

THE EFFECT OF KAIZEN IMPLEMENTATION AND SUSTAINABILITY ON PERFORMANCE OF THE
MANUFACTURING SECTOR IN ETHIOPIA

DISSERTATION
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Submitted by

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CERTIFICATE

This is to certify that the thesis, entitled “**The Effect of Kaizen Implementation and Sustainability on Performance of Manufacturing Sector in Ethiopia**” submitted to the Texila American University, in partial fulfillment of the requirements for the award of the Degree of Doctor of Philosophy in **Management** is a record of original research work done by **Mr Abebe Nigatu**, under my/our supervision and guidance and the thesis has not formed the basis for the award of any Degree / Diploma / Associate ship / Fellowship or other similar title to any candidate of any University.



Signature of the Guide

Professor Satya Murty Kopparthi

DECLARATION

I, **Mr Abebe Nigatu** declare that this thesis entitled **The Effect of Kaizen Implementation and Sustainability on Performance of Manufacturing Sector in Ethiopia** submitted in partial fulfillment of the degree of Doctor of Philosophy is a record of original work carried out by me under the supervision of **Professor Murty S.Kopparthi, Dr. Anju M.Verma and Dr. Andrew Parris** , and has not formed the basis for the award of any other degree or diploma, in this or any other Institution or University. In keeping with the ethical practice in reporting scientific information, due acknowledgements have been made wherever the findings of others have been cited.

A handwritten signature in blue ink, appearing to read 'P.T. Abebe Nigatu', with a horizontal line underneath.

Abebe Nigatu Endalew

25th June 2020

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ACRONYMS

BPR	Business Process Reengineering
CEO	Chief Executive Officer
DBE	Development Bank of Ethiopia
EKI	Ethiopian Kaizen Institute
GRIPS	Graduate Research Institute for Policy Studies
GTP	Growth and Transformation Plan
JICA	Japan International Corporation Agency
JIT	Just In Time
KPI	Key Performance Indicator
MDG	Millennium Development Goals
MoFED	Ministry of Finance and Economic Development
MoI	Ministry of Industry
MoTI	Ministry of Trade and Industry
PASDEP	Plan for Accelerated and Sustainable Development to End Poverty
PDCA	Plan- DO- Check -Act
PLC	Private Limited Company
PLS	Partial Square Method
QC	Quality Circle
QCC	Quality Control Circles
SMEs	Small and Medium Enterprises
TPM	Total Productive System.
TPS	Toyota Production System

TQC	Total Quality Control
TQM	Total Quality Management
UK	United Kingdom
USA	United States of America

CHAPTER 1: INTRODUCTION

Kaizen Philosophy as a key to Japan's competitive success (Imai, 1986) has become a management style and has been practiced throughout most countries to improve productivity, efficiency, quality and work area. It has been implemented in both developing and developed economies and encountered challenges in the transferability process.

The sustainability of Kaizen practice has also been challenging in many cases (Pillet & Maire, 2008). Transferring Kaizen outside Japan has faced various challenges depending on the context or culture of a country where Kaizen is implemented. Many studies indicate that adoption and effectiveness of Kaizen transfer process outside Japan's culture has been facing difficulties in several countries (Beteman & David, 2002); and (Bessant, Gilbert, Harding, & Webb, 1994).

According to Aoki, several studies have been conducted on the transferability of Kaizen culture to organizations outside Japan. He mentions for example, studies in USA (Aoki, 2008) cited (Abo, 1994; Kenney & Florida, 1993; Liker., 1999) and in UK (Elger & Smith, 2005; Oliver & Wilkinson, 1992; Saka, 2004) indicate that the implementation of Kaizen is influenced mainly by the national culture in specific and the social and economic context of a country where the Kaizen philosophy was implemented. Similarly, Aoki cited a study conducted by Taylor attested the same in China where Kaizen was being practiced (Hong., 2006a, b; Taylor, 1999)

(Patil, 2003) conducted a field study of one Kaizen event in a manufacturing organization to determine whether results were sustained eight months after the event. Through a sustainability checklist and audit conducted by the researcher, it was found that sustainability was not guaranteed after the practice despite the improvements achieved. In fact, as the comparison of key performance indicators between Japanese, UK and USA auto-parts manufacturers (Oliver et al. (2002) cited by (Aoki, 2008) shows, there is still a large gap in terms of the *kaizen* sustainability between Japanese and western companies.

According to (Otsuka, Jin, & Sonobe, 2018)

- In Ethiopia reports indicated that *kaizen* interventions have often resulted in Productivity improved by 37.2%
- Reduction of waste accounts for 55.2% and defect reduction accounts for 31.3%.
- The cost of production was reduced by 6% and search time was reduced by 95%.
- Similarly, for the model companies, industrial accidents were found to be reduced from 49.5% to 15%.
- The problem-solving abilities of employees was observed, and the workers solved 50.3% of the identified problems.

The question, therefore, will be whether these results and improvements have been sustained or short lived. It is also inspiring to study the relationship between the implementation process and its impact on sustainability of the practice and the effect on operational and strategic performances.

Most local studies done had concentrated on the relationship between implementation of *kaizen* and operational performance improvement. This research is necessary because no known studies have been done locally on the sustainability of Kaizen. (Ries, 2011)

In Ethiopia the manufacturing sector operates in a very complex and unfavorable business operating environment characterized by low productivity, high operating cost, poor infrastructure, inadequate and expensive financing and inadequate managerial and technical skills (Desta, Asegedom, Gebresas, & Asheber, 2014), (EKI, ., 2014b), and (Alberto, 2018). Unskilled labor with limited experience and low productivity coupled with other factors have been major challenges in manufacturing sector in Ethiopia (Getinet & Admit, 2001).

With the desire to address the operational performance, Kaizen culture was introduced in Ethiopia to address the operational challenges (cost optimization, waste reduction, quality improvement, and delivery speed among others) and improving entrepreneurial, managerial and technical skill development through the implementation of kaizen philosophy.

Kaizen implementation has resulted in improvements in performance of manufacturing companies in Ethiopia (Otsuka, Jin, & Sonobe, 2018) and (Desta, Asegedom, Gebresas, & Asheber, 2014)

and the level of achievement is different. The research problem, therefore, is to define the how of Kaizen implementation (tools Vs thinking) and the context (level of leadership commitment, organizational culture, and involvement of employees) affects the sustainability of Kaizen (improved culture, institutionalized change, longevity and the impact on performance of companies).

To study the effect of Kaizen Implementation and Sustainability on performance, the following questions were applied:

- What tools, methods or thinking were applied in the implementation process?
- What are the success factors in sustaining the Kaizen culture? What did the successful ones do differently from others?
- Is there a relationship between how Kaizen is practiced to its sustainability Kaizen and how is performance affected?

Some studies were conducted on the implementation of Kaizen and the impact on performance of manufacturing firms. Almost no one has looked at the sustainability aspect of Kaizen in Ethiopia in relation to the how of the practice and its effect on performance. This research focusing on the sustainability of Kaizen has been interested to see how implementation variables influence sustainability (longevity, adoption, extent to which the culture really is changed) and how this influences performance variables. The implementation factors could include factors like amount of training, use of consultants or internal experts, the level of emphasis on tools versus thinking, putting Kaizen into individual performance objectives/reviews, which tools and practices were applied, senior leadership support and national culture.

In most research papers and reports, the researchers have observed that the concept of Kaizen is viewed only as a process improvement tool instituted in a strategy of an organization. The focus is only about the process, methods and systems performance of organizations within the traditional approach of managing performance of an organization. What matters most in the old school of thought is the relationship in the methods, systems and tools within the organization. The focus is only on the managerial or administrative procedures and application of the tools or systems.

Today's modern society, where business dynamism is changing fast, requires going beyond the traditional managerial approach. It requires a managerial discipline to harness the entrepreneurs' opportunity available in the market (Ries, 2011). This needs Transformative approach that focuses on value addition to customers. Leadership becomes a key for the success of any corporation. The question, therefore, would be how corporate governance (leadership, structure, and culture) can be transformed to incorporate the leadership skills that can enhance the involvement of all employees for a continuous improvement approach that can influence performance of organizations strategically without compromising the natural role of corporate governance to manage resources and returns in most effective, efficient and sustainable ways.

Most of studies conducted on Ethiopian manufacturing companies in relation to Kaizen practice focus on the implementation and the practices and results achieved. Very little has been researched on the sustainability of Kaizen factors. This gap has triggered this research to be conducted beyond the implementation of kaizen outside Japan, the origin of the Kaizen culture.

The sustainability of the Kaizen practices and its relationship with implementation contexts and the effect on performance in a given social, economic and cultural aspects are put in to perspective. The focus of the research is the how of the kaizen implementation practice in relationship to Kaizen sustainability and their impact on operational and strategic performance in Ethiopian Manufacturing companies.

I.1 Objective of the Study

The general objective of this research is to establish the relationship between kaizen implementation, sustainability, and performance in Ethiopian manufacturing sector which have been implementing Kaizen for at least three years since Kaizen was introduced in Ethiopia.

The specific objectives of this research are:

- To study and understand the relationship between Kaizen implementation (how it is implemented and the context in which it is implemented) and operational and strategic performance in the Ethiopian manufacturing sector over the years of Kaizen practice.

- To study and understand the effect of Kaizen implementation on the sustainability of Kaizen practice.
- To study and understand the relationship between Kaizen sustainability and operational/strategic performance.

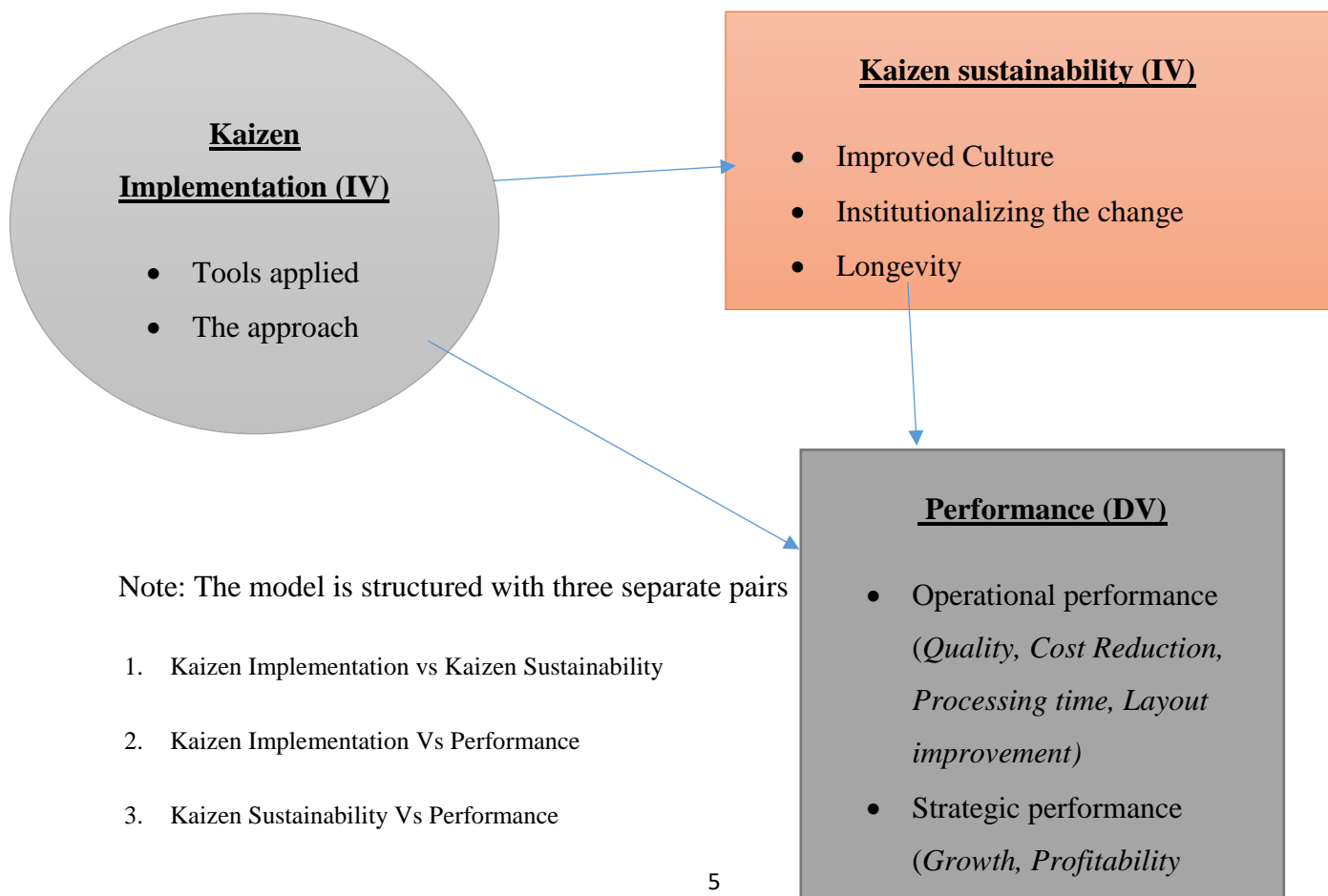
I.2 Hypothesis

The how and the context Kaizen is implemented affects the sustainability and has effect on operational performance. Three Hypothesis are formulated as:

- H1: Kaizen Implementation significantly affects Kaizen Sustainability
- H2: Kaizen Sustainability significantly affects Performance
- H3: Kaizen Implementation significantly affects performance

I.3 Conceptual Framework

Figure 1. 1 Conceptual Framework structured to design the thesis work



CHAPTER II: LITERATURE REVIEW

The Literature Review focuses on the concept of Kaizen Philosophy, Kaizen implementation, sustainability and impact of Kaizen practice on organizations' performance through review of case studies, surveys and reports on Kaizen practices for organizations implementing Kaizen globally and in Ethiopia. Challenges of Kaizen Practices, Kaizen implementation in Ethiopia and its effect on the companies' operations is also reviewed based on various kinds of literature available on Ethiopian Kaizen practice.

