Table 31** where the Mann-Whitney Asymp Sig value is less than 0.05 (**p< 0.05**).

Item	Description	Mean Rank		Mann Whitney Asymp. Sig. (2-tailed)
		Company1	Company2	
SSITM1	Senior management commitment & involvement	55.58	30.53	**0.00***
SSITM2	Clear vision & long term strategy	51.75	33.77	**0.00***
SSITM3	Need for introducing LSS established from start	54.82	31.18	**0.00***
SSITM4	Adequate LSS training	48.34	36.64	**0.006***
SSITM5	LSS project selection & prioritisation	45.7	38.88	0.122
SSITM6	Strong link between LSS initiatives & strategic objectives of company	48.11	36.84	**0.02***
SSITM7	Allocation of adequate resources	45.17	39.32	0.227
SSITM8	Organisation culture supporting change	42.24	41.8	0.919
SSITM9	Effective communication	51.43	34.03	**0.001***
SSITM10	Support & encouragement from top management	55.29	30.78	**0.00***
SSITM11	Realistic goals & timelines	42.55	41.53	0.834
SSITM12	Pressure to deliver results quickly	50.42	34.89	**0.002***
SSITM13	High level of employee engagement & participation	45.74	38.84	0.094
SSITM14	LSS methodology too extensive & time consuming	47.53	37.33	**0.049***
SSITM15	Employees view LSS as mere set of tools, techniques to solve problems	37.09	46.14	**0.042***
SSITM16	LSS awareness and benefits	54.38	31.54	**0.00***
SSITM17	Process to track & measure LSS projects performance	48.67	36.37	**0.008***
SSITM18	Effective execution & project management	44.84	39.6	0.275
SSITM19	Effective & fair process for selecting candidates for LSS training	43	41.16	0.718
SSITM20	Availability of LSS expert help & coaching	42.29	41.76	0.891
SSITM21	HR rewards & recognition linked to LSS initiatives	39.13	44.42	0.284
SSITM22	Open culture & team autonomy	50.93	34.46	**0.001***
SSITM23	High implementation & training costs affecting success & sustainability	34.82	48.07	**0.01***
SSITM24	Established continuous improvement culture	42.97	41.18	0.698
SSITM25	LSS initiatives well integrated into the continuous improvement culture	50.08	35.18	**0.004***

Table 31: Summary of Mann-Whitney Test Results **(* p < 0.05)**

In addition to the statistical testing, **Figure 12** below visually demonstrates the comparison of employee perceptions based on mean ranks for each item and existence of significant differences in the areas outlined above between company1 and company2.

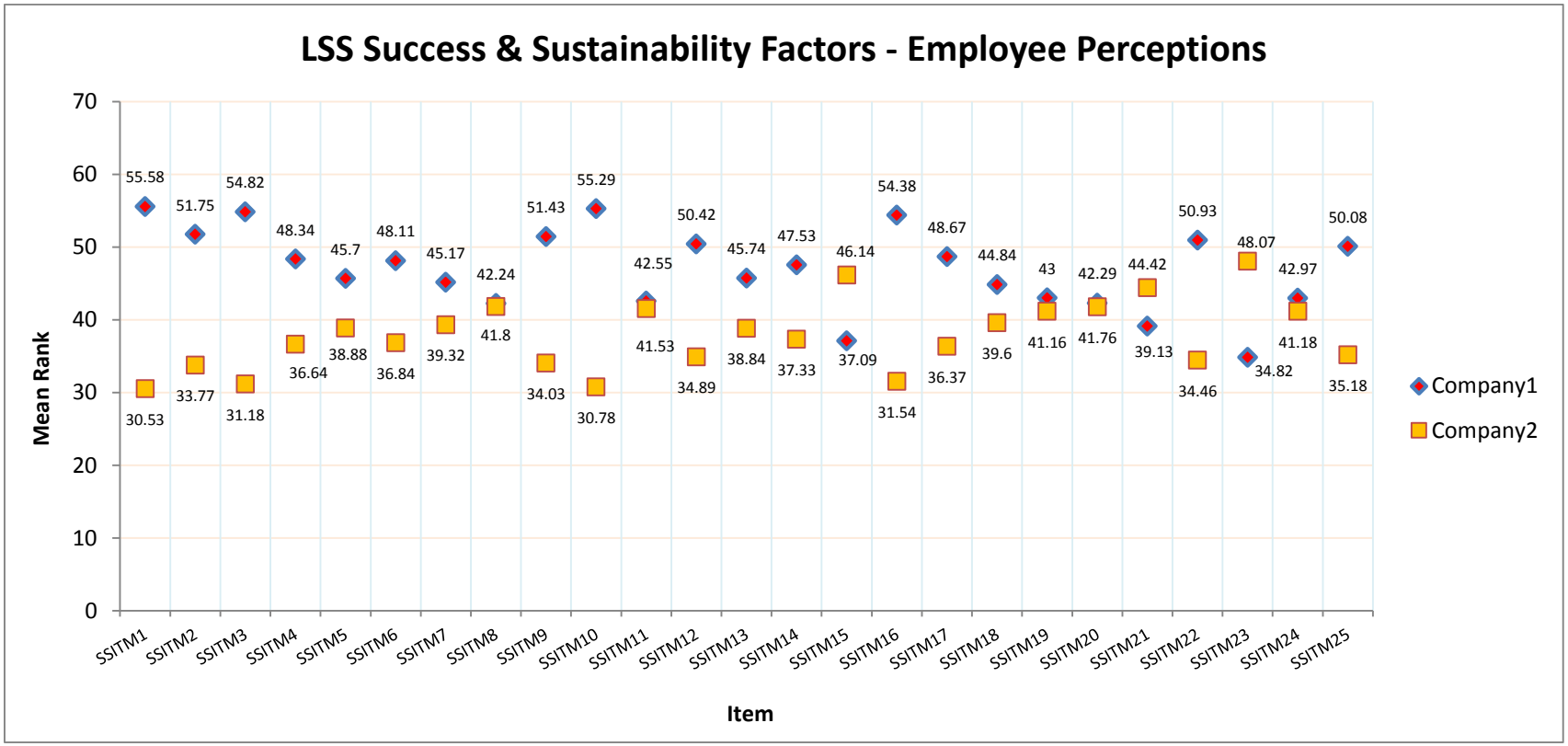

Figure 13: LSS Success and Sustainability Factors – Mean Ranks plot of Scale Items

The results suggest that there is a broad level of agreement from employees of company1 across all factors that affect the success and sustainability of LSS initiatives with the exception of the two factors: Employees view LSS as mere set of tools, techniques to solve problems; and High implementation & training costs affecting success & sustainability, where the scores were lower. Lower scores for these factors meant that these factors were acting as enablers. Whereas the employees from company2 were less in agreement with most of the factors with the exception of the factors: Employees view LSS as mere set of tools, techniques to solve problems; and High implementation & training costs affecting success & sustainability, where higher scores meant these factors acted like the barriers.

In addition, it is important to note the below from the results.