II.1 Definition of Kaizen

Kaizen is a Japanese word that refers to continuous process improvement, which is compounded of two Japan words -Kai means change and Zen good for the better and gives the full meaning of 'Change for the Better' (Palmer, 2001). Chen and other authors similarly define Kaizen as a "process of improvement of the standard way of work" (Chen, Dugger, & Hammer, 2000)

(Ghazali & Mahmud, 2015) See Kaizen beyond improvement process tool. Kaizen for them is a Japanese philosophy that promotes thinking that small improvements can make a difference through a result of continuous effort through the participation of everyone in the organization from the top management to the lower level employees.

II.2 Kaizen was originated in Japan

According to (Singh & Singh, 2009) Kaizen was originated in Japan in 1950 when there was a challenge of labor shortage and ineffective management practice. The Japanese government wanted to address the management approach and the lack of labor issues through workforce collaboration.

American quality gurus Deming, and others introduced various process improvement tools which eventually were developed in a Japanese way (Neyestani, 2017). The need for the process-oriented management strategy had become high to address the economic crises due to the rise of oil prices in the 1970s and economic challenges in the '80s and '90s because of the increased cost of raw materials and labor, increased global competition, changing consumer values and shorter product

life cycles. There was growing intent to change the process and methods of work to overcome the challenges. The idea of process improvement got its foundation during this period of economic crises after World War II. The concept of continuous improvement was developed in the US and transferred to Japan after the Second World War (Bhuian & Baghel, 2005) where it got its name 'Kaizen.'

Post-World War II was a challenging business era for Japanese companies as the market competition was stiff because American companies use mass production techniques, which gave economics of scale for them. In the war, shrunken Japanese economy capital investment in large machines was practically impossible. Due to this economic pressure, there was a shift from mass production thinking to the idea of small batches which helped Toyota to introduce Lean manufacturing approach (Ries, 2011)

In several types of research on Toyota's success in quality production, it is agreed that the lean manufacturing thinking helped Toyota to produce diversified and better-quality products because the lean process management thinking allows managers and workers to identify problems much sooner and to catch defects immediately.

According to (Imai M. , 1986), Kaizen is an umbrella concept, which includes all Japanese process improvement practices; customer orientation, TQC (total quality control), Quality Circles (QC), and others. These are unique Japanese principles and tools which significantly transformed Japanese companies to follow the process-oriented way of thinking with a culture of continues improvement with an idea of engaging people at all levels. Imai simplified the principles and tools to one word under the umbrella: KAIZEN. (Imai M. , 1986) has also defined Kaizen as having three pillars waste (Muda) elimination, workplace (Gamba) improvement, and work standardization with the application of methods and tools such as quality control circles, suggestion systems, and total quality control.

In some literature, Kaizen is also seen as an applied model that applies tools at a company level to improve productivity with an enabling system to overcome the company performance challenges (Alberto, 2018)

(Zimmerman, 1991) also describes Kaizen as any change tool that results in improvement of processes and work standards, ease of use, on time delivery, durability, operations flexibility, customer satisfaction and low cost to enhance customer value.

II.3 Concept of Kaizen Philosophy

Since the Japanese management guru Masaaki Imai, introduced the concept of Kaizen in 1986, several types of research were conducted on Kaizen (Shang, 2017). Some literature indicates that even before Kaizen was conceptualized as an umbrella of process improvement, the idea of process improvement started in the 1800s as some companies were engaging employees to provide insights that help improve work efficiency.

Gradually Kaizen has been perceived as a people-oriented management strategy that focuses on process-oriented improvement involving all employees at all levels of an organization through the generation and consideration of suggestions (Imai, 1986). In some literature Kaizen concept is described in terms of three main views as (1) Kaizen is continuous (2) Kaizen is incremental and (3) Kaizen is participative, with an emphasis on employee engagement and satisfaction. (Brunet & New, 2003).

Several authors have written on the concept of kaizen for instance (Abhijit, Madhuri, Saikat, & Gourab, 2013) (Deniels, 1995), (Alsmadi, 2009), (Aoki, 2008), (Chase, 1998), (Cheser, 1998) and (Imai M. , 1986). In all these and other sources, the concept Kaizen approach is discussed in the perspective of customer value and its impact on producing quality products and services.

According to Womack and Jones (1996) cited by (Andrew P. , 2013), the Lean Kaizen approach contributed to the rise and success of the Toyota production system. The achievements of Toyota Production System (TPS), one of the process' improvement tools, would not be possible without the lean Kaizen thinking and principles internalized by the implementers from top to down.

In the Lean thinking approach “process is considered as only the foundation upon which a greater company culture can be developed” (Ries, 2011); moreover, the author adds that active learning, creativity, and innovations depend on the culture built in the organization. This thought agrees

with (Anh, Matsui, & Yen, 2015) who argue that culture impacts the effectiveness of Kaizen implementation.

The contemporary management thinking on efficiency of production process and systems focuses on group not individuals unlike Tylor's scientific management principle that emphasizes ability is all-dependent on individual task (Ries, 2011) Taylorism is obviously in contrary to Kaizen thinking which promotes the idea that each worker has the wisdom to contribute to a teamwork as a whole. Moreover, most importantly the purpose of the scientific management that workers should be treated as little more than automation is far from the Kaizen philosophy. The scientific management was not accepted by Japanese employees and was resisted by the labor union. These dynamics compelled Japanese thinkers to develop a management strategy which gives due attention to people orientation.

Lean production thinking in factories emphasizes the importance of workers wellbeing. The most important aspect of lean thinking according to (Ries, 2011) is to think that productive capacity greatly exceeds our ability to know what to build. To increase the productivity of workers and machines to feed, clothe and house the world's populations. This marks the vital aspect of Kaizen philosophy in Japanese managerial strategy.

Thus, the success of Kaizen practice depends on how well the people and task orientation balance is maintained. This, therefore, is directly factored into the organizational culture. Moreover, for Kaizen sustainability success, the managerial strategy that an organization applies should ensure keeping improvement continually. This thought is attested by (Pande, Neuman, & Cavanagh, 2003) saying that the most difficult challenging question confronting business leaders and managers in the new millennium is not "How do we succeed? It's "How do we stay successful."

(Spear S. J., 2009) In agreement with the Kaizen thoughts, put the following problem-solving approach should shift towards applying scientific methods at high speed and low cost. He continues arguing that problem-solving should go beyond fixing something to result in creating new knowledge and developing the capacity of peoples' problem-solving skills.

(Spear & Bowen, 1999) mentioned that the success of Toyota is due to the principles of lean being understood and implemented well by the management and staff. (Winy, 2011) Also describes

Kaizen as a continuous improvement management tool in producing a quality product and services which is vital in a stiff competitive business environment. There is strong evidence that kaizen helped Japanese companies to overcome the productivity and quality challenges when they encountered stiff global competition from American and European manufacturers after mid-1940s (Chen, Dugger, & Hammer, 2000).

Kaizen can also be defined as the process of innovation in firms involving the entire workforce comprising customer orientation, quality control, new product development just in time and automation, cooperative employer-employee relationships and so on (Alberto, 2018)-

However, (Shang, 2017) argues that Kaizen and Innovation are two different things. Kaizen can be defined from the perspective of innovation but cannot be considered as the same thing as innovation. Shang also recommends the need for further research to establish the relationship between Kaizen and Innovation. In a study related to the impact of Kaizen on the performance of manufacturing companies (Rahmanian & Rahmatinejad, 2013) mentioned that all changes made are not innovations.

Although the definitions for Kaizen are given from different perspectives, there is a consensus that Kaizen has resulted in significant improvements and has become a Japanese unique management tool. Thus, it has been widely transferred to various cultures (Anh P. a., 2011). The positive effects of Kaizen on Japanese companies have raised interests among researchers as it has proven to improve the productivity of companies, production of quality products and services with minimum efforts and resources deployed (Aoki, 2008).

In several kinds of literature, conceptual differences between the Japanese and the Western management approaches have been reflected. The primary difference has been about the size of the changes and the human elements approaches. The Japanese approach emphasizes small incremental changes under existing technology while the Western approach favors innovation based on technological breakthroughs (Imai M. , 1986).

The second conceptual difference is about people orientation. The Japanese approach focuses on human elements, while the Western approach is more of task-oriented which focuses on result-based performance (Imai, 1997).

One of the widely applied management tools of Western origin is Business Process Re-engineering (BPR) (Hammer M. , 1990), BPR differs from kaizen mainly because of its drastic change. It is a breakthrough change not incremental improvements unlike Kaizen with dramatic changes with the fundamental rethinking and radical redesign of business processes to achieve in critical measures of performance (Hammer M. , 1990), (Hammer & Champy, 1993).

(Singh & Singh, 2009) They reviewed several schools of thoughts on the concept of Kaizen. The definitions of Kaizen in various perspectives can be summarized as in the table below

Kaizen conceptualization	Cited author
Kaizen is a strategy that includes thoughts, systems, and tools within the bigger picture of leadership involving people and culture, all driven by the customer.	Imai (1986)
Teamwork factored in the concept of Kaizen- the contribution of collaboration to make the concept of Kaizen	Wickens (1990)
Kaizen is process-oriented thinking - processes must be improved before better results are obtained	Hammer <i>et al.</i> (1993)
Continuous Improvement is an ‘an organization-wide process of focused and sustained incremental innovation’.	Bassant and Caffyn (1994)
Kaizen philosophy in the business process management transforms the thinking of both management and employees at all levels to focus on value addition	Newitt (1996)
Kaizen is lean thinking and lay out a systematic approach to help organizations systematically to reduce waste.	Womack and Jones (1996)
Kaizen is based on making small changes regularly-reducing waste and continuously improving productivity, safety, and effectiveness	Cheser (1998)

Continuous Improvement technique is the recognized way of making significant reduction in production costs	Williams (2001)
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Source: (Singh & Singh, 2009) summary by the researcher

The review of the several thoughts on the concept of Kaizen as continuous improvement (the table above) can be put into three primary perspectives:

- Kaizen is a totality of concepts, methods, and systems applied to improve process incrementally and continuously.
- Kaizen is a philosophy which impacts attitudes of employees and managers towards the work area improvement, quality of products and services and Increased business performance (cost reduction, reduced waste, lead time, increased productivity and zero defect).
- Kaizen is process oriented and emphasizes humanity aspects.

These perspectives are also reflected in the works of several other researchers who describe the Kaizen model as a focused and structured improvement project at an organizational level that is implemented by committed cross-functional teams to improve a given work area, with a specific goal within a given period.

The concept of kaizen focuses on continuous improvement through Input, Process and Output stages (Rahmanian & Rahmatinejad, 2013) to improve efficiency, to identify and fix problems at all levels. However, (Rahmanian & Rahmatinejad, 2013) notes that Kaizen practice is not only about solving a problem but it is also about maintaining the change and improvement on a continuity basis, which cannot be separable. Continuity implies the need to do better and there is always better. In one of the recent publications, (Andrew P. , 2019) highlights the idea of continuously improving as "Continuously improving emphasizes the need for everyone always to work to make things better."

From the discussion of the Kaizen concept by (Singh & Singh, 2009) there is no one single meaning that can be given to Kaizen. It can only be defined in the perspective of a given context and how it can be applied as a tool for change.

II.4 Kaizen Tools (Techniques)

5S: The word "5S" was generalized in 1980's in the manufacturing sector in Japan. It is derived from an acronym of five Japanese words which stands for Seiri (Sort), Seiton (Straighten/set in order), Seiso (Shine), and Seiketsu (Systematize / Standardize), and Shitsuke (sustain /Self-Discipline) (Otsuka, Jin, & Sonobe, 2018).

Many companies begin their lean transformation with 5S as it depicts some of the most visible examples of waste and it helps to establish the framework and discipline required to successfully pursue other continuous improvement initiatives (Brady, 2011)

The 5 S as a Kaizen tool helps to eliminate waste. According to (Spear S. J., 2009) is anything that takes a longer time than necessary, any effort and creativity that does not create value to customers. (Spear S. J., 2009) Adds that improving a process is not an end by itself. It can only be a means of building kaizen improvement skills of workers. This thought underlines the essential aspects of process Improvement, in general, it is developing the capability for everyone in an organization from top to bottom.

Unlike Tylor's scientific management, Kaizen philosophy problem solving approach is built by solving puzzles without prescribed solutions. (Spear S. J., 2009) Emphasizes process improvement as the participants' process improvement capabilities by coaching workers as they try to improve the process. This is ideally in line with the principles of Kaizen philosophy.

The following are Kaizen tools applied in Kaizen practices in several projects as discussed by (Otsuka, Jin, & Sonobe, 2018).

- **Waste (Muda) Elimination:** Muda means waste in Japanese. According to (Womack & Jones, 1996), seven types of wastes should be eliminated. The residues are overproduction, transportation, waiting, inventory, motion, over processing and defects.
- **Suggestion System:** A 'Suggestion System' is the method by which the employees can give feedback on improvement ideas through management hierarchy and according to (Berger, 1997) Suggestion System is complimentary part of the organizational design when mainly is work is designed based on individual tasks and procedures. In companies such

as Toyota and Canon, 60 to 70 suggestions per employee per year are written down and implemented (Poornima, 2011). Through ideas, the employee participates in continuous improvements activities in the workplace and play a vital role in upgrading standards (Imai M. , 1986).