- The scores from company2 were below par on factors: senior management commitment & involvement; clear vision & long term strategy; need for introducing established from start; management support & encouragement for employees to participate in LSS initiatives; and creation of high level of awareness & its' benefits to the organisation, which suggested that there was a lack in these key enabling factors that contribute to the success and sustainability of LSS initiatives. Whereas, much higher scores from company1 on the same factors indicate that, these key enabling factors were either met or present.

- The views of employees from both company1 and company2 were more or less in agreement with factors: organisation culture supports change; goals and timelines set for LSS projects were realistic; selection process for candidates to participate in LSS training was fair; availability of adequate LSS expert help & coaching; established continuous improvement culture in the organisation.
- There is more belief by employees of company1 compared to employees of company2 with regards to: adequate LSS training; LSS project selection based on suitability and prioritisation; strong link between LSS initiatives & strategic objectives of the company; provision for adequate resources; effective communication by top management on LSS initiatives; high level of employee engagement & participation; well-defined process for tracking and measuring LSS projects performance; creation of open culture for LSS initiatives and providing team autonomy by top management; LSS initiatives well integrated in the continuous improvement culture.
- Employees of both company1 and company2 were less in agreement with existence of a well-defined HR rewards and recognition system linking to LSS initiatives.
- Employees of company1 believed more that they are under pressure to deliver results for LSS initiatives, and LSS methodology is too extensive and time consuming compared to employees of company2.

5.7 LSS Critical Success Factors (CSFs)

This section attempts to answer the below research question by analysing and presenting the results of the LSS critical success factors ranking section responses from the survey.

Q4: How does the ranking of Top 10 Critical Success Factors (CSFs) that affect the success of LSS initiatives compare between company1 and company2?

5.7.1 LSS Critical Success Factors (CSFs) Ranking

This section presents the results from the ranking of top 10 LSS critical success factors (CSFs) for Company1 and Company2. To ascertain how employees ranked the top 10 CSFs, number of responses rating each CSF at each Rank level was calculated and multiplied with a weighted number corresponding to each rank level to compute a weighted score. Number of Rank1 responses for a CSF was multiplied by a weighted number 1, rank2 responses by 2, rank3 responses by 3 so on up to rank10. The weighted scores for all 10 rank levels were then added for each CSF to arrive at a Total weighted score. The CSF with the lowest total weighted score would be the one that is regarded by employees as the most important CSF; second lowest will be the second most important CSF and so on that affect the success of LSS initiatives. The results of this analysis for Company1 and Company2 are presented below in **Table 32** and **Table 33** respectively.

CSF - Comapny1	Rank1	Rank2	Rank3	Rank4	Rank5	Rank6	Rank7	Rank8	Rank9	Rank10	Total Score
1: Senior Management Commitment, participation and support	16	32	15	4	0	0	0	0	0	0	67
2: Organization culture supporting change	3	8	36	52	15	6	0	16	0	0	136
3: A clear vision and long term plan for LSS initiatives linking to business strategy	18	20	6	16	15	6	0	0	0	0	81
4: LSS awareness, training & education	0	8	39	60	15	6	0	8	0	10	146
5: Sufficient & clear allocation of resources (financial, human & systems)	0	0	0	4	45	102	70	0	9	0	230
6: Linking LSS initiatives with HR rewards and recognition	0	0	0	4	20	24	56	88	45	50	287
7: LSS projects selection & prioritization	0	2	6	0	55	42	42	16	63	20	246
8: An effective communication plan	0	0	3	0	0	12	49	96	81	70	311
9: Tracking and review of LSS projects & performance	0	2	0	4	0	6	0	24	117	190	343
10: LSS initiatives embedded & integrated with continuous improvement culture	1	4	9	8	25	24	49	56	27	40	243

Table 32: LSS Critical Success Factors (CSFs) – Company1

CSF - Company2	Rank1	Rank2	Rank3	Rank4	Rank5	Rank6	Rank7	Rank8	Rank9	Rank10	Total Score
1: Senior Management Commitment, participation and support	18	36	6	12	5	0	7	8	9	0	101
2: Organization culture supporting change	6	14	30	60	25	0	14	0	0	0	149
3: A clear vision and long term plan for LSS initiatives linking to business strategy	19	16	21	16	0	6	7	0	27	20	132
4: LSS awareness, training & education	1	10	45	48	10	30	14	16	9	0	183
5: Sufficient & clear allocation of resources (financial, human & systems)	0	2	3	8	30	90	63	56	18	20	290
6: Linking LSS initiatives with HR rewards and recognition	0	2	3	4	15	24	63	80	36	120	347
7: LSS projects selection & prioritization	0	2	6	8	55	66	63	24	45	10	279
8: An effective communication plan	0	4	3	12	5	24	28	40	135	100	351
9: Tracking and review of LSS projects & performance	0	0	0	4	10	18	21	64	117	150	384
10: LSS initiatives embedded & integrated with continuous improvement culture	1	4	18	8	70	12	35	72	9	30	259

Table 33: LSS Critical Success Factors (CSFs) – Company2

The top 10 CSFs in order of importance were arrived at for both company1 and company2 by sorting the total weighted score in ascending order. The results are summarised below in **Table 34**.

CSF Rank	**Company1**		**Company2**	
Rank	CSF	Total Score	CSF	Total Score
1	Senior Management Commitment, participation and support	67	Senior Management Commitment, participation and support	101
2	A clear vision and long term plan for LSS initiatives linking to business strategy	81	A clear vision and long term plan for LSS initiatives linking to business strategy	132
3	Organization culture supporting change	136	Organization culture supporting change	149
4	LSS awareness, training & education	146	LSS awareness, training & education	183
5	Sufficient & clear allocation of resources (financial, human & systems)	230	LSS initiatives embedded & integrated with continuous improvement culture	259
6	LSS initiatives embedded & integrated with continuous improvement culture	243	LSS projects selection & prioritization	279
7	LSS projects selection & prioritization	246	Sufficient & clear allocation of resources (financial, human & systems)	290
8	Linking LSS initiatives with HR rewards and recognition	287	Linking LSS initiatives with HR rewards and recognition	347
9	An effective communication plan	311	An effective communication plan	351
10	Tracking and review of LSS projects & performance	343	Tracking and review of LSS projects & performance	384

Table 34: LSS Critical Success Factors (CSFs) – Combined Summary

The results indicate that, the views of employees from both company1 and company2 are well aligned with respect to the top 4 and bottom 3 CSFs in terms of their importance and criticality to the success of LSS initiatives. The 5^{th}, 6^{th} and 7^{th} most important CSFs slightly differ between company1 and company2. The below four CSFs were rated as the first, second, third and fourth most important CSFs by employees of both company1 and company2.

1. Senior Management Commitment, participation and support
2. A clear vision and long term plan for LSS initiatives linking to business strategy
3. Organization culture supporting change
4. LSS awareness, training & education

6. Discussion

6.1 Introduction

This chapter focusses on analysing the results from the survey with respect to the four research questions identified for this study and outlined in chapter 3. The academic literature was also used to answer the research questions along with the survey results.

6.2 LSS initiatives summary

This section attempts to answer the below research question by analysing the survey results presented in the previous chapter.

Q1: How does the perceptions of employees on the performance of LSS initiatives in their organisations compare between company1 and company2?

There is strong evidence from the results that employees of company2 did not believe that the LSS initiatives were successful or have been sustained. In contrary, employees of company1 believe the LSS initiatives have been more or less successful and have been sustained. Survey results indicate that these are the two areas that the views of employees significantly differed between company1 and company2. Furthermore, employees of company1 believed more that: process improvement is given high importance in the organisation; expected level of benefits have been met from the LSS initiatives; and the organisation

will benefit more by continuing and sustaining the LSS initiatives; when compared to employees of company2.

It is imperative that, for any process improvement methodologies like LSS to be embraced and successful, process improvement is made a high priority and given high importance in the organisation. The literature clearly outlines the significance of making process improvement a high priority in organisations in order for LSS change efforts to succeed and sustain. Academic literature suggested that companies abandon the change efforts if the method does not seem to provide clear evidence of expected results in terms of performance Naslund (2008). It is evident from the survey results that, these two key factors seem to be lacking in company2 but present in company1, which would explain why the LSS initiatives were not successful and have not been sustained in company2 whereas LSS initiatives were successful and have been sustained in company1.

Also, there is strong evidence from the survey results that, no other process improvement methodologies were being used at company1 and LSS was the preferred process improvement methodology. This suggests that, there appears to be a strong commitment and focus on LSS at the organisational level and to use LSS for all process improvement efforts and projects. On contrary, there was strong evidence to support that other process improvement methodologies were being used at company2 and LSS was not the preferred methodology for process improvements. This suggests either a lack of serious commitment to LSS at the organisation level or the organisation shifting its focus from sticking exclusively

to one methodology to adopting multiple methodologies and choosing one that best fits based on the situation and requirements.

One interesting point to note from the results is, there was a broad level of agreement between the views of employees from both company1 and company2 that, they currently use and intend to use LSS methodology and/or tools for process improvement efforts irrespective of whether LSS initiatives are successful or sustained at organisation level. While this is implied for company1 as no other methodologies are being used and LSS is the preferred methodology; for company2 this indicates that there's still a preference for LSS at the employee level even though it is not successful and sustained at the organisation level.

6.3 LSS benefits

This section attempts to answer the below research question by analysing the survey results presented in the previous chapter.

Q2: How does the perceptions of employees on the benefits of LSS initiatives in their organisations compare between company1 and company2?

The results indicate that the views of employees from both company1 and company2 were broadly aligned and did not differ significantly with respect to the overall benefits of LSS initiatives in the organisations. The literature clearly outlines that LSS provides better quality in the services industry by increasing quality and reducing cost of service delivery simultaneously thus leading to increased efficiency. Increased efficiency will eventually cost less by making the

best use of the resources available in the company (Psychogios et al. 2012, De Koning et al., 2008).

However, there seems to be more belief from employees of company2 with respect to the realisation of benefits from LSS initiatives such as: increased process efficiency; reduction in process lead/cycle times; cost reduction; increased customer focus; efficient resource utilization; increased quality; increased customer satisfaction; and operational & financial gains, whereas employees from company1 did not show the same level of belief.

Furthermore, the views differed significantly on cost reduction and slightly less significantly on operational & financial gains, whereby employees of company2 believed cost reduction and operational & financial gains are more realised than employees of company1. The literature supports that LSS will reduce cost, increase profit and add value to an organisation in the long run. As company1 has been using LSS for a longer period than company2, employee beliefs on LSS benefits should have been more favourable.

The views were broadly aligned with respect to the realisation of waste reduction, increased customer focus and employee productivity.

It is interesting to note that employees of company1 largely believed that the LSS initiatives were successful and have been sustained, but believe less with respect to the realisation of benefits from the LSS initiatives. Whereas, employees of company2 largely believed that LSS initiatives were not successful

and have not been sustained, but believe more with regards to the realisation of LSS benefits.

6.4 LSS factors affecting success and sustainability

The literature outlines various factors that affect the success and sustainability of LSS initiatives. These factors could act as enablers or barriers to the success and sustainability of LSS depending on whether they are met or not met in the organisation. This section attempts to answer the below research question by analysing the survey results presented in the previous chapter.

Q3: How does the perceptions of employees on the factors affecting the success and sustainability of LSS initiatives in their organisations compare between company1 and company2?

The results of the survey indicated that there were significant differences in the perceptions of employees on some of the factors that affect the success and sustainability of LSS between company1 and company2. The results indicate that, there is a broad consensus among views of employees from company1 that most of the factors that affect the success and sustainability of LSS are either met or present in their organisation. Also, employees of company1 believed more that these factors were met in their organisation than employees of company2.

The factors or the areas where the views significantly differed between the two companies were the ones where employees of company2 did not believe that these factors were met or present in the organisation. Of these, there is strong

evidence to suggest that employees of company2 believed there was a clear lack in the below factors:

- Senior management commitment & involvement -
- Clear vision & long term strategy;
- Need for introducing LSS established from start
- LSS awareness and benefits

Furthermore, the results also indicate that the below factors were also lacking in company2 but to a lesser degree compared to the four factors outlined above.

- Strong link between LSS initiatives & strategic objectives of company
- Effective communication
- Support & encouragement from top management
- Process to track & measure LSS projects performance
- Open culture & team autonomy
- LSS initiatives well integrated into the continuous improvement culture

Though employees of company2 believed more with the below factors compared to company1, presence of these factors meant that these were inhibitors or barriers to the success and sustainability of LSS.

- Pressure to deliver results quickly
- LSS methodology too extensive & time consuming
- High implementation & training costs affecting success & sustainability
- Employees view LSS as mere set of tools, techniques to solve problems

Also, employees from company2 believed less with the below factors suggesting these were lacking but to a lesser degree, whereas employees of company1 believed they were present or met.

- Adequate LSS training
- LSS project selection & prioritisation
- Allocation of adequate resources
- High level of employee engagement and participation
- Effective execution & project management

Employees of both companies believed that there was a lack in the HR rewards and recognition system linking to LSS initiatives, which again is a barrier for LSS success.

There is strong evidence from the results to suggest that all or majority of the above outlined factors were met or present in company1, which are the enablers for LSS success and sustainability. So, from the evidence it is clear that there was a lack in most of the key factors that enable the success and sustainability of LSS in company2, whereas these enabling factors were met or present in company1. This would indicate why employees of company2 did not believe the LSS initiatives were successful or sustained in their organisation and the opposite for company1.

6.5 LSS top 10 critical success factors (CSFs)

This section attempts to answer the below research question by analysing the survey results presented in the previous chapter.

Q4: How does the ranking of Top 10 Critical Success Factors (CSFs) that affect the success of LSS initiatives compare between company1 and company2?

The results of the ranking of top 10 CSFs indicate that, there is broad consensus between the views of employees of company1 and company2 with respect to the top 4 and bottom 3 CSFs. However, the views differed slightly with respect to the ranking of CSF5, 6 and 7.