- **Quality Control Circle (QCC):** According to QCC (Otsuka, Jin, & Sonobe, 2018) is the platform, which brings participants from all levels of employees from top management, managers, supervisors, to shop floor workers. The Kaizen concept utilizes the cooperative features of the QCC to collect suggestions on the work process (Imai M. , 1986). QCC is also a useful tool for employee development and effective workplace utilization when the management commitment is assured to support and encourage the participation of employees with the due respect of the humanity of the employees.
- **Total Quality Management (TQM):** According to (Kanji, 1990), TQM is the way of life of an organization committed to customer satisfaction through continuous improvement. Total Quality Management TQM is all about management practices, philosophies and methods to improve the way an organization does business, makes its products, and interacts with its employees and customers.
- **Toyota Production System (TPS):** TPS is the philosophy which organizes manufacturing and logistics at Toyota, including interaction with suppliers and customers (Likert, 2003). Its focus is on the elimination of waste and defects at all points of production (inputs, process, and output) (Andrea, Claudio, & Vittorio, 2018) calls TPS alternatively as Lean Manufacturing to refer to a manufacturing improvement process based on the fundamental goal of the Toyota Production System to minimize or eliminate waste while maximizing production flow (Ono T. , 1988).
- **Just-In-Time (JIT) System:** JIT, a part of TPS, is a production system aimed at eliminating non-value- adding activities of all kinds and achieving a lean production system flexible enough to accommodate fluctuations in customer orders (Monden, 2011).
- **Kanban System:** Kanban refers to a system for controlling production and replenishment throughout its entire value stream. The method can be used by any company seeking to lower costs by better control of their processes." (Vatalaro & E.Taylor, June3, 2005). A Kanban is a process that helps to control and manage materials. It is basically a method

used to monitor a flow of materials in the production system and used as a control of overloading of processes by establishing upper limits to the work in progress inventory.

- **Total Productive Maintenance (TPM):** TPM is a management system that focuses on reduction of costs, improvement of inventory and performance of manufacturing companies (Ahusha & Khamba, 2007). This system is used in companies with continuous production processes to achieve the excellence through Autonomous Maintenance and Planned Maintenance.

II.5 Kaizen principles

Kaizen principles and implementation tools are the whole way of approaching the continual improvement of processes and have a significant impact upon the improvement of quality and productivity (Yokozawa, Steenhuis, & deBruijin, 2011).

Kaizen principles are defined in different ways based on the perspectives of researchers. Some consider principles as an outcome of Kaizen to be an improvement that is continuous, participatory, incremental, and low investment. In several literature Kaizen is in terms of a set of principles, systems (TQM, TPS, TPM ...), methods (PDCA, 5S...) and tools (7QCs Muda elimination, visualization ...)

(Dipak, Ajay, & Shubham, 2015) Indicate that Japanese competitive success is based on kaizen principles. Several researchers defined Kaizen principles in various perspectives. For example, according to (Bagul, Niraj, Ahire, & Pranay, 2016). Kaizen principles are viewed in the aspects of improving quality defects, workplace improvement, decrease waste, empowering employees and continuous improvement. The idea of employee involvement is vital in kaizen practice. People orientation characterizes Kaizen philosophy (Tadesse, 2014).

(Jalu, 2015) also describes Kaizen principles as *"Ask " WHY" five times and seek root causes and avoid conventional fixed ideas with the idea of not making excuses and practicing questioning practices with a culture of correct it right away when mistakes are made."*

In the view of the principle described by (Jalu, 2015) Kaizen practices are not about perfection, and it emphasizes that Kaizen is not about spending money but using wisdom. He says, *"Do not spend money for Kaizen use your wisdom,"* (Jalu, 2015).

According to (Dipak, Ajay, & Shubham, 2015), Kaizen principle emphasizes on teamwork with the idea of using all the teams' knowledge. This principle focuses on the need to involve employees in any process improvement endeavors and stresses that Kaizen rules may vary from company to company.

(Tadesse, 2014) emphasize the principles of Kaizen as valuing human beings and employees' discipline whereas (Haftu, 2015) focuses on improving and maintaining standards and improving on small improvements of work standards.

Literature in the field of process improvement indicates that Kaizen is both a management tool and a philosophy that influences the thinking of workers towards quality, productivity, customer values and driver of performance with maintaining the balance between the empowerment and work satisfaction of employees (Singh & Singh, 2009).

Kaizen, according to (George O, 2009) is a management style which is different in many ways in terms of the extent it is deepened in the culture of Japanese society, it is mirrored in the function of the societal values and attitudes.

II.6 Kaizen Implementation and Operational Impact

Several types of research on Kaizen indicate that Kaizen philosophy has expanded outside Japan, rapidly in countries such as in US, Asia, Australia, Europe, and Africa with encouraging results in terms of improving productivity, cost reduction, lead-time, and quality. The Success of the implementation, however mainly depends on the respective cultural dimensions of countries (Flynn & Saladin, 2006) and (Power.D, Schoenherr, & Samson, 2010).

As Kaizen is expanded in many countries, many types of research assert that the implementation to be successful requires ensuring the context and culture appropriately adopted to Kaizen thinking. Some of the context and culture factors identified in studies are a conducive political framework, harmonious social relations, compassionate and sympathetic attitude, and capacity to take responsibility individually and collectively and ability to work as a team (Ohno, et al., 2009).

If the practices can be sustained, the Kaizen way of doing work will have an impact on the operational performance of organizations (Zimmerman, 1991). Various researches conducted on Kaizen practice in Japanese manufacturing companies have proven a considerable improvement in manufacturing operational performance (Liker.J, 2004), (Ono T. , 1988), (Womack & Jones, 1996), (Womack, Jones, & Roos, 1990).

(Venkataitha & Sagi, 2012) Discussed a case study on six kaizen practices across large scale automobile manufacturing organizations. The kaizen practices namely participation of employees in decision-making, communication, respect for top management, employee involvement, training and education, and perceived quality performance were analyzed in this case study.

In this research, (Venkataitha & Sagi, 2012) it was proven that kaizen is practiced at an organizational level with a focus of improving work area with specific goals with the involvement of a dedicated cross function team. The analysis of the case studies has proven that (Manuel.F Susare, 2008) kaizen practices help to eliminate waste by empowering employees with the responsibility, time and tools to uncover areas for improvement and to support change (Venkataitha & Sagi, 2012) cited Brunet, et, al 2003).

Another survey was also conducted by (Marodin, Frank, Tortorella, & Fettermann, 2017) in the Brazilian automotive supply chain to see the effect of kaizen implementation on the performance of organizations. In the review, 64 companies of automobile supply chains were considered, and the results show a reduction in the lead time due to the implementation of TPM practices and reduce the inventory based on the adoption of JIT practices (Ono T. , 1988).

As indicated in several case studies and surveys, kaizen has been demonstrated to impact the organizations' performance in terms of improving productivity, cost reduction, delivery time and quality of products and services. Studies that had focused on Japanese manufacturing techniques had all illustrated the importance of *kaizen* in the improvement of organizational performance (Liker.J, 2004), (Ono T. , 1988), (Womack & Jones, 1996).

As a matter of the fact that kaizen has been believed to affect organizational performances, it has become one of the packages of the Japanese technical support to developing countries (Marin, Garcia-Sabater, & Bonavia, 2009). As a platform of comfort from Japanese individual factors and

government partnership (GRIP), it is widely practiced in Asia by Japanese firms and increasingly in Latin America and Eastern Europe as well (Marin, Garcia-Sabater, & Bonavia, 2009).

II.7 Cases and Surveys on Kaizen Practices

Since the introduction and successful stories of kaizen in Japan, kaizen has begun appealing to several companies outside Japan especially in the manufacturing sector across the world.

In the review of cases and surveys conducted by various researchers in different countries at different companies, mainly focusing on manufacturing sectors is presented below.

In the study made on the Small and Medium Enterprises (SMEs) in Malaysia (Ghazali & Mahmud, 2015), the findings of the case study show that kaizen implementation can be successful if Kaizen practices are well integrated and applied. Where Kaizen practices, which include employees' commitment, empowerment, participation, and understanding of corporate strategy, are correct, applied; kaizen was proven vital in enhancing the competitiveness of companies, in this case, SMEs.

The case study has also revealed that kaizen practices encounter challenges related to failure to motivating employees and lack of skills to manage the continuous improvement process. The employees' motivation and ability of employees to implement Kaizen tools is critical for the success of Kaizen (Tadesse, 2014).

Similar findings were indicated in the case study of (Ravee, 2014). In this particular case the research revealed management challenges in administering kaizen in terms of the complexity of both technical and social working systems and process. According to this study, the success of implementation depends on the technical and managerial abilities to manage kaizen practices, which also requires the involvement of all employees. This asserts the principle that Kaizen should involve every employee in making a change (Dipak, Ajay, & Shubham, 2015).

(Andrew P. , 2013) also argues that culture affects the way problems are perceived. (George O, 2009) even in his research on process improvement also establishes horizons of perception.

(Jalu, 2015) States that Kaizen requires the ability of people on how to do it not why it cannot be done. The strength comes through the synergy of teamwork. Several researchers underscore the importance of using the teams' knowledge rather than an individual's knowledge for the active practice of Kaizen (Dipak, Ajay, & Shubham, 2015).

The case study made by (Ravee, 2014) indicated that the perception of having additional workload affects the kaizen practice effectiveness. The effective kaizen implementation demands kaizen discipline, understanding methods, and process and practicing questioning conventional fixed ideas (Jalu, 2015)

In most successful companies, the results were achieved due to the kaizen practice that improved in creating suggesting systems which enhances the bottom-up approach of decision-making, and employee engagement, and the ability to detect operational errors before a problem occurs (Dipak, Ajay, & Shubham, 2015). And, when a problem arises as (Jalu, 2015)says the ability to correct it immediately is a characteristic of Kaizen culture. Kaizen has helped the workers in Kubota to be problem conscious in Kubota. This justifies one of the principles of Kaizen defined by (Jalu, 2015)

(Rahmanian & Rahmatinejad, 2013) have also studied kaizen implementation and its effect in Iranian Manufacturing companies. According to this study, the result was a significant improvement in productivity. The productivity improved 30%, 50% and even 100 % or more over the years continuously.

The critical thing to be noted in all the cases reviewed is that the changes achieved were without a considerable investment. This supports the claim in many findings that kaizen can bring significant changes with no significant investments (Smadi, 2009).

(Chanda, 2017) has also researched on Zambian manufacturing companies and concluded that implementing kaizen programs; the companies were successful in improving quality, delivery performance, and cost reduction.

In this particular case study, the findings asserted the success of standard kaizen practices the 5s, suggestion systems, and employee attitudes were at different extent. It was elaborated that the ‘5s’ was successfully implemented, whereas the ‘suggestion system’ was implemented to a minimal

level. The employee attitude was discovered to be the most challenging while the least kaizen practice performed was management support.

Several types of research attest that the key to Japanese competitive success is due to Kaizen practices such as waste removal, people involvement and problem-solving approach (Puneet, Kumar, & Singh, 2015) Waste removal approach requires a suitable housing keeping discipline of employees (Bagul, Niraj, Ahire, & Pranay, 2016).

According to (Desta, Asegedom, Gebresas, & Asheber, 2014) implementation of kaizen has significant improvements in productivity, quality of product and services and motivated several companies to apply kaizen in their respective companies in many countries in outside Japan.

In all the cases reviewed, the success factors for Kaizen practices are almost similar. The findings indicate the importance of leadership and employees' engagement and commitment to improvement culture. According to (Ghazali & Mahmud, 2015) excellent communication between top management and employees, having clarity on corporate strategy, having kaizen champion, employees' good knowledge in the organization are essential aspects for kaizen to be successfully implemented.

II.7.1 Case Studies and Surveys reviewed by (Singh & Singh, 2009)

The case studies and surveys reviewed by (Singh & Singh, 2009) done by other researchers from different countries and companies confirmed that Kaizen could result in improved performance in terms of increased productivity, improved quality, reduced cost, improved safety and enhanced delivery time.

Not all the cases and surveys prove that all continuous improvement (Kaizen) practices have been successful in all aspects. Some organizations failed to achieve the intended results. Some of the cases reviewed by (Singh & Singh, 2009) shows the Kaizen can be applied in all operations and all sectors. Globally Kaizen has been widely applied with appropriate adoptions to fit into a given context. The case reviews and the surveys also indicate that Kaizen tools, systems, and methods used are not the same in all cases. The choice of the plans, systems, and tools depend on the specific context and needs.

Kaizen was applied in a Simulation Model Development, and the result obtained was cost saving considerably (J. Singh and H. Singh cited Jayaraman et al. (1995). This confirms the prerogative that Kaizen has cost reduction impact when appropriately applied.

Kaizen was also applied to a small-sized Custom Made Furniture Industry – the review of the case study has shown that Kaizen or continuous improvement resulted in higher quality, lower cost and higher productivity (J. Singh and H. Singh cited Radharamanan et al. (1996). This conforms with the basic principles of Kaizen which emphasizes the improvement in the operational variables (cost, productivity, and quality).

Morris Electronics Limited an Indo- Japanese joint venture firm has applied a continuous improvement system and achieved improvement in productivity and sustained competitiveness (J. Singh and H. Singh cited Chaudhari (1997). In this particular case, the exciting feature of the Kaizen is that companies can improve productivity on a continual base (i.e: outcome sustainability).