Senior management commitment, involvement and support was ranked as the most important CSF at the top by employees of both companies. Published literature has highlighted the criticality of management commitment, involvement and support to the introduction, success and sustainability of LSS in organisations and the results of the ranking confirm this. This is consistent with the findings from many other empirical studies on LSS CSFs, published in the literature (eg. Laureani et al., 2012; Manville et al., 2012; Antony et al., 2002; Coronado et al., 2002; Psychogios et al., 2012).

It is interesting to note that clear vision and long term plan for LSS linking business strategy was ranked as the second most important CSF by employees of both companies. The literature outlines the importance of establishing a clear vision and long term plan linking to business strategy for the success and sustainability of LSS (Dale, 2000), this finding contests the findings from previous empirical study by Laureani et al (2012) which found organisation culture as the second most important CSF. However, the finding from this study is consistent with the findings from the study by Manville et al (2012).

From the results, organisation culture supporting change, and LSS awareness and training were ranked as the third and fourth most important CSFs by

employees of both companies. These findings are in contrast with the findings from previous empirical study by Laureani et al (2012) which found organisation culture as the second most important CSF and LSS awareness and training was not in the top 5 CSFs.

Another interesting finding from the study is that, employees of both companies seem to place some weight on the importance of linking LSS initiatives with HR reward and recognition system by ranking this as the 8th most important CSF. While Henderson and Evans (2000) outlined the importance of this to the LSS success and added this to the list of CSFs in their study, previous empirical studies have found this to be one of the most least important CSFs.

6.6 Practical Implications

The results of this study have several practical implications that should be beneficial to senior management, business owners, organisations and academics in terms of getting a deeper understanding of the perceptions of employees on LSS initiatives in services organisations.

In terms of academic contributions, this study adds to the existing literature on LSS by way of confirmation of already published work regarding benefits of LSS initiatives, factors that affect the success and sustainability of LSS initiatives and critical success factors (CSFs) in both company1 and company2.

The key contribution this study makes to the literature is by way of providing a framework for empirically testing the perceptions of employees and different

groups involved in the LSS initiatives on the different aspects of LSS initiatives in their organisations. This study attempted to understand and assess the perception of employees on various aspects of LSS initiatives in organisations by gathering the collective views of all groups involved in the LSS initiatives through empirical means. While this study only included two organisations in the services sector, there is scope for other academics to adapt this framework to expand the study to include more organisations in the services sector to achieve generalizability. Also, even though this study was conducted on companies in the services sector, other academics may explore to adapt this framework to conduct similar studies in other sectors or across multiple sectors.

Furthermore, this study empirically tested the factors that affect the success and sustainability of LSS initiatives and re-affirmed the critical role certain factors such as: senior management commitment, involvement and support; Clear vision and long term strategy; organisation culture etc., play in this regard.

In terms of managerial contributions, this study confirmed and stressed the importance of senior management role in various facets of LSS implementation, its success and sustainability. The study also highlighted the importance of organisations and senior management establishing a clear vision and long term strategy for LSS initiatives. This including other key findings from this research may be of interest to senior management and organisations already practicing LSS initiatives and others who are looking at introducing in their organisations. Furthermore, the model used in the study could be useful for senior management and organisations in terms of understanding how employees perceive or view the

performance and various aspects of LSS initiatives, which could help identify the issue areas or areas that require further improvement, so senior management can implement necessary interventions to correct or improve the problem areas. The model used in this study can also enable organisations and senior management to conduct a reality check to understand how well the LSS initiatives are being viewed by various groups in the organisation.

6.7 Limitations of the research

This study has several limitations. The first limitation was the sample size. Two multinational companies in the services sector in Ireland that are or were using LSS initiatives and known to the researcher were selected and employees from these two companies who have participated or involved in the LSS initiatives were selected and invited to participate in the study. 54 employees from company1 and 59 employees from company2 were invited to participate in the online survey of which 38 (70%) employees from company1 and 45 (76%) employees completed the survey, resulting in an overall response rate of 73%. Considering the study only included a subset of employees who have participated in LSS initiatives from two companies in the services sector in Ireland, it should be noted that the findings from this study are only relevant to the sample population and companies, and may not be relevant to other groups of employees in the two companies, or other companies in the services sector who were not included in the study. Hence, the findings from this study may not be generalisable to the entire employment in services sector in Ireland. Also, the

sample size of the population (83 respondents) could also influence the statistical strength of this research. Therefore, in order to increase the significance of the findings, future research on a larger sample population is recommended (Saunders et al., 2012).

Another limitation was the sampling method used for the study. For this research a convenient sampling method was used meaning, companies and individuals who were known to the author and easiest to include were selected to participate in the research. Bryman and Bell (2007) argue that, though convenience sampling is the cheapest and easiest to conduct and can provide interesting data, it is the least reliable design due to limitations in generalisability and lack of ability to ensure precision. As the study used a non-probability sampling method, there was no system to ensure that everyone in the population had an equal chance to be selected (McNabb, 2013). Therefore, characteristics of individuals who were not chosen for the sample remain unknown. Also, it should be noted that, characteristics of participants who took part in the study could differ from the characteristics of individuals who did not wish to take part in the study (Groves et al., 2008). It is recommended for future research to use probability sampling in order to increase the significance of the findings that are representative of the whole population and to increase generalisability.

This study used only quantitative methods through a self-report survey questionnaire and hence is open for single source bias (Eisenhardt, 1989). The quantitative method used was based on data collected from a self-administered questionnaire developed by the researcher. The results from the data gathered

may have been limited due to responses bias (Groves et al., 2008). Participants who volunteered to take part in the study may have a stronger interest in the LSS topic than those who did not take part in the study. Also, the circumstances of the participant while answering the survey questionnaire could have influenced the results. While completing the survey questionnaire at work, answers may have been influenced by the presence of partakers' managers and colleagues which could have prevented participants from answering questions honestly.

Also, the survey results were open to the interpretation and bias of the researcher. The research was based on two companies in the services sector and hence the generalisation of results may be questionable or may not be possible.

7. Conclusion

The main purpose of this chapter is to examine the research questions and determine the conclusions reached as part of this research. The overall objective of this research is to investigate the perceptions of employees from the two organisations in the services sector in Ireland on the performance, benefits, success and sustainability factors and CSFs of LSS initiatives in their organisations. In order to answer the main research question, four research questions were set out for this study as outlined in chapter 3.

The study used quantitative methods to gather employee perceptions on the above outlined aspects of LSS from employees who have participated or involved with LSS initiatives from two organisations in the services sector in Ireland. The study compared the views of employees between the two companies and found significant differences in the areas of: performance of LSS initiatives; and factors that affect success and sustainability of LSS. The study also identified the specific areas where the views differed significantly between the two companies.

There is a strong evidence to suggest that LSS initiatives were largely viewed as unsuccessful and not sustained by employees of company2, while it's largely viewed successful and sustained by employees of company1. Furthermore, there was evidence to suggest that employees of company2 believe process improvement is not given high importance and expected level of benefits were not realised from LSS initiatives. Whereas, the views of employees of company1 were opposite to that of company2. While it is imperative that process improvement efforts are given high importance in order for business and process improvement concepts like LSS to succeed, not realising expected benefits from change efforts like LSS may result in organisations abandoning the change efforts (Naslund, 2008).

Interestingly, both company employees showed a preference to continue using LSS methods and tools in their process improvement efforts, irrespective of if

LSS is successful or sustained in the organisation. This indicates that a subset of employees in company2 view LSS favourably even though the general consensus from company2 being LSS largely unsuccessful. Furthermore, company1 did not seem to use any other process improvement methods and used LSS as the preferred method for process improvements. Whereas, company2 did seem to use other methodologies and LSS was not the preferred methodology.

The views of both company employees were more or less aligned with respect to the benefits of LSS initiatives with the exception of realisation of cost reduction, wherein company2 employees believed cost reduction was realised more than company1. However, the level of agreement to the benefits of LSS from both companies was relatively low.

The views on the factors that affect success and sustainability of LSS largely differed between the two companies with significant differences in some key areas. There is strong evidence to suggest that there was a clear lack of some of the key enablers for LSS success in company2 such as: senior management commitment & involvement; clear vision & long term strategy; need for introducing LSS established from start; LSS awareness and benefits. Whereas, these key enablers were present in company1. Absence or lack of these key enabling factors in company2, suggest that the LSS initiatives may have failed or have not been sustained which justifies the view from employees of company2 that the LSS initiatives were not successful and not sustained. On contrary, all

the key enabling factors were present or met in company1 which justifies their view that LSS initiatives are successful and have been sustained.

With respect to ranking of the top 10 CSFs, the views from both company employees were well aligned for the top 4 CSFs: Senior Management Commitment, participation and support; a clear vision and long term plan for LSS initiatives linking to business strategy; Organization culture supporting change; and LSS awareness, training & education. One interesting finding is, ranking of a clear vision and long term plan for LSS initiatives linking to business strategy as the 2nd most important CSF as none of the previous studies on CSFs ranked this factor within the top 5 CSFs.

So, from employees' perspective the above top 4 CSFs were the most important factors for the success & sustainability of LSS initiatives. But, in reality most of these key factors were either absent or lacking in company2 but present in company1. As outlined in the literature, LSS efforts would fail if one or more of the CSFs are not met or lacking. The perceptions of employees from company1 and company2 affirm the theory outlined in the literature.

In summary, this research attempted to empirically investigate the employee perceptions on LSS initiatives and validate these against the literature. This objective was met and the perceptions of employees from both companies tie in with the published literature in terms of validating the theory against reality.

8. Recommendations for further research

As stated earlier, most of the empirical studies to date on LSS have focussed on identifying the CSFs in organisations across different sectors. Majority of these studies identified the CSFs based on what factors were considered as the most important for the success of LSS initiatives, either by a particular group or across specific groups of employees in organisations. While there are many qualitative studies using a case study method that have looked at the implementation of LSS, barriers during implementation, success factors and experiences at a single company across different sectors, there have been no empirical studies conducted to understand the views of employees or various groups that are normally involved with LSS initiatives on various aspects of LSS in

organisations. This study made an attempt to empirically test the perceptions of employees on the performance, benefits, factors that affect success and sustainability and top 10 CSFs in two services organisations in Ireland.

The study used quantitative methods to gather employee perceptions on the above outlined aspects of LSS from employees who have participated or involved with LSS initiatives from two organisations in the services sector in Ireland. The study compared the views of employees between the two companies and found significant differences in the areas of: performance of LSS initiatives; and factors that affect success and sustainability of LSS. The study also identified the specific areas where the views differed significantly between the two companies. The study did not look at the views of senior management or SLT from the two companies; hence the findings represent only one side of the coin (employees' views). So, future research can look at gathering views of senior management as well using qualitative methods such as semi-structured interviews to get a deeper insight (Yin, 1994; Saunders et al., 2012) or mixed method approach in order to avoid single source bias and improve validity (Eisenhardt, 1989) to get a more rounded view on LSS initiatives in organisations.

While the collected data for this study had scope for further analysis such as comparing the views by gender, age, LSS involvement type etc., within the company and as well as between the companies, this analysis was not performed as this was deemed not necessary for this study. However, future research can leverage the data and expand the study to include further analysis by different

groups or factors to get an insight into if the views on LSS initiatives differ between these groups and attempt to establish why.

Furthermore, the questionnaire developed for this study has the provision for collection of other important data such as: high level of importance for process improvement; LSS expert team (BB/MBB) based in-house or external; number of dedicated LSS experts, which may influence the outcome of LSS initiatives in organisations. Future research may attempt to establish if and how these factors influence the outcome of LSS initiatives in organisations.

Finally, this study was conducted on employees from two companies in the services sector in Ireland, findings may not be generalised for the entire services sector. So, future research can attempt to expand the study to include a larger sample of companies in the services sector in order to generalise the findings across the sector. Other potential future research option is to replicate this study or adapt the questionnaire used in this study to assess employee perceptions in organisations in other sectors or across multiple different sectors.

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APPENDIX I – Survey Questionnaire

Employee Perceptions on Lean Six Sigma (LSS) Initiatives in Services Organisations

The survey aims to examine the employee perceptions on the performance, benefits and factors affecting the success or failure of Lean Six Sigma (LSS) initiatives in services organisations.

General Questionnaire
This section requires the respondent to demographic questions.

***Gender:**

Male Female

***Age Group**

18 - 25

26 - 35

36 - 45

46 - 55

55+

***Please specify how long you have worked in this organisation:**

- 0 - 1 year
- 2 - 3 years
- 4 - 6 years
- 7 - 9 years
- 10+ years

***Number of years your organisation was/has been using LSS methodology?**

- 0 - 1 year
- 2 - 4 years
- 5 - 7 years
- 8 - 10 years
- 10+ years

***Does your organisation use any other process improvement methodology?**

- Yes
- No
- Don't Know

***Is LSS the preferred methodology for process improvements in your organisation?**

- Yes

- No
- Don't Know

***Is/was LSS expertise (core LSS excellence team) based in-house or provided by a third party vendor?**

- In-House
- Third party vendor (contracted)

***Number of dedicated full time LSS expert (Black Belt/Master Black Belt) resources at your organisation:**

- 1 - 2
- 3 - 4
- 5 - 6
- 6+
- None

***Your involvement with LSS initiatives in your organisation**

- Participated in LSS training only
- Participated in LSS projects
- Lead/Managed one or more LSS Projects
- LSS Expert - Coached and Trained employees in LSS (BB/MBB)
- LSS Champion/Project Sponsor

LSS (Lean Six Sigma) Initiatives Summary
Employee beliefs on performance of LSS Initiatives in the organisation

***Please indicate the extent to which you agree/disagree with the following (on a scale of Strongly Disagree - Strongly Agree):**

Do you believe:

	Strongly Disagree	Disagree	Partly Disagree	Neither Agree/Nor Disagree	Partly Agree	Agree	Strongly Agree
Process improvement is given high importance in the organisation?	○	○	○	○	○	○	○
LSS initiatives were/are successful in your organisation?	○	○	○	○	○	○	○
LSS initiatives have been and will be sustained in your organisation?	○	○	○	○	○	○	○
LSS initiatives have provided the expected level of benefits to the organisation?	○	○	○	○	○	○	○
You use and intend to use the LSS methodology or tools in process improvements, irrespective of LSS is successful or sustained at the organisational level?	○	○	○	○	○	○	○
The organisation would have/will benefit more by continuing & sustaining the LSS initiatives?	○	○	○	○	○	○	○