Sheridan (1997) and Erlandson al (1998) (cited by J. Singh and H. Singh) applied Kaizen practices to Allied Signa Inc., Jet engine Manufacturing industry. The result shows improvement work in process by 89% and productivity increased by 88.5% and floor space saving was recorded to be around 2000sq.ft. Similarly, the Kaizen tool applied to the Fuel Filter Assembly resulted in an increase in production rate by 80% and the variation rate decreased from 50% to 1%.

Similarly, Kaizen was applied in Commercial Manufacturing and Aerospace Manufacturer. The output of the Kaizen implementation was a substantial improvement in the manufacturing process. In another different case (Adams et al. (1999 cited by (J. Singh and H. Singh) applied Kaizen tools in a leading international company manufacturing medical products. Successful results were achieved in terms of quality improvement, customer satisfaction, cost reduction and morale of workers. In this case, the Kaizen was combined with business reengineering approach, and the result was profound.

Savolainen (1999) cited by (J. Singh and H. Singh) conducted two case studies in the medium-sized metal industry and other larger group in construction and concrete industry. The result was that Kaizen tools brought in better understanding of the process.

Burns (2000) cited by J. Singh and H. Singh applied Kaizen tool called Overall Equipment Effectiveness (OEE) to six pilot areas identified out of which three were successful in terms of reducing change over times and helped the company to produce more diversified products and managing challenges in the machine overloading. In this case, the Kaizen approach impacted organizational effectiveness.

Chen et al. (2000) cited by (J. Singh and H. Singh) applied Kaizen on a small manufacturing designing system. Kaizen has resulted in a reduction of unit cost by 25%, discount of floor space requirement by 15% and improved communication network in the organization.

Lee (2000) cited by (J. Singh and H. Singh) conducted a case study at Nicholas Foods Manufacturing food products. In this case study, the company values employees, and as a result, employees are motivated to strive for excellence. The Kaizen tools (5S and team training resulted in a reduction of quality rejections, reduction in change overtimes and increase inefficiencies.

Ashmore (2001) cited by (J. Singh and H. Singh) the Kaizen tools and methodology applied in Toyota company resulted in the sales increase by multiple of at least 69% and the profit increased by 54 times in the fiscal year

(Palmer, 2001) has also conducted a study on Kaizen effect in the BAE SYSTEM focusing on removal of Muda (waste). The impact of the Kaizen implementation was processed time reduction from 610 hours to 290 hours, which resulted in an overall saving of over a million dollars per year.

Ahmed et al. (2005) cited by (J. Singh and H. Singh) conducted a study in a Casting Based Manufacturing Plant which was implementing Kaizen and found that effectiveness and efficiency were improved due to continuous improvement endeavors.

Granja et al. (2005) cited by (J. Singh and H. Singh) conducted a study in a construction company and concluded that combining target and Kaizen concept is helpful to the construction company to meet value for the customer at a low price with a reasonable profit. This is in alignment with the emphasis of the principle of Kaizen to customer value.

Dehghan et al. (2006) as cited by J. Singh and H. Singh reviewed the case study of Kaizen project in National Productivity Improvement Program (NPIP) at a Chaharmahal-Bakhtiari Agricultural Organization. The application of 5s and process improvement tools were applied and resulted in a decrease in 11% stations, decrease in 11.7% moving around, 16% time saving, 34.2% length decrease and 53% saving in transportation cost.

Validya and McCartney (2006) cited by discussed the application of Kaizen to welding operations by taking two examples of a small sample of 100 welding performance appraisals that have been carried out in Canada in recent years. In this case study, it was confirmed that by involving everyone in the organization significant results could be achieved. The result of continuous improvement factors the involvement of everyone in the organization that is in line with one of the principles of Kaizen.

Kikuchi et al. (2007) cited by J. Singh and H. Singh studied the case of Kaizen application in the semiconductor industry. The result shows that a 7% reduction in cost on the consumption of gases and chemicals for 12 items. From this result, it was concluded that it could be applied to other areas as well.

Chandrasekaran et al. (2008) cited by applied Kaizen methods to solve part mismatch problem in automobile assembly production line. The observed result was a reduction in quality rejections, elimination of rework processes and cost saving.

II.7.2 Surveys Reviewed by (Singh & Singh, 2009)

Various researchers analyzed the study conducted in different companies at different time. Here the research reviewed by (Singh & Singh, 2009) is considered to discuss the success or failure of the Kaizen practice in different parts of the world.

Gbband Davies (1990) cited by J. Singh and H. Singh has surveyed Australian Small to Medium Enterprises (SMEs). The survey has indicated that corporate culture, creating an effective structure and, analyzing competitors, developing cooperation and partnerships, and developing flexibility and speed of response are parts of Kaizen continuous improvement that influenced the operation of the SMEs.

Similarly, Soderquist (1996) cited by J. Singh and H. Singh reviewed the survey on Kaizen practices in French SMEs and found encouraging results in terms of customers' satisfaction concerning the performance of the organizations' performance in product innovation activities.

Bassant (2000) cited by J Singh & Singh discussed the survey that has been conducted by continuous improvement Research Advantage at UK firm. The study suggested that 65% of companies consider continuous improvement to be useful and about 50 % have shown interest to apply the Kaizen concept, and 19% claimed they have a sustained process of constant improvement in operations and convinced that it affects productivity, quality and delivery performance.

Hongming et al. (2000) cited by J Singh & Singh surveyed Chinese companies and found that not all companies that conducted continuous improvement activities achieved desired results.

Mackle (2000) cited by J Singh & Singh cited by presents a survey conducted by a Kaizen institute in UK which was designing and implementing CI with many companies and the study was done with all clients of UK clients. The survey shows that organizations have not successfully implemented these improvements programs. However, the survey indicates opportunities for improvement.

Terziovski (2001) cited by J Singh & Singh discussed a survey conducted on continuous improvement and SMEs performance in 115 Australian manufacturing industries and concluded that ongoing management strategy and systems are significant predictors of SMEs performance.

Gonsalves (2002) cited by J Singh & Singh surveyed the effect of continuous improvement on performance in 500 manufacturing companies. From the survey, it was concluded that constant improvement implementations have a positive influence on the operations of companies. In this survey, it was mentioned that integrated continuous improvement and business process reengineering have positive effects on the company's performance.

Malik and YeZhuang (2006) cited by J Singh & Singh surveyed 105 Spanish and 50 Pakistan Companies to analyze the outcome of continuous improvement practices in these industries. The results show that the Spanish industries which employ these tools are fairly more experienced and progressive than Pakistan industries.

Tseng et al. (2006) cited by J Singh & Singh examined the effect of continuous improvement and cleaner production on operational performance. The result shows that constant improvement might not be able to improve operational performance. However, continuous improvement plays a significant role in a cleaner production implementation.

Yan- Jiang et al. (2006) cited by J Singh & Singh surveyed by using the data of global continuous innovation network to analyze the influencing factors of constant improvement. The result shows that the internal motivation factors are responsible for the popularization of ongoing improvement activities and have a varying degree of influence on these activities.

Malik et al. (2007) cited by J Singh & Singh surveyed by a comparative analysis between two Asian developing countries, China and Pakistan, by scrutinizing how they are deploying continuous improvement practices. The result shows that the industries in both countries are using continuous improvement methodologies but with different extents.

The conclusion from the review of the case studies and surveys that the continuous improvement approach is useful to make organizations effective and efficient. Notwithstanding the difference in the context of the organizations and the methods, tools or systems applied, the effect of Kaizen on the performance of the organization is verified to be spot-on.

II.8 Transferability and Sustainability Kaizen

Today Kaizen is widely being transferred in Asia, Africa, the Middle East, and Europe. Following the success of Kaizen in Japanese companies, Kaizen has been promoted outside Japan as a preferred management tool (George O, 2009).

The success of managers in Asian countries like Japan, Singapore, South Korea, and Taiwan over the years has been rapid and more successful because of similarities in the Kaizen culture and the national culture of these countries (George O, 2009). Similarly, though cultures could be different in Africa several scholars believe that Kaizen can also be transferred successfully into Africa (George O, 2009), (Desta A. , 2011), and (Otsuka, Jin, & Sonobe, 2018). One of the attractions to Kaizen by several countries and companies is that *kaizen* is a low-cost approach to improve

productivity. It applies existing equipment and human resources more efficiently and effectively focusing on enhancement of the internal capability of a firm (Imai M. , 1986).

According to the book edited by (Tetsushi, Keijiro, & Kimiaki, 2018) industrial development has been a success in countries where Kaizen was implemented. The authors believe that Kaizen had a significant contribution to the success achieved

In addition to being a low-cost method, Kaizen as a change tool does not bring drastic result. Kaizen focuses on common sense change, low cost, and low-risk improvement not innovation (Bagul, Niraj, Ahire, & Pranay, 2016). Kaizen philosophy promotes changes through continuous improvement on an incremental basis focusing on monitoring standards, workplace improvement through waste removal (Zimmerman, 1991).

(Ohno, et al., 2009) suggest that *kaizen* may be particularly appropriate for companies in low-income countries, which face financial constraints, as it does not require a considerable investment.

(Smadi, 2009) adds that if adequately implemented Kaizen can substantially contribute to continuous improvement and thus, drive organizations for high competitiveness without a need for significant investment.

From the studies, the researchers' general conclusion is that as Kaizen is a philosophy that defines work, improvement, values, reason, mind, and language in context to Japanese culture and the implementation is influenced by the social, economic and cultural backgrounds of Japan (Kono, 1982).

(Kono, 1982) Indicated that although the Japanese management system is ingrained in Japanese culture, many of its aspects are the result of rational judgment and were transferred to Japan from the U.S and other countries. He claims that these practices are too indigenous to Japan, but it is still possible to transfer these practices to other countries. This claim is supported by several other research (Anh, Matsui, & Yen, 2015).

Various kinds of literature indicate that cultural factors are vital in transferring the concept of Kaizen or (Rechat & Wilderom, 1988) for instance, emphasized the role of culture and found that successful transfer of kaizen practices such as the suggestion system, is possible in non-Japanese

companies through organizational culture transformation. According to (Smadi, 2009) one of the challenges in Kaizen implementation is a suitable culture of creativity and mindset of unfreezing a status quo.

Kaizen as a management style has both the dimensions of principles and methods. However, the management philosophy is affected by the cultural values of management. (Flynn & Saladin, 2006) and (Power.D, Schoenherr, & Samson, 2010) assert that that cultural dimensions influence a process of the management decision-making process.

With the management decision-making process the impact of the view According to (Yokozawa, Steenhuis, & deBruijin, 2011) there are various stages in the kaizen transfer process and the factors influencing each step. A case study conducted by (Yokozawa, Steenhuis, & deBruijin, 2011) in Japanese manufacturing companies identified three critical stages in the kaizen process. These are preparation, implementation, and integration. Influences of the factors are different at different stages.

Despite several success stories in kaizen implementation, failures in the implementation of kaizen are also reported in several cases. (Putti & Chong, 1985) , for example, noted that Japanese companies in Singapore were least successful in the practices, which are implemented in their mother companies in Japan. (Fukuda, J. Gordon, Oliver, & Wilkinson, 1989) also mentioned of failures in the implementation of Japanese management systems (that encompasses kaizen) in non-Japanese companies.

(Pillet & Maire, 2008) surveyed 40 organizations to examine their performance vis-a-vis application of different types of Kaizen tools (e.g., 5S, QCC etc.) and identified factors that they viewed as most important for sustainability for Kaizen practices.

The surveys conducted by (Pillet & Maire, 2008) has shown that across multiple process improvement activities, organizations sustained, on average, only 40 percent of improvements, which further illustrates the difficulty that organizations have in supporting improvements

Among several researchers (Oppong, 2013) the study conducted on Sub Saharan African Countries indicated that cultural and social values impact kaizen transfer. The African employees are influenced by cultural values which are directly reflected in the work culture (Andrew P. , 2013).

(Otsuka, Jin, & Sonobe, 2018) also discusses the challenges of Kaizen practice, and one of the issues is creating the discipline in employees about developing the skill sets that Kaizen requires. In several countries, Kaizen was modified to the respective contexts, and the challenge, mainly is that customization of the Kaizen culture and the skill development is more dubious in African countries. The commitment of management and making it a human-friendly in a given management style are critical factors for the success of Kaizen implementation.

(Otsuka, Jin, & Sonobe, 2018) raises a question regarding the sustainability of Kaizen in the book 'Applying Kaizen in Africa'

“According to a certain survey. Less than 30% of firms received Kaizen training in the past continue to practice Kaizen. Is it possible to make Kaizen more sustainable?” (Otsuka, Jin, & Sonobe, 2018).

According to, Sonobe and et al. commitment of top management, basic literacy level to understand the necessary training on concepts of Kaizen and making Kaizen human-oriented have been critical factors in the adoption of Kaizen process to a given context.

Kaizen has become a culture in Japan. It has become the Japanese style of business and management and is deeply rooted in the literature and is highly factored into the values and attitudes. Transferring kaizen from one culture to a different one, therefore, needs a cautious approach as it gets difficult to replicate or adopt Japanese management styles due to context-specific challenges (Rechat & Wilderom, 1988).

One possible reason why South Korea and Taiwan have shown rapid growth may be due to the cultural similarities in management approaches, which made kaizen probably more successful in these countries than other countries. The management styles of South East Asian countries are close to Japanese management styles (Ravee, 2014) and (Shang, 2017).

The challenge of kaizen transfer is more complicated in African countries due to infrastructure, and governance factors coupled with the culture challenges (O.Tasie, 2009) and (Tetsushi, Keijiro, & Kimiaki, 2018). Kaizen transfer and implementation need more work to adapt the given culture of a country to kaizen culture (Anh, Matsui, & Yen, 2015)

(Otsuka, Jin, & Sonobe, 2018) on the report on the experience of Ethiopia in transfer and dissemination of Kaizen, it was mentioned that the cultural difference between Japan and the diversified ethnicity of Africa are challenges to the successful transfer of Kaizen

(Otsuka, Jin, & Sonobe, 2018) have studied several cases of Kaizen practices in different continents. According to his review, JICA has been supporting many African countries (Cameron, Egypt, Ethiopia, Ghana, Kenya, Tanzania and Zambia in carrying out several Kaizen projects in these countries in Africa since 2005. When Kaizen projects were started in Africa through JICA's support, it was high economic growth time to most African countries. Competition in the international market became critical for African countries especially for Sub-Saharan Countries; thus, the need for improving productivity a driving force to implement Kaizen in these countries.

(Anh, Matsui, & Yen, 2015) Did an empirical study on kaizen practices and different cultural dimensions in Asian manufacturing companies. The finding in this study concludes that there is a positive correlation between kaizen practices and cultural aspects. The researchers suggest the right method at the right time is the critical success factor for the transfer of kaizen culture.

(Anh, Matsui, & Yen, 2015) the researchers applied the model of Hofstede - the national culture framework (1980, 2001) to compare the national cultural differences between Japan and Vietnam.

(Anh, Matsui, & Yen, 2015) discussed the difference in cultural dimensions such as power distance, uncertainty avoidance, Individualism/ collectivism, and masculinity/ femininity) of Japan and Vietnam.

The researchers were interested to understand the impact of the cultural dimensions on kaizen practices 'small group problem solving', 'process control,' 'employees' suggestion.'

As indicated in the research data table made by the researchers, clearly there are significant differences between the values of national cultural dimensions of Japan and Vietnam. The values for uncertainty avoidance, masculinity/ femininity, power distance, and individualism /collectivism are (95, 40), (92, 30), (54, 70) and (46, 20) respectively. The researchers concluded that understanding the difference between the cultures and proper adoption of the Kaizen practices is essential to transfer the kaizen culture into a given national culture.

According to (Macpherson, Lockhart, Kavan, & Iaquinto, 2015) Kaizen is a broad philosophical approach that can be applied to meet specific goals for different members of the organizations without a universal consensus how it works in various context. Kaizen in Japan, for instance, is considered to drive workers' creativity, proactivity, and innovation in the workplace.

According to (Anh, Matsui, & Yen, 2015), the national culture dimension is the critical determinant for the success of the transferability. The findings of the study indicate that there is a positive correlation between kaizen practices and cultural aspects of the performance of the organization.

Research on Kaizen sustainability is minimal compared to the studies available on the implementation of Kaizen. The factors that determine the viability of Kaizen practices were studied by (Ghazali & Mahmud, 2015). The research indicated that sustainability depends on how improvement is made active and what tools or methods were applied in the implementation. The engagement and performance of managers and operators in terms of achieving the goal of the organization effectively through continuous improvement is critical for sustaining the practices (Bhuian & Baghel, 2005).

Several types of research and cases studies discussed here indicate that the impact of kaizen implementation was significant on lead time reduction, cost reduction, quality and, and waste elimination. Measurable improvements were obtained (Puneet, Kumar, & Singh, 2015). The results have proven that kaizen produces positive improvements, but the sustainability issue remains challenging and needs further research.

In most of the literature on kaizen, the transferability challenges and the effect of kaizen on operational performance have been widely discussed. Several types of research focused little on

the sustainability aspect of kaizen practices. The study by (Li & Found, 2016) also indicates that challenges on kaizen transfer could be related to national culture and organizational culture.

From the case studies discussed above, it can be concluded that the success of kaizen implementation depends on identifying the right practices at the right time. According to (Anh, Matsui, & Yen, 2015) how kaizen is implemented and which kaizen methods are applied needs critical attention for the kaizen culture to be successful in an international context.

The cases give evidence that kaizen, despite the challenges that may be encountered in relation to adoption and adaptability to the context of a given country or organization has proven to be essential management tool for improving the production, cost reduction, workplace improvement, and improving quality of products and services (Rechat & Wilderom, 1988).

II.9 Challenges of Kaizen Practices

Several studies made on kaizen implementation have identified common challenges to kaizen implementation in general and at the organization level in particular. Studies conducted on manufacturing companies practicing kaizen indicate common problems such as resistance to change, the inability of management to motivate employees and lack of understanding of companies' mission, vision and strategy are some among several challenges in the endeavor of kaizen implementation.

Some researchers have attributed these challenges to the context specificity of kaizen. Kaizen being Japanese origin, some researchers argue that Kaizen cannot be replicated in a different culture. (Rechat & Wilderom, 1988) and (Smadi, 2009) in line with this also indicated in his study the success of Kaizen is not always guaranteed, like the work environment and organizational culture can be variables in its implementation.

Some studies, however, show that Kaizen can be replicated in a different culture as long as there is a managerial commitment. Management commitment is one of the critical factors that influence the success of kaizen implementation (Bessant J. , 2003). According to them, this is because management commitment determines the allocation of resources for kaizen activities.

(Ghazali & Mahmud, 2015) Ascertained similar challenges of Kaizen transfer in his study conducted on Small and Medium Enterprises' (SMEs). Kaizen is highly imputed by work orientation and the value of work in one's life. The work orientation is dependent or influenced by the national culture, organization structure and the context in which an organization operates (Oppong, 2013) which in turn determines the effectiveness of kaizen practice in the organization.

Kaizen, as described by (Rahmanian & Rahmatinejad, 2013) affects changing the mindset of employees in terms of customer value, which is respecting and meeting the needs and demands of customers. This is in line with the principle of having every interaction with customers and suppliers (Bagul, Niraj, Ahire, & Pranay, 2016) which is the TQM thinking.

Most importantly, customer satisfaction factor is critical to sustaining the results of continuous improvement. (Mullins, 2010) Also discusses the employee side of satisfaction in the work area. He describes the concept of Kaizen in terms of Total Quality Management (TQM) as a way of life for an organization as a whole, committed to total customer satisfaction through a continuous process of improvement and the contribution and involvement of people.

In several kinds of literature, it is noted that employee satisfaction is an essential aspect of implementing and sustaining Kaizen. According to (Mullins, 2010), the workers' pride in work and control process reflects the management style which is in line with the principles of Kaizen where the human side of quality improvement and the treatment of employees is vital for the success of Kaizen which is supported by the principle of people orientation in Kaizen practice (Haftu, 2015).

II.10 Kaizen in Ethiopia

II.10.1 How Kaizen was started in Ethiopia

In a globally competitive business environment, companies particularly those in developing economies choose to enhance their capabilities to encounter the challenges they face. According to (Beshah, 2018) one of the most recognized simple and less costly technique that helps to enhance competitiveness is kaizen- continuous improvement. Improving customer service, making operation faster, more activity, reduction in costs and quality improvement are challenges faced by most industries today (Ethiopian Kaizen Institute(EKI), 2014) and (Alberto, 2018).

Several reports and researches indicate that the Ethiopian government has started a nationwide reform on its civil services system since 1994 to improve the service delivery systems. For instance, the government-initiated implementation of one of the process improvement tools; Business Process Reengineering (BPR) with the intention of radical changes in its civil service system (Getahun T. , 2011) and (Tadesse, 2014)

In 2008 after 14 years of experimenting BPR, the government of Ethiopia through the former Prime Minister of the country initiated the idea of transferring the Kaizen from Japan to Ethiopia (Desta, Asegedom, Gebresas, & Asheber, 2014).

Kaizen as a management tool was introduced in Ethiopia in 2009 with the Japan International Cooperation Agency (JICA) in response to the request from the government of Ethiopia. Japanese government, through bilateral development cooperation had for many years shown interest to support the transfer of Kaizen as part of the development assistance package. The government of Ethiopia was keen to implement the Kaizen philosophy to enhance the national development strategy to foster economic growth through improving productivity and efficiency (JICA & GRIPS, 2011) and (Otsuka, Jin, & Sonobe, 2018)

According to the report from Ministry of Industry, the proceedings released on Dec 2011 from the ‘Industrial Policy Dialogue between Ethiopia and Japan where the Prime Minister and his high-level delegation participated, the request was made to Japanese Government for support on Kaizen transfer to Ethiopia (MOI, 2011).

One of the agendas in the dialogue was the concept, practice, and institutionalization of Kaizen-global practice and Ethiopian application which motivated the Prime Minister to initiate the request for Kaizen transfer. In the dialogue, the Ethiopian side was represented by a high-level delegation, and from the Japanese side, present were GRIPS researchers, JICA officials, and experts and other universities’ experts (GRIPS, 2012).

II.10.2 Piloting Kaizen Projects in Ethiopia

After the support was secured from the Japanese government, the Ethiopian government started working on the preparation to bring in the Kaizen culture into the country particularly in

manufacturing sectors. According to the report from Ministry of Industry (MOI, 2011) in 2009 the ministry of Trade and Industry reviewed about 63 manufacturing companies that were located within the 100 kms of Addis Ababa, the capital city of Ethiopia to assess the their quality and productivity status from October 2009 to June 2011 (MOI, 2011).

Based on the assessment result only 30 manufacturing companies; ten from Metal; 6 from Agro-Processing; 6 from Chemicals; 4 from Leather and four from Textiles were selected for piloting Kaizen Projects.

According to the same report from the Ministry of Trade and Industry (MOI, 2011),the manufacturing companies were selected for the projects based on their proximity to the capital city, and level of contribution to the export and import, the level of capital invested and the qualified employees.

The assessment of JICA on pilot projects has shown that out of the six companies chosen as the Kaizen models; 3 of them, i.e. 50 % of them were in chemical sector, and 1 from each of metal, textile and Agro-processing sectors. None from the leather sector was qualified to be a Kaizen Model (Ethiopian Kaizen Institute, 2017) and (JICA & GRIPS, 2011).

The report also indicates that after the successful implementation of the pilot projects, the Ethiopian Kaizen Institute was established in November 2011by the council of the ministers' regulation No. 256/2011 with the mission of scaling up the Kaizen projects across the country.

The Kaizen projects in Ethiopia have been implemented in two phases. The first phase was conducted from October 2009 to June 2011. The second phase was implemented from Nov 2011 to Oct 2012, (JICA., 2013).

According to a report from EKI, the first Kaizen pilot project has confirmed that the Ethiopian companies well-received kaizen philosophy. The second project was to train consultants to build the capacity of the Ethiopian Kaizen Institute (EKI., 2013) which comprised of 57 consultants and 133 trainers.

The third project, which is currently underway focuses on advanced level Kaizen knowledge comprising of 90 Kaizen consultants. This project targets the 30 pilot projects which completed the piloting phase. As part of sustaining and promoting Kaizen across the country, Ethiopia has developed local capacity development programs in partnership with local universities to train Kaizen professionals. In this program 18, Kaizen consultants were graduated with master's degrees. Besides, 38 students were enrolled in a master's program.

The recent report obtained from Ethiopian Kaizen Institute (EKI .. , 2019) shows that Kaizen has been implemented across different industries including manufacturing and service sectors with a total number of 148 manufacturing companies and 106 Service sectors across different parts of the country.

II.10.3 Kaizen Practices in Ethiopia and Results Achieved

As discussed in various case studies and surveys, corporations in the developed world have proven that successful Kaizen approaches can deliver increased productivity, maximization of profit, customer satisfaction, and market share (Admasu, 2015) and (Desta, Asegedom, Gebresas, & Asheber, 2014) and many other scholars also believe that Kaizen principles can be applied to the context of developing countries (Desta A. , 2011).

The Government of Japan through the Japan International Cooperation Agency (JICA) agreed to offer assistance in transferring the Kaizen technology, and the Kaizen project was designed with close support from JICA. As indicated in (EKI, Ethiopian Kaizen Institute; Growth and Transformation Plan(GTP II) 2015-2020, 2015a) and (EKI, Comprehensive understanding of Kaizen and Implementation Strategy, 2014b). After the project design phase was completed, the former Ministry of Trade and Industry established kaizen unit with professionals drawn from the ministry and relevant sectoral institutes, and JICA deployed a consultant team to work with the Unit. The kaizen project was officially launched with the first National Kaizen Seminar in the presence of high-level officials from both sides. With the project pilot companies, kaizen was selected as one of the management tools to improve and enhance the managerial capability to implement Growth and Transformation Plan (Ethiopian Kaizen Institute(EKI), 2014).

According to the report from the director of Research Program Division of JICA Research Institute, the project was designed jointly by JICA and Ministry of Industry (Ethiopia) with a project life from October 2009 to 2011. The sector focused on for the pilot phase was the manufacturing area, 30 companies were selected. The project was designed with three objectives:

- Pilot project performance to scale it up to the national level
- Human Resources Development aiming to transfer Kaizen skills to the staff of the ministry of industry (Ethiopia)
- National Plan Formulation- to disseminate the Kaizen activates across the manufacturing companies in Ethiopia.