LSS (Lean Six Sigma) Benefits
Employee beliefs on LSS benefits to the organisation

***Please indicate your level of agreement with the following statements with respect to the LSS initiatives in your organisation (On a scale of Strongly Disagree - Strongly Agree):**

Do you believe:

	Strongly Disagree	Disagree	Partly Disagree	Neither Agree/Nor Disagree	Partly Agree	Agree	Strongly Agree
LSS has/had increased the efficiency of internal processes in the organisation?							
LSS has/had been very effective in reducing waste in the processes?							
LSS has/had considerably reduced process lead times & cycle times?							
The organisation is/was able to reduce costs considerably as a result of LSS improvements?							
LSS has/had helped the organisation to be more customer focussed?							
LSS improvements have/had resulted in efficient							

utilization of resources (human, financial and system)?							
LSS has/had helped the organisation to achieve increased quality?							
LSS improvements have/had resulted in increased employee productivity?							
LSS initiatives have/had been effective in increasing customer satisfaction?							
The organisation has/had achieved considerable operational & financial gains from LSS initiatives?							

LSS - Factors affecting Success & Sustainability
Employee beliefs on factors affecting LSS success & sustainability

***Please indicate the extent to which you agree/disagree with the below with respect to the LSS initiatives in your organisation (on a scale of Strongly Disagree - Strongly Agree):**

Do you believe:

	Strongly Disagree	Disagree	Partly Disagree	Neither Agree/Nor Disagree	Partly Agree	Agree	Strongly Agree
There is/was a high level of commitment and involvement from							

top management in the LSS initiatives?							
There is/was a clear vision and long term strategy for introducing LSS established by top management?							
The need for introducing LSS clearly established and communicated from start?							
There is/was adequate LSS training provided to employees?							
The projects are/were selected based on suitability to LSS and prioritised properly?							
There is/was a strong link between LSS initiatives/projects and strategic objectives of the company?							
Adequate resources (financial, technical & human) are/were provided for the LSS initiatives and projects?							
The organisation culture embraces and supports change?							

There is/was effective communication by management on the LSS initiatives?							
The senior management do/did actively encourage and support employees to participate in LSS initiatives?							
The goals and timelines set for LSS projects are/were realistic?							
You are under pressure to deliver results quickly for LSS projects?							
There is/was a high level of employee engagement and participation on LSS initiatives?							
The LSS methodology is too extensive and time consuming?							
The employees do/did view LSS as a mere set of tools, techniques and practices to solve problems?							
The management do/did create a high level of awareness of LSS and the benefits it can bring to organisation?							

There is/was a well-defined process for tracking and measuring the performance of LSS projects?							
There is/was effective execution and project management of LSS projects?							
The selection process of candidates to participate in LSS training and projects is/was fair and effective?							
The LSS expert help & coaching is/was sufficiently and readily available for LSS projects?							
There is/was a well-defined HR rewards and recognition system linking to LSS initiatives?							
The management have/had created a open culture for LSS initiatives and provided team autonomy?							
High implementation and LSS training costs may have caused LSS initiatives to fail or difficult to sustain in your organisation?							

There is/was a well-established continuous improvement culture in the organisation?	○	○	○	○	○	○	○
The LSS initiatives are/were well integrated into the continuous improvement culture of the organisation?	○	○	○	○	○	○	○

LSS Critical Success Factors - Ranking
Rank the Top 10 critical success factors (CSFs) for LSS Initiatives in Organisations.

***Please rank the below 10 Critical Success Factors (CSFs) that contribute to the success and sustainability of LSS Initiatives in the decreasing order of importance (Most Important at the top - Least important at the bottom):**

Click on an item in the list on the left, starting with your highest ranking item, moving through to your lowest ranking item.

Your choices:

Senior Management Commitment, participation and support
Organization culture supporting change
A clear vision and long term plan for LSS initiatives linking to business strategy
LSS awareness, training & education
Sufficient & clear allocation of resources (financial, human & systems)
Linking LSS initiatives with HR rewards and recognition
LSS projects selection & prioritization
An effective communication plan
Tracking and review of LSS projects & performance
LSS initiatives embedded & integrated with continuous improvement culture

Your ranking:

1:
2:
3:
4:
5:
6:
7:
8:
9:

10: 

Click on the scissors next to each item on the right to remove the last entry in your ranked list

APPENDIX II – Data Analysis SPSS Results

LSS Initiatives Summary Scale – Normality Test results

Case Processing Summary

		Cases					
		Valid		Missing		Total	
	Company	N	Percent	N	Percent	N	Percent
LSSInitiativesSummaryScale	Company1	38	100.0%	0	0.0%	38	100.0%
	Company2	45	100.0%	0	0.0%	45	100.0%

Table 4: LSS Initiatives Summary Scale by Company Case Summary

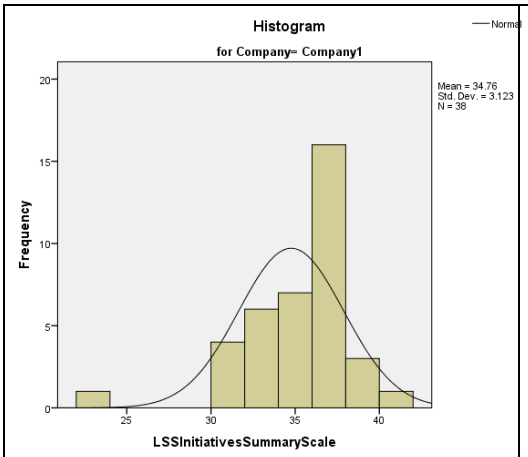

Figure 5: LSS Initiatives Summary Normality Test Company1

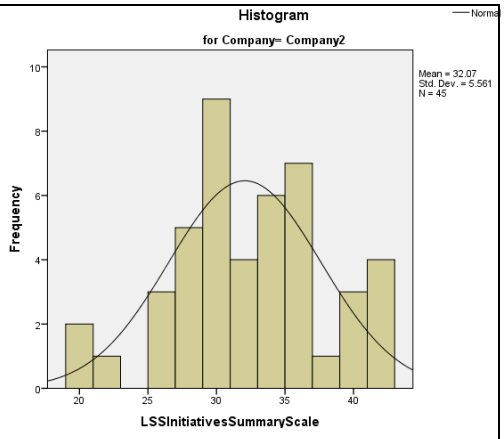

Figure 6: LSS Initiatives Summary Normality Test Company2

Descriptives

	Company			Statistic	Std. Error
LSSInitiativesSummaryScale	Company1	Mean		34.76	.507
		95% Confidence Interval for Mean	Lower Bound	33.74	
			Upper Bound	35.79	
		5% Trimmed Mean		34.96	
		Median		36.00	
		Variance		9.753	
		Std. Deviation		3.123	
		Minimum		23	
		Maximum		41	
		Range		18	
		Interquartile Range		4	
		Skewness		-1.431	.383
		Kurtosis		4.269	.750
	Company2	Mean		32.07	.829
		95% Confidence Interval for Mean	Lower Bound	30.40	
			Upper Bound	33.74	
		5% Trimmed Mean		32.17	
		Median		31.00	
		Variance		30.927	
		Std. Deviation		5.561	
		Minimum		20	
		Maximum		42	
		Range		22	
		Interquartile Range		8	
		Skewness		-.105	.354
		Kurtosis		-.213	.695