Ethiopia is one of the African countries, which are implementing Kaizen in Africa since 2009. According to the report from EKI, It was found that out of 28 companies piloted 10 (more than one- third) were graded with notable achievements, which can be considered a success to have Kaizen Model companies. (Tetsushi, Keijiro, & Kimiaki, 2018) The report shows the following results were achieved:

- Productivity improved by 37.2%
- Reduction of waste accounts for 55.2% and defect reduction accounts for 31.3%.
- The cost of production was reduced by 6% and search time was reduced by 95%.
- Similarly, for model companies, industrial accidents were found to have reduced from 49.5% to 15%.
- The problem-solving abilities of employees were observed, and the workers solved 50.3% of the identified problems.

This result encouraged the government of Ethiopia and JICA to scale up the Kaizen implementation in other companies as well. After the pilot phase, several companies implemented the kaizen philosophy across the country mainly in manufacturing factories.

II.10.4 Challenges of Kaizen Implementation in Ethiopia.

(Desta, Asegedom, Gebresas, & Asheber, 2014) also conducted a study on three companies in Ethiopia Mesfin Industrial Engineering PLC, Almeda Textile Factory PLC., and Sheba Leather

and Tanning Industry PLC), which were among the selected for piloted projects during phase I of the Kaizen implementation.

He indicated in his findings that the transferability of the Kaizen culture was challenged by the current organizational culture that the results were not successful.

From the case studies by (Desta, Asegedom, Gebresas, & Asheber, 2014) and others, we can see that the success of Kaizen Culture implementation depends mainly on the change in the culture. As some studies indicate a certain level of improvements in productivity and efficiency can be achieved, but the effectiveness of Kaizen transferability depends critically on the alignment of the organizational culture to the Kaizen culture. Several researchers have indicated in their studies that learning is essential factor affecting the kaizen transfer process (Fukuda, J. Gordon, Oliver, & Wilkinson, 1989).

When there is a lack of synergy between the Kaizen culture and the existing culture of an organization, transferability cannot be guaranteed. (Lillrank & Kano, 1989) indicated that direct transfer of Japanese Kaizen practices often fails due to differences in cultures. Most organizations fail in Kaizen implementation only due to failure related to cultural transformation. The success of the implementation of Kaizen in foreign companies depends on the cultural and social context (Aoki, 2008).

In Ethiopia, it has been about ten years since Kaizen was introduced. It is, therefore, attractive to researchers to know if Kaizen has been sustainable and to assert its effect on the operational performance of the organizations in Ethiopia, which have been implementing the Kaizen methods.

Due to economic, environmental, cultural, and political dynamics, Business in Ethiopia like elsewhere in developing economy continues to be difficult and unpredictable. Despite all the political and global economic challenges Ethiopia has registered double-digit economic growth for the last ten years (Desta A. , 2011). Recently a political reform has been taking place which introduced economic reforms through opening up the market and more privatization (Ahmed, 2018).

Despite the government's effort to change the economic structure, one of the challenges for Ethiopia has been competitiveness on the global market. According to (Getinet & Admit, 2001) Ethiopia's experience in industrialization and competitiveness was found to be poor. Competitiveness is key in sustaining the development efforts in the globalized world. Globalization is a must to face, and the only way to overcome challenges and grasp the opportunities provided by global market is to have a competitive economy. This is more appealing to the countries like Ethiopia which aspire to have export-led economy (Shang, 2017).

For a growing economy like Ethiopia low productivity has always been a deadlock to be competitive in the global market. For economy structure which suffers from small productivity Manufacturing industries as (Robinson, 1991) suggests continuous improvement is one of the core strategies for excellence in production and is considered vital in today's competitive environment Which again is not an easy task as continuous improvement calls for endless effort for development involving everyone in the organization (Imai M. , 1986)

Since Kaizen was introduced to Ethiopia, improvements in efficiency, productivity, and work area improvements were recorded. Several cases studies and reports indicate that in the companies which have been implementing Kaizen in Ethiopia show that productivity and efficiency are significantly being improved (JICA., 2013) (Desta, Asegedom, Gebresas, & Asheber, 2014) and (Admasu, 2015).

The critical challenge for manufacturing sectors in Ethiopia and like most other developing economies is the lack of managerial methodologies like Kaizen (Ohno, et al., 2009). Some works of literature indicate that lack of capital and technological capabilities are significant problems in the manufacturing and service sectors. For example, (Admasu, 2015) asserts that the most feasible and easy and quick to be improved with a little investment and resources are changing the managerial capacity with Kaizen tools. Therefore, Kaizen becomes an appropriate tool for developing economies.

After four years Kaizen's introduction to Ethiopia, (Desta A. , 2011) describes the Ethiopian manufacturing industries which contribute not more than 5% to the Gross Domestic Product(GDP) as having challenges mainly due to low skilled human resources and technological gaps.

Manufacturing organizations strive to improve their performance by applying different managerial tools. The government is also committed to improving productivity by transferring Kaizen technology to the sector.

(Andrew P. , 2013) discussed in his study on the challenges of process improvement in East Africa that with low level of economy, the scarcity of capital and resources to cover budget required for investment in innovation and technological improvement becomes a challenge to a country and may lead to fragility, outdated, inefficient and ineffective infrastructure, equipment/tools and processes

In a context where capital scarcity is high when processes are not efficient and effective and when productivity is low, the need for Kaizen culture becomes more appealing. The drive for continuous improvement with a kaizen methodology is the small investment the Kaizen tools require (Ohno, et al., 2009). Kaizen does not require huge investment and expertise. It only takes available resources, commitment, engagement, and mindset to change the way business is done, i.e., culture change (Aoki, 2008).

(Andrew P. , 2013) And (Desta A. , 2011) on process improvement challenges in Ethiopia, they mention that the cultural aspect is a significant challenge in the implementation of process improvement projects. The cultural factors have led to inflexible, bureaucratic process with too many hands-offs, reviews, and approvals have been challenges to Kaizen implementation (Andrew P. , 2013).

Using Hofstede's cultural dimensions Power Distance (PDI), Model Individualism (IDV), Masculinity (MAS), Uncertainty Avoidance (UAI), and Long-Term Orientation (LTD) values can be used to compare the fundamental cultural differences between Japan and Ethiopia.

Country	PDI	IDV	MAS	UAI	LTD
Japan	54	46	95	92	80
Ethiopia	70	20	65	55	-

Source: Hofstede (1980, 2001)

From the table, we can see that there is a clear difference between the cultures of the two countries. Mainly the difference in power distance should be given attention in Kaizen transfer process to Ethiopia. Ethiopia is on the highest side of power distance, which is not favorable for employee participation. The uncertainty avoidance value differences also indicate that there is a significant difference in the degree of the culture of solving a problem.

The degree of Uncertainty Avoidance is the degree to which people within a culture are made uncomfortable by situations they perceive to be unstructured, unclear or unpredictable and power distance is defined as the extent to which less powerful members of institutions and organizations accept that power is distributed unequally (Anh, Matsui, & Yen, 2015).

The differences in the cultural values indicate that kaizen implementation in Ethiopia may have challenges related to Kaizen practices such as Employee participation and feedback system. For successful implementation and sustainability, culture transformation becomes essential (Desta A. , 2011).

Imai and et al. also mention that for kaizen implementation to be successful it is crucial that organizational culture exists where operators can admit their mistakes (Imai M. , 1986), (Ono T. , 1988). Andrew also mentions in his study on Process Improvement Projects in East Africa that employees lack to say a problem is a problem until it becomes a problem (Andrew P. , 2013). This is partly related to the level of Uncertainty avoidance dimension of culture.

As (Imai, 1997) emphasized workers' participation providing an essential suggestion for their organization in the Japanese companies in his case study on Toyota and Canon is a critical success factor for Kaizen practice. For Ethiopian Culture the high value of power distance will challenge the kaizen Practice effectiveness unless managed to transform the culture in this regard. Ethiopia is on the lower side of uncertainty avoidance; this is also critical as it affects the creativeness and innovation of employees who are essential factors in Kaizen practice.

(Parry & Song, 1993) and (Kono, 1982) mentions the importance of decision-making authority, centralization, and formalization which are influenced by power distance, in turn, affect the effectiveness of Kaizen practices (Giving suggestions and participation in decision making).

(Anh, Matsui, & Yen, 2015) Suggest that in transferring the Kaizen culture to other countries, the cultural differences should be considered to focus on which dimensions of the national culture should be paid attention to by the culture transformation endeavors. Suggestion systems, quality circle, and self-management are standard methods to motivate workers to achieve Kaizen according to (EKI., 2013). This implies that the cultural dimensions should be well understood and in its specific national context for Kaizen to be successful.

The issues mentioned by the researchers are related to the culture dimensions and value difference in the Hofstede's Model. In addition to these unique challenges, we note some trends affecting developing countries. Some of the problems were similar to what Andrew Parris discussed in his research on what international NGOs are facing in their work in his article on "Improving Processes for good in East Africa" (Andrew P. , 2013). The researcher believes and is convinced that some of the issues discussed in this article are also true for business companies operating in Ethiopia. Some of the problems are found to be more relevant to the Ethiopian context.

The contexts in which companies, particularly the manufacturing companies, operate are getting increasingly dynamic and complex and should be responsive to the dynamics of the market. Improving the decision-making processes and approaches is critically essential in the responsiveness aspect (Spear S. J., 2009). In the competitive global and local markets, the performance of the companies determines the marketing competition and its sustainability that in effect influences the game through marketing strategies (Corbett.C, Van Wassenhove, & de Constance, 1993).

The dynamics of globalization entails companies to more quickly experiment, learn from experience, adopt new ways of doing things, and adapt themselves to their changing contexts (Andrew P. , 2013). This justifies why Kaizen needs to be promoted in Ethiopia. Ethiopian companies, we believe, have to learn and adapt changes happening in the business environment quickly.

Reports from Ethiopian Kaizen Institute (EKI , , 2014b) indicate that companies in Ethiopia, which implemented Kaizen, have significantly managed the changing business environment and

some achievements were reported. Implementing kaizen, according to (EKI., 2013) is believed to have tangible results. These include:

- Improves profit,
- Improves customer satisfaction,
- Discovers hidden talents,
- Promotes self-development,
- Improves the motivation and morale of employees at each level,
- Enhances communication between top, bottom level,
- Helps to build and to improve teamwork,
- Creates ownership and trust within each other,
- Reducing waste,
- Proper use of time by making the appropriate layout of the machinery getting space and the setup of the entire enterprise premises,
- Engages and empowers employees at all levels, and
- Improves the overall work environment.

II.10.5 Why Kaizen for Ethiopia

Kaizen was selected as one of the management tools that can be applied in the Ethiopian context where there is a need of improvement in productivity, cost reduction, service delivery and to develop the managerial capability to implement the Growth and Transformation Plan of the country (GRIPS). Kaizen is a low-cost approach which does not require a huge investment and high technology (Ohno, et al., 2009), it will be more appropriate to adopt Kaizen culture in Ethiopian Context where productivity and efficiency are at the lower level.

The director of Ethiopian Kaizen Institute was interviewed by a local newspaper called " Capital Ethiopia (Getahun G. , 2013). He mentioned that the change initiatives that were introduced to Ethiopia before Kaizen was not so successful due to factors related to the investment they required. The radical change has not helped much to attain the intended objective, and as kaizen does not need huge investment and is a change that happens incrementally, the Kaizen concept works better for Ethiopia. (Haftu, 2015) also asserts the idea that the benefit of Kaizen, unlike BPR, is the

people orientation aspect; which is focused on people, changing the people's attitude and building their capacity.

The business environment globally is becoming more competitive and challenging in general and for developing economies in particular. Several studies on the development of Ethiopia show that low productivity and poor quality in both production and service is the bottleneck for the economy. (Beshah, 2018) in his presentation on “The need for Quality and Productivity Improvement “cited Daniel Kitaw et al. indicating that the competitiveness of the manufacturing industries are low and the quality management awareness is little.

(Beshah, 2018) Mentioned in his presentation, the quality problems are observed in several sectors of the Ethiopian economy. In education, health, public services, and construction industries quality has been recorded at low. Quality thinking is not reflected in the work culture, and inferior quality product and services continue to constrain economic development.

Ethiopian companies have been struggling to survive in the global market mainly due to the quality factor in the competition world. When competition increases, developing the economy is prone to failure. The need for continuous process improvement becomes essential for such savings. Increasing competition in the global economy necessitates Kaizen philosophy's continuous improvement to be implemented in developing economies like Ethiopia. Quality of products and services improvement is required by competition in the industrial world (Winy, 2011).

There is enormous opportunity to effectively transfer Kaizen technology to Ethiopia due to long-lived economic assistance from Japan government. The bilateral relation creates an opportunity for effective implementation of Kaizen. The environment is feasible as the assistance for kaizen comes through private channels such as intra-company technology transfer and support for local suppliers. The public channels such as official development assistance and guidance provided by various civic organizations have the well-established infrastructure in Ethiopia because of the political will from both governments to strengthen economic cooperation. The political will is essential for Kaizen transfer at a national level in a similar way (JICA & GRIPS, 2011) and (EKI, ., 2014c) mentioned management commitment as critical for the success of Kaizen practices.

CHAPTER III: RESEARCH METHODOLOGY

According to (Kerlinger, 1986) research design is the plan and structure of tools to obtain answers to research questions or test the research hypothesis. The Plan represents the approach to be used in collecting and analyzing data in order to answer the research questions (Cooper & Schindler, 2013). The research design summarizes the essentials of the research activity and time frame. Based on the research questions driven by the research objectives and types of data obtained, it establishes a framework to define the relationship among the study variables and also outlines the procedures for every research activity.

A cross sectional survey was conducted among CEOs, Kaizen Officers, and Middle Level Managers in Ethiopian manufacturing firms which have been implementing Kaizen for at least three or more years. Companies that have been implementing and adopting the kaizen methodology were targeted in this research to evaluate the relationships between Kaizen implementation outcomes and sustainability factors and the effect on operational and strategic performance.