Table 5: LSS Initiatives Summary Scale by Company Descriptive Statistics

LSS Initiatives Summary Scale – Differences by items

Ranks

	Company	N	Mean Rank	Sum of Ranks
SEPITM1	Company1	38	44.79	1702.00
	Company2	45	39.64	1784.00
	Total	83		
SEPITM2	Company1	38	48.68	1850.00
	Company2	45	36.36	1636.00
	Total	83		
SEPITM3	Company1	38	49.51	1881.50
	Company2	45	35.66	1604.50
	Total	83		
SEPITM4	Company1	38	44.84	1704.00
	Company2	45	39.60	1782.00
	Total	83		
SEPITM5	Company1	38	42.76	1625.00
	Company2	45	41.36	1861.00
	Total	83		
SEPITM6	Company1	38	44.63	1696.00
	Company2	45	39.78	1790.00
	Total	83		

Table 9: Mann-Whitney Test Mean Ranks for LSS Initiatives Summary Scale Items

LSS Benefits Scale – Normality Test Results

Case Processing Summary

		Cases					
		Valid		Missing		Total	
	Company	N	Percent	N	Percent	N	Percent
LSSBenefitsScale	Company1	38	100.0%	0	0.0%	38	100.0%
	Company2	45	100.0%	0	0.0%	45	100.0%

Table 14: LSS Benefits Scale by Company Normality Test Case Summary

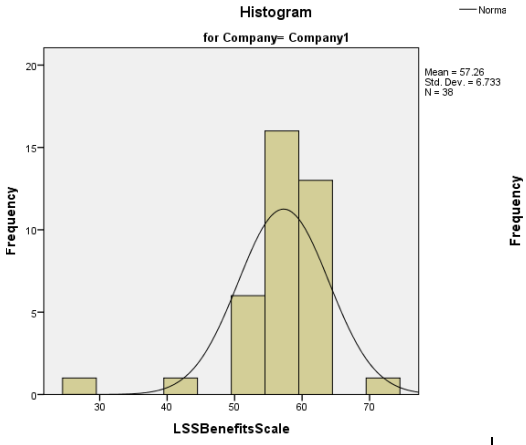

Figure 8: LSS Benefits Normality Test Company1

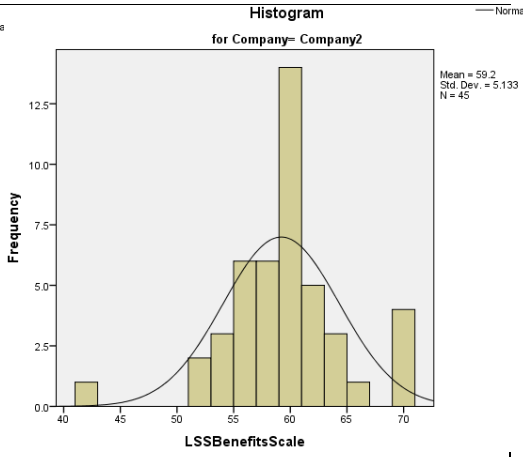

Figure 9: LSS Benefits Normality Test Company2

Descriptives

	Company			Statistic	Std. Error
LSSBenefitsScale	Company1	Mean		57.26	1.092
		95% Confidence Interval for Mean	Lower Bound	55.05	
			Upper Bound	59.48	
		5% Trimmed Mean		57.95	
		Median		58.00	
		Variance		45.334	
		Std. Deviation		6.733	
		Minimum		27	
		Maximum		70	
		Range		43	
		Interquartile Range		6	
		Skewness		-2.511	.383
		Kurtosis		10.772	.750
	Company2	Mean		59.20	.765
		95% Confidence Interval for Mean	Lower Bound	57.66	
			Upper Bound	60.74	
		5% Trimmed Mean		59.27	
		Median		59.00	
		Variance		26.345	
		Std. Deviation		5.133	
		Minimum		42	
		Maximum		70	
		Range		28	
		Interquartile Range		5	
		Skewness		-.211	.354
		Kurtosis		2.580	.695

Table 15: LSS Benefits Scale by Company Descriptive Statistics

LSS Benefits Scale – Differences by items

Ranks

	Company	N	Mean Rank	Sum of Ranks
BITM1	Company1	38	39.78	1511.50
	Company2	45	43.88	1974.50
	Total	83		
BITM2	Company1	38	42.47	1614.00
	Company2	45	41.60	1872.00
	Total	83		
BITM3	Company1	38	37.91	1440.50
	Company2	45	45.46	2045.50
	Total	83		
BITM4	Company1	38	36.67	1393.50
	Company2	45	46.50	2092.50
	Total	83		
BITM5	Company1	38	39.99	1519.50
	Company2	45	43.70	1966.50
	Total	83		
BITM6	Company1	38	38.34	1457.00
	Company2	45	45.09	2029.00
	Total	83		
BITM7	Company1	38	40.99	1557.50
	Company2	45	42.86	1928.50
	Total	83		
BITM8	Company1	38	44.32	1684.00
	Company2	45	40.04	1802.00
	Total	83		
BITM9	Company1	38	37.95	1442.00
	Company2	45	45.42	2044.00
	Total	83		
BITM10	Company1	38	37.45	1423.00
	Company2	45	45.84	2063.00
	Total	83		

Table 19: Mann-Whitney Test Mean Ranks for LSS Benefits Scale Items

LSS Success and Sustain Factors Scale – Normality Test Results

Case Processing Summary

		Cases					
		Valid		Missing		Total	
	Company	N	Percent	N	Percent	N	Percent
LSSSuccessSustainFactorsScale	Company1	38	100.0%	0	0.0%	38	100.0%
	Company2	45	100.0%	0	0.0%	45	100.0%