III.1 Research design and Sampling technique

In this study, the unit of analysis is the firm, and the target population is the manufacturing firms in Ethiopia that have been implementing Kaizen for at least three years since Kaizen was introduced in Ethiopia. The sampling design used for this study was a census and included CEOs, Kaizen Officers, Middle Level Managers and Kaizen Institute Experts and Consultants. The appropriateness of the choice of this design necessitated by the relatively small number of known manufacturing firms that have adopted Kaizen in Ethiopia from the time of its introduction to at least three years implementation time.

Regression analysis was done separately for the individual performance measures (dependent variables) against the set of measures of kaizen implementation factors and Kaizen sustainability factors (independent variables). In addition, a regression model was used to evaluate the overall relationship between kaizen implementation practices related to sustainability factors and the effect on performance. The relationship between the how of Kaizen implementation and

sustainability factors and their effect (separately) on performance was tested using regression analysis and design of experiments.

The results of the data analysis was also validated through visits and conversations in the work place with Kaizen officers, company managers and employees met at the shop floor. The validation report is included in this thesis in chapter four of the paper. The excel analysis to each of the samples taken during the visit is compared against the actual observation in the work place and the conversation with employees. The charts for each company generated from excel analysis on the factor analysis by company is attached to the report of each visit of respective companies. The secondary data (periodic reports and kaizen related data) and observation in the visit were used to validate the data analysis result obtained through the survey using questionnaire.

III.2. Data Collection and Instruments

III.2.1 Questionnaires

These were distributed online, and the response were collected through Survey Monkey through each participant's personal email. The questionnaire used a five-point Likert scale to measure the extent of the impact of each factor on the group factors Implementation, Sustainability and Impact (from 'Not at all' to 'Very much'; not at all =1 and very much = 5) that collected the respondents' responses to Kaizen Implementation, Kaizen sustainability factors and performance elements quantitatively through close-ended questions. The study targeted operations managers and Kaizen team leaders/ experts who have considerable experience with Kaizen practices, tools and techniques to ensure accuracy and authenticity of the information is provided for the study.

The field visit and "Best Practice" sharing workshop were also the validation platforms used in this research. After the data analysis sample of five Kaizen implementing companies were selected based on convenience sampling method and were visited to validate the findings through the SurveyMonkey tool. The results of the findings and the visits report were also shared to stakeholders gathered from almost all Kaizen Implementing Manufacturing companies and scholars invited from universities and Kaizen consultants from Kaizen Institute for annual best practice workshop organized by Ethiopian Kaizen Institute. The proceedings from the previous

workshops and the presentations in the current workshop were also used as input for this research for the validation of the findings and as a feedback to the overall Kaizen practice in the country.

The questionnaire was designed to have four sections. Section 1- consisted of questions that provided information on the specifics of individuals interviewed and the units/departments of operation. Section 2 -consisted of questions that established how kaizen has been practiced. Section 3- had questions on the sustainability factors (improved culture, longevity, and Section 4 - comprised questions that provided data on the operational/strategic performance measures/outputs.

III.2.2 Data Analysis

Descriptive statistics were used for data analysis with Statistical Practices and Social Services (SPSS) to make the analysis. The use of descriptive statistics in data analysis was due to its appropriateness in finding out the basic features of the study data and hence aid in realization of the research objectives. For both objectives there was a need to measure the “influence” of a variable on another i.e., the influence of Kaizen implementation practice on sustainability factors and the effect on performance and that required the use of a regression parameter. Partial Least Square (PLS)-Path method Analysis was also applied to test regression among the implementation and sustainability combined factors vis-à-vis the performance factors. The PLS analysis clearly shows which factors are related to which and the degree of the influence of the input factors on the output factors. The group factors of the input variables are also analyzed to see the level of the impact on out factors.

Partial least squares analysis is a multivariate statistical technique that allows comparison between multiple response variables and multiple explanatory variables. Partial least square is one of a number of covariance-based statistical methods that are often referred to as structural equation modeling (Pirouze, 2006).

Data Analysis using Excel for individual companies was also done for all companies participated in the survey to determine the correlation among the factors on individual company basis. Based on the responses from each company the correlation between factors (Implementation,

Sustainability and Impact) was analyzed for each company to see the degree of the impact of each factor on each company at individual level.

Regression Model

The regression equation was ($Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots \varepsilon$):

Where: β_0 = Constants, Y = Performance outcomes, X_1 = Kaizen Implementation factors, X_2 = Kaizen sustainability factors and ε = standard error.

The relationships among Implementation (I), Sustainability(S) and Performance (P) described as follows.

Implementation → Sustainability: $S_x = a + bI_1 + cI_2 + dI_3 + eI_4 + fI_5$

Sustainability → Performance: $P_x = a + bS_1 + cS_2 + dS_3$

Implementation → Performance: $P_x = a + bI_1 + cI_2 + dI_3 + eI_4 + eI_5$

Implementation = I_1 = tools

I_2 = leadership commitment

I_3 = empowerment

I_4 = communication of Kaizen/results

I_5 = outside Consultants

Sustainability = S_1 = improved culture

S_2 = longevity of Kaizen initiative

S_3 = institutionalized change

Impact = P_1 = Operational Performance (Cost reduction, Quality Improvement, Schedule Improvement)

P_2 = Strategic Performance (growth, profitability, competitiveness)

CHAPTER IV: DATA ANALYSIS AND RESULTS

PART I: STATISTICAL ANALYSIS

IV.1 Analysis using SPSS

IV.1.1 Introduction

This section presents the analysis and interpretation of data according to the objectives of the study. It covers the basic demographics of the respondents and companies' profiles; analysis and interpretation of results on *Kaizen* implementation activities, sustainability practices, and overall performance. It also presents linear regression analysis on the relationship between *Kaizen* implementation, *Kaizen* sustainability and *kaizen impact on* performance.

IV.1.2 Response rate

Manufacturing Companies identified to have adopted the *Kaizen Philosophy* in Ethiopia were included in the study and questionnaire was circulated to the 102. Out of that total, 87 were fully completed. These 87 respondents were the ones used for this analysis. This gives the rate of response of 85.3% that is believed to be a good rate. Moreover, the study found no outliers in the data.

IV.1.3 Basic demographic characteristics of study participants

Table 4.1 shows the distribution of the basic demographic characteristics of the respondents. Large percentage (93.1%) of the respondents were males. The highest percentage (43.6%) were aged 26-35 years followed by 36-45 years (39.6%). Regarding level of education, more than half (52.6%) hold Bachelor's Degree and considerable percentage (41.2%) hold Master's Degree and above. Forty-nine (48.0%) respondents have been working for their current companies for 5 years while only 2.9% have been with their current companies for 20 years and above.

table 4. 1 demographic characteristics of respondents

Variables	Frequency	Percent
Gender (n=101)		
Male	95	93.1
Female	6	5.9
Age in years (n=101)		
18-25	3	3.0
26-35	44	43.6
36-45	40	39.6
46-55	12	11.9
>55	2	2.0
Level of education (n=97)		
Basic Education	2	2.1
Diploma/Tertiary	4	4.1
Undergraduate	51	52.6
Masters & above	40	41.2
Duration of work in the current company in years (n=102)		
0 – 5	49	48.0
6 – 10	31	30.4
11 – 15	13	12.7
15 – 20	6	5.9
20 and above	3	2.9

IV.1.4 Respondent companies' profile information

As indicated in Table 4.2, about half (48.5%) of the respondents reported that the companies were in existence for 20 years and above whereas less than five years were only 6.9%. However, majority (79.4%) indicated that their companies introduced *Kaizen* within the last 5 years.

Concerning the type of firms, the highest number was that of chemical companies (38.9%) and metal companies (27.8%). Most respondents (56.6%) stated that their companies were using 1st level of *Kaizen* implementation.

Table 4. 2 Companies profile information

Variables	Frequency	Percent
Duration of the organization in the business in years (n=101)		
0 – 5	7	6.9
6 – 10	13	12.9
11 – 15	23	22.8
15 – 20	9	8.9
> 20	49	48.5
Duration of kaizen implementation in a company in years (n=102)		
0 – 5	81	79.4
6 – 10	20	19.6
> 10	1	1.0
Type of firm (n=18)		
Agro	1	5.6
Chemical	7	38.9
Leather	4	22.2
Metal	5	27.8
Textile	1	5.6
Level of <i>Kaizen</i> Implementation (Level I or Level II) (n=83)		
1 st level implementation	47	56.6
2 nd level implementation	36	43.4

4.4 Extent of *Kaizen* activities implementation

The respondents were requested to specify the degree to which the *Kaizen* implementation activities including tools applied, leadership commitment, empowerment, communication and outside consultants have been adopted by their companies as shown in Table 4.3. The results are

presented in frequencies and percentages according to the responses of '*not at all*', '*little extent*', '*moderate extent*', '*much extent*' and '*very much extent*'. Generally, majority of the respondents rated the *Kaizen* implementation at '*moderate extent*'. On the implementation factors, tools applied were rated on average at '*moderate extent*'; implementation of visual management (39.1%), standard work (40.2%), process mapping (43.7%), 7 Mudas (47.1%), employee suggestion program (35.6%), process monitoring using statistical process control (36.8%), root cause analysis (41.4%), mistake proofing (36.8%), total productive maintenance (34.5%) and layout improvement (44.8%). However, 5S (40.2%) and quality control circles (31.0%) were rated at '*much extent*' and '*very much extent*' respectively.

The frequencies for the items on leadership were relatively high where higher numbers of respondents reported and rated at much extent that senior leaders and managers go to the production floor (36.8%), that top management supports the organization's *Kaizen* initiatives and activities (32.2%) and that *Kaizen* was applied in non-manufacturing areas such as human resources, finance and procurement (34.5%).

Among the empowerment items, most respondents indicated that quality control circles (46.0%) was used at moderate extent whereas key performance indicators (KPIs) (39.1%) and *Kaizen* improvements (37.9%) were implemented at much extent rates. Similarly, (42.5%) of the respondents reported there was much of company developing and relying on internal expertise. Though the highest number indicated *Kaizen* thinking was used at moderate extent (31.0%), it is worth noting that a considerable percentage (21.8%) mentioned that it was not applied at all. Regarding to communication, (40.2%) of the respondents rated that there was moderate clear and consistent communication which accounts the highest percentage. However, concerning to outside consultants, higher number (34.5%) rated '*Little extent*' on companies using and relying on outside experts.

Table 4. 3 Extent of Kaizen activities implementation

Implementation	Items	Not at all, n(%)	Little, n(%)	Moderate, n(%)	Much, n(%)	Very much, n(%)
Tool	5S	3(3.4)	5(5.7)	18(20.7)	35(40.2)	26(29.9)
	Visual Management	2(2.3)	7(8.0)	34(39.1)	32(36.8)	12(13.8)
	Standard Work	0(0.0)	8(9.2)	35(40.2)	30(34.5)	14(16.1)
	Process Mapping	0(0.0)	14(16.1)	38(43.7)	23(26.4)	12(13.8)
	7 Mudass	2(2.3)	9(10.3)	41(47.1)	24(27.6)	11(12.6)
	Quality control circles	1(1.1)	11(12.6)	25(28.7)	23(26.4)	27(31.0)
	Employee suggestion program	4(4.6)	21(24.1)	31(35.6)	21(24.1)	10(11.5)
	Process monitoring using statistical process control	7(8.0)	21(24.1)	32(36.8)	19(21.8)	8(9.2)
	Root cause analysis	1(1.1)	16(18.4)	36(41.4)	29(33.3)	5(5.7)
	Mistake proofing	4(4.6)	23(26.4)	32(36.8)	24(27.6)	4(4.6)
	Total Productive Maintenance (TPM)	8(9.2)	22(25.3)	30(34.5)	20(23.0)	7(8.0)
	Layout Improvement	4(4.6)	9(10.3)	39(44.8)	23(26.4)	12(13.8)
Leadership commitment	Senior leaders and managers going to the production floor	2(2.3)	9(10.3)	27(31.0)	32(36.8)	17(19.5)
	Top management supported the organization's <i>Kaizen</i> initiative and activities	0(0.0)	14(16.1)	23(26.4)	28(32.2)	22(25.2)
	<i>Kaizen</i> was applied in non-manufacturing areas such as human resources, finance and procurement	1(1.1)	11(12.6)	23(26.4)	30(34.5)	22(25.3)
Empowerment	Quality control circles used to make improvements and develop capacity	2(2.3)	10(11.5)	40(46.0)	28(32.2)	7(8.0)
	Key Performance Indicators (KPIs) used to measure performance	1(1.1)	12(13.8)	29(33.3)	34(39.1)	11(12.6)
	<i>Kaizen</i> improvements were part of employee performance objectives and appraisals	5(5.7)	10(11.5)	22(25.3)	33(37.9)	17(19.5)

	Your company developed and relied on internal expertise	0(0.0)	8(9.2)	21(24.1)	37(42.5)	21(24.1)
	Your company didn't just apply <i>Kaizen</i> 'Tools,' but also promoted <i>Kaizen</i> 'Thinking'	19(21.8)	25(28.7)	27(31.0)	9(10.3)	7(8.0)
Communication	Clear and consistent communication on <i>Kaizen</i> stories and results/improvements achieved	0(0.0)	14(16.1)	35(40.2)	30(34.5)	8(9.2)
Outside consultants	Your company used and relied on outside experts	8(9.2)	30(34.5)	23(26.4)	20(23.0)	6(6.9)

IV.1.5 Descriptive statistics of *Kaizen* activities implementation

Table 4.4 shows the descriptive statistics of *Kaizen* activities implementation using mean and standard deviation. This was measured by a scale of 1 to 5 where score 1 was given for '*not at all*'; 2 = '*little extent*'; 3 = '*moderate extent*'; 4 = '*much extent*'; and 5 = '*very much extent*'. Overall average was also calculated for each group of implementation practices including tools applied, leadership commitment, empowerment and total implementation activities by aggregating the items in each group. The results show that 5S had the highest extent of implementation with a mean of 3.87 followed by company developing and depending on internal expertise (mean= 3.82). However, the *Kaizen* practices with least extents of implementation were promotion of *Kaizen* 'thinking' (mean = 2.54) and dependence on outside experts (mean = 2.84).