Table 24: LSS Success and Sustainability Factors Scale by Company Case Summary

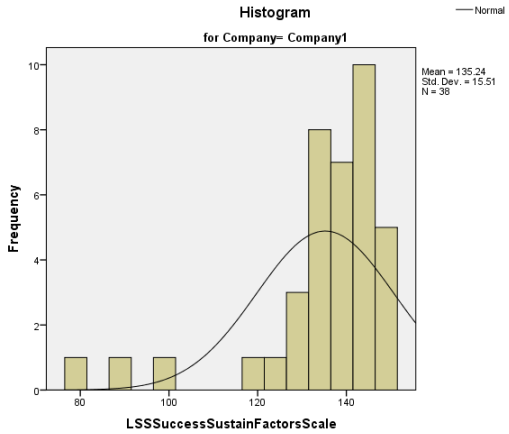

Figure 11: LSS Success and Sustainability Factors Normality Test Company1

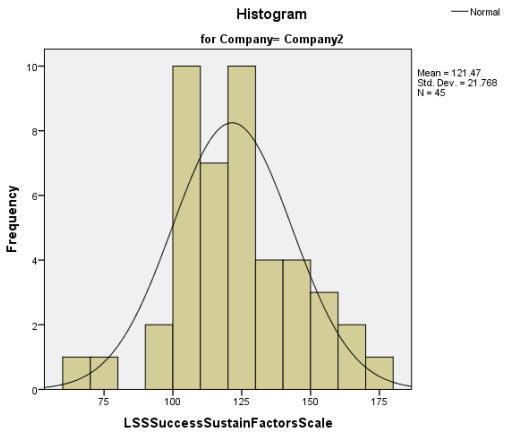

Figure 12: LSS Success and Sustainability Factors Normality Test Company2

Descriptives

	Company			Statistic	Std. Error
LSSSuccessSustainFactorsScale	Company1	Mean		135.24	2.516
		95% Confidence Interval for Mean	Lower Bound	130.14	
			Upper Bound	140.33	
		5% Trimmed Mean		137.22	
		Median		139.00	
		Variance		240.564	
		Std. Deviation		15.510	
		Minimum		79	
		Maximum		151	
		Range		72	
		Interquartile Range		13	
		Skewness		-2.355	.383
		Kurtosis		5.870	.750
	Company2	Mean		121.47	3.245
		95% Confidence Interval for Mean	Lower Bound	114.93	
			Upper Bound	128.01	
		5% Trimmed Mean		121.67	
		Median		121.00	
		Variance		473.845	
		Std. Deviation		21.768	
		Minimum		60	
		Maximum		175	
		Range		115	
		Interquartile Range		28	
		Skewness		-.011	.354
		Kurtosis		.998	.695

Table 25: LSS Success and Sustainability Factors Scale by Company Descriptive Statistics

LSS Success and Sustain Factors Scale – Differences by scale items

Ranks

	Company	N	Mean Rank	Sum of Ranks
SSITM1	Company1	38	55.58	2112.00
	Company2	45	30.53	1374.00
	Total	83		
SSITM2	Company1	38	51.75	1966.50
	Company2	45	33.77	1519.50
	Total	83		
SSITM3	Company1	38	54.82	2083.00
	Company2	45	31.18	1403.00
	Total	83		
SSITM4	Company1	38	48.34	1837.00
	Company2	45	36.64	1649.00
	Total	83		
SSITM5	Company1	38	45.70	1736.50
	Company2	45	38.88	1749.50
	Total	83		
SSITM6	Company1	38	48.11	1828.00
	Company2	45	36.84	1658.00
	Total	83		
SSITM7	Company1	38	45.17	1716.50
	Company2	45	39.32	1769.50
	Total	83		
SSITM8	Company1	38	42.24	1605.00
	Company2	45	41.80	1881.00
	Total	83		
SSITM9	Company1	38	51.43	1954.50
	Company2	45	34.03	1531.50
	Total	83		
SSITM10	Company1	38	55.29	2101.00
	Company2	45	30.78	1385.00
	Total	83		
SSITM11	Company1	38	42.55	1617.00
	Company2	45	41.53	1869.00
	Total	83		
SSITM12	Company1	38	50.42	1916.00
	Company2	45	34.89	1570.00
	Total	83		
SSITM13	Company1	38	45.74	1738.00
	Company2	45	38.84	1748.00
	Total	83		

Ranks

	Company	N	Mean Rank	Sum of Ranks
SSITM14	Company1	38	47.53	1806.00
	Company2	45	37.33	1680.00
	Total	83		
SSITM15	Company1	38	37.09	1409.50
	Company2	45	46.14	2076.50
	Total	83		
SSITM16	Company1	38	54.38	2066.50
	Company2	45	31.54	1419.50
	Total	83		
SSITM17	Company1	38	48.67	1849.50
	Company2	45	36.37	1636.50
	Total	83		
SSITM18	Company1	38	44.84	1704.00
	Company2	45	39.60	1782.00
	Total	83		
SSITM19	Company1	38	43.00	1634.00
	Company2	45	41.16	1852.00
	Total	83		
SSITM20	Company1	38	42.29	1607.00
	Company2	45	41.76	1879.00
	Total	83		
SSITM21	Company1	38	39.13	1487.00
	Company2	45	44.42	1999.00
	Total	83		
SSITM22	Company1	38	50.93	1935.50
	Company2	45	34.46	1550.50
	Total	83		
SSITM23	Company1	38	34.82	1323.00
	Company2	45	48.07	2163.00
	Total	83		
SSITM24	Company1	38	42.97	1633.00
	Company2	45	41.18	1853.00
	Total	83		
SSITM25	Company1	38	50.08	1903.00
	Company2	45	35.18	1583.00
	Total	83		

Table 29: Mann-Whitney Test Mean Ranks for LSS Success & Sustain Factors Scale Items

Test Statistics[a]

	SSITM1	SSITM2	SSITM3	SSITM4	SSITM5	SSITM6
Mann-Whitney U	339.000	484.500	368.000	614.000	714.500	623.000
Wilcoxon W	1374.000	1519.500	1403.000	1649.000	1749.500	1658.000
Z	-4.920	-3.493	-4.623	-2.727	-1.547	-2.325
Asymp. Sig. (2-tailed)	.000	.000	.000	.006	.122	.020

Test Statistics[a]

	SSITM7	SSITM8	SSITM9	SSITM10	SSITM11	SSITM12
Mann-Whitney U	734.500	846.000	496.500	350.000	834.000	535.000
Wilcoxon W	1769.500	1881.000	1531.500	1385.000	1869.000	1570.000
Z	-1.209	-.102	-3.470	-4.801	-.210	-3.126
Asymp. Sig. (2-tailed)	.227	.919	.001	.000	.834	.002

Test Statistics[a]

	SSITM13	SSITM14	SSITM15	SSITM16	SSITM17	SSITM18
Mann-Whitney U	713.000	645.000	668.500	384.500	601.500	747.000
Wilcoxon W	1748.000	1680.000	1409.500	1419.500	1636.500	1782.000
Z	-1.676	-1.972	-2.029	-4.548	-2.663	-1.091
Asymp. Sig. (2-tailed)	.094	.049	.042	.000	.008	.275

Test Statistics[a]

	SSITM19	SSITM20	SSITM21	SSITM22	SSITM23	SSITM24
Mann-Whitney U	817.000	844.000	746.000	515.500	582.000	818.000
Wilcoxon W	1852.000	1879.000	1487.000	1550.500	1323.000	1853.000
Z	-.361	-.137	-1.071	-3.272	-2.582	-.388
Asymp. Sig. (2-tailed)	.718	.891	.284	.001	.010	.698

Test Statistics[a]

	SSITM25
Mann-Whitney U	548.000
Wilcoxon W	1583.000
Z	-2.910
Asymp. Sig. (2-tailed)	.004

a. Grouping Variable: Company

Table 30: LSS Success and Sustain Factors Scale Items Mann-Whitney Test Statistics