Moreover, the level of each item was determined using the following equation: Interval length = (highest score -lowest score)/ (three stages) = (5-1)/3 = 1.33. Accordingly, the levels of *Kaizen* implementation were divided as 'low' with mean of 2.33 and below, as 'medium' with mean of 2.34 to 3.67 and as 'high' with the mean of 3.68 – 5. The levels of the *Kaizen* implementation activities were medium and high with predominance of the 'medium' level.

Table 4. 4 Descriptive statistics of Kaizen activities implementation

Implementation	Item	Mean	Std. deviation	Level
Tool	5S	3.87	1.02	<i>High</i>
	Visual Management	3.52	0.91	<i>Medium</i>
	Standard Work	3.57	0.87	<i>Medium</i>
	Process Mapping	3.38	0.92	<i>Medium</i>
	7 Mudas	3.38	0.92	<i>Medium</i>
	Quality Control Circles (QCC)	3.74	1.07	<i>High</i>
	Employee suggestion program	3.14	1.06	<i>Medium</i>
	Process monitoring using statistical process control	3.00	1.08	<i>Medium</i>
	Root cause analysis	3.24	0.86	<i>Medium</i>
	Mistake proofing	3.01	0.96	<i>Medium</i>
	Total Productive Maintenance (TPM)	2.95	1.09	<i>Medium</i>
	Layout Improvement	3.34	1.00	<i>Medium</i>
	Aggregate mean scores for the tools applied	3.35	0.70	<i>Medium</i>
Leadership commitment	Senior leaders and managers going to the production floor	3.61	0.99	<i>Medium</i>
	Top management supported the organization's <i>Kaizen</i> initiative and activities	3.67	1.03	<i>Medium</i>
	<i>Kaizen</i> was applied in non-manufacturing areas such as human resources, finance and procurement	3.70	1.02	<i>Medium</i>
	Aggregate mean scores for leadership	3.66	0.80	<i>Medium</i>
Empowerment	Quality control circles used to make improvements and develop capacity	3.32	0.87	<i>Medium</i>
	Key Performance Indicators (KPIs) used to measure performance	3.48	0.93	<i>Medium</i>
	<i>Kaizen</i> improvements were part of employee performance objectives and appraisals	3.54	1.11	<i>Medium</i>
	Your company developed and relied on internal expertise	3.82	0.91	<i>High</i>

	Your company didn't just apply <i>Kaizen</i> 'Tools,' but also promoted <i>Kaizen</i> 'Thinking'	2.54	1.18	<i>Medium</i>
	Aggregate average score for empowerment	3.34	0.71	<i>High</i>
Communication	Clear and consistent communication on <i>Kaizen</i> stories and results/improvements achieved	3.37	0.86	<i>Medium</i>
Outside consultants	Your company used and relied on outside experts	2.84	1.10	<i>Medium</i>
	Overall average score of implementation (tool, leadership commitment, empowerment, communication and outside consultants)	3.37	0.63	<i>Medium</i>

IV.1.6 Frequency on the extent of Kaizen sustainability practices

The percentages and counts of responses for items relating to *Kaizen* sustainability practices including improved culture, longevity and institutionalized change are demonstrated in Table 4.5 below. The degree of sustainability was evaluated using '*not at all*', '*little extent*', '*moderate extent*', '*much extent*' and '*very much extent*'. It is seen that the major responses ranged between moderate and much extents, where the percentages range from 30.0% to 42.5%. The highest percentage with much extent rate was that of *Kaizen* becoming part of organizational identity (42.5%) and with moderate extent was on team's problem-solving culture established (42.5%).

Table 4. 5 Frequency on the extent of Kaizen Sustainability practices

<i>Kaizen Sustainability</i>	<i>Item</i>	Not at all, n(%)	Little, n(%)	Moderate, n(%)	Much, n(%)	Very much, n(%)
Improved culture	<i>Kaizen</i> has become part of organizational identity	3(3.4)	6(6.9)	30(34.5)	37(42.5)	11(12.6)
	Team problem solving culture has been established	1(1.1)	8(9.2)	37(42.5)	27(31.0)	14(16.1)
	Shop floor employees are fully committed to <i>Kaizen</i>	2(2.3)	13(14.9)	34(39.1)	25(28.7)	13(14.9)
	Team problem solving duplicate of 24	1(1.1)	15(17.2)	29(33.3)	31(35.6)	11(12.6)
	Working culture has been improved	1(1.1)	8(9.2)	30(35.5)	33(37.9)	15(17.2)
	Management accepts changes made as a result of <i>Kaizen</i> events	1(1.1)	11(12.6)	24(27.6)	30(34.5)	21(24.1)
	Employees accept changes made as a result of <i>Kaizen</i> events	1(1.1)	7(8.0)	27(31.0)	34(39.1)	18(20.7)
Longevity	<i>Kaizen</i> is having a greater impact over time	5(5.7)	12(13.8)	21(24.1)	30(34.5)	19(21.8)
	<i>Kaizen</i> has influenced our thinking to plan for long term rather than optimizing short term performance	3(3.4)	8(9.2)	28(32.2)	34(39.1)	14(16.1)
Institutionalized change	Organizational structure and policies have enabled your organization to sustain <i>Kaizen</i> improvement outcome	5(5.7)	12(13.8)	24(27.6)	34(39.1)	12(13.8)

IV.1.7 Descriptive statistics on the extent of *Kaizen* sustainability practices

The descriptive statistics on the degree of *Kaizen* sustainability practices using average and standard deviation is shown in Table 4.6. The same principle depicted under descriptive statistics of *Kaizen* activities implementation (section 4.4) was applied where score 1 was given for ‘*not at all*’; 2 = *little extent*’; 3 = *moderate extent*; 4 = *much extent*; and 5 = *very much extent*. In addition to the mean of each item, an overall average was also calculated by aggregating the items in each group. The mean score ranges from 3.39 to 3.70 and the standard deviation is between 0.78 and 1.07. Management and employee acceptance to changes made as a result of *Kaizen* events had the

highest mean of *Kaizen* sustainability practices with 3.68 and 3.70 respectively. However, shop floor employees' commitment, team problem solving duplicate of 24 and organizational structure/policies for improvement outcome were with the least mean score ranging from 3.39 to 3.41.

The level of each item was determined using the equation presented above [interval length = (highest score -lowest score)/ (three stages) = (5-1)/3 = 1.33]. Accordingly, levels of *Kaizen* sustainability were divided as 'low' with mean of 2.33 and below, as 'medium' with mean of 2.34 to 3.67 and as 'high' with them mean of 3.68 – 5. All items had medium level of *Kaizen* sustainability practices except management acceptance to changes and employee acceptance to changes which had high level.

Table 4. 6 Descriptive statistics on the extent of Kaizen Sustainability practices

<i>Kaizen Sustainability</i>	Item	Mean	Std. deviation	Level
Improved culture	<i>Kaizen</i> has become part of organizational identity	3.54	0.93	Medium
	Team problem solving culture has been established	3.52	0.91	Medium
	Shop floor employees are fully committed to <i>Kaizen</i>	3.39	0.99	Medium
	Team problem solving duplicate of 24	3.41	0.96	Medium
	Working culture has been improved your organization	3.61	0.92	Medium
	Management accepts changes made as a result of <i>Kaizen</i> events	3.68	1.02	High
	Employees accept changes made as a result of <i>Kaizen</i> events	3.70	0.93	High
	Overall average score for the improved culture	3.55	0.78	Medium
Longevity	<i>Kaizen</i> is having a greater impact over time	3.53	1.15	Medium
	<i>Kaizen</i> has influenced our thinking to plan for long term rather than optimizing short term performance	3.55	0.99	Medium
	Overall average score for longevity	3.54	0.90	Medium
Institutionalized change	Organizational structure and policies have enabled your organization to sustain <i>Kaizen</i> improvement outcome	3.41	1.07	Medium
Overall average score of <i>Kaizen</i> Sustainability (improved culture, longevity and institutionalized change)		3.53	0.75	Medium

IV.1.8 Frequency distribution on performance

As depicted in Table 4.7, the respondents were requested to show the degree to which their companies have improved strategic performance and operational performance. The results are presented in frequencies and percentages according to the responses of '*not at all*', '*little extent*', '*moderate extent*', '*much extent*' and '*very much extent*'. The predominant performance from moderate to much extent ranged from 28.7% to 42.5%. Overall, most indicated with highest percentage '*much extent*' of performance. Those who indicated '*not at all*' were insignificant.

Table 4. 7 Frequency distribution on performance/impact

Operational performance	Item	Not at all, n(%)	Little, n(%)	Moderate, n(%)	Much, n(%)	Very much, n(%)
Strategic performance	Increased company growth	4(4.6)	18(20.7)	30(34.5)	26(29.9)	9(10.3)
	Increased profitability	1(1.1)	18(20.7)	25(28.7)	29(33.3)	14(16.1)
	Enhanced competitiveness	0(0.0)	14(16.1)	25(28.7)	34(39.1)	14(16.1)
Operational performance	Improved flow of production	0(0.0)	9(10.3)	25(28.7)	32(36.8)	21(24.1)
	Reduction in lead time	1(1.1)	13(14.9)	29(33.3)	29(33.3)	15(17.2)
	Improved manufacturing flexibility	1(1.1)	10(11.5)	30(34.5)	36(41.4)	10(11.5)
	Improved product quality	0(0.0)	9(10.3)	20(23.0)	37(42.5)	21(24.1)
	Lower inventory levels	1(1.1)	14(16.1)	27(31.0)	32(36.8)	13(14.9)
	Improved productivity	0(0.0)	12(13.8)	22(25.3)	33(37.9)	20(23.0)
	Improved efficiency	0(0.0)	11(12.6)	25(28.7)	30(34.5)	21(24.1)

IV.1.9 Descriptive statistics of performance

Table 4.8 demonstrates the descriptive statistics of strategic performance and operational performance using average and standard deviation. The score 1 was given for '*not at all*'; 2 = '*little extent*', 3 = '*moderate extent*', 4 = '*much extent*' and 5 = '*very much extent*'. In addition to the mean of each item, an overall average was calculated by aggregating the items in each group. The mean score ranges from 3.21 to 3.80 and the standard deviation is between 0.84 and 1.04. Increased company growth had the least mean of performance while improved product quality had the highest score mean.

The level of each item was determined by the following equation [interval length = (highest score - lowest score)/ (three stages) = $(5-1)/3 = 1.33$]. Accordingly, the levels of performance were divided as 'low' with mean of 2.33 and below, as 'medium' with mean of 2.34 to 3.67 and as 'high' with them mean of 3.68 – 5. All items had medium and high levels of strategic performance and operational performance.

Table 4. 8 Descriptive statistics of operational performance

Operational performance	Item	Mean	Std. deviation	Level
Strategic performance	Increased company growth (in market share)	3.21	1.04	<i>Medium</i>
	Increased profitability	3.43	1.03	<i>Medium</i>
	Enhanced competitiveness	3.55	0.95	<i>Medium</i>
	Overall score of strategic performance	3.39	0.93	<i>Medium</i>
Operational performance	Improved flow of production	3.75	0.94	<i>High</i>
	Reduction in lead time (from order to delivery)	3.51	0.99	<i>Medium</i>
	Improved manufacturing flexibility	3.51	0.89	<i>Medium</i>
	Improved product quality	3.80	0.93	<i>High</i>
	Lower inventory levels	3.48	0.97	<i>Medium</i>
	Improved productivity	3.70	0.98	<i>High</i>
	Improved efficiency	3.70	0.98	<i>High</i>
	Overall score of operational performance	3.64	0.84	<i>Medium</i>
Overall average score of performance (Average of strategic performance and operational performance)		3.56	0.84	<i>Medium</i>

IV.1.10 Reliability of the tools

Cronbach's alpha (α) was used to measure the reliability of the data collection tools. As defined by (Kothari, 2004), it is testing the internal consistency of the items used in the tool to collect the information. A coefficient alpha approaching to 1 is considered as an evidence that the items measure an underlying construct ((Kothari, 2004)). Table 4.9 shows the summarized reliability tests for *Kaizen* implementation activities, *Kaizen* sustainability and performance (strategic and operational). According to (Sekaran, 2003), Cronbach alpha coefficient of above 0.7 implies that the data collection instrument is reliable. As indicated in the table below, the Cronbach's alpha

value for each tool is more than 0.9 which surpasses the minimum of 0.7 and this shows the reliability of the research tools used in the study.

Table 4. 9 Reliability test

Variable	Number of items	Cronbach's Alpha	Comment
<i>Kaizen</i> implementation activities	22	0.930	Reliable
<i>Kaizen</i> Sustainability	10	0.919	Reliable
Performance (strategic and operational)	10	0.963	Reliable

IV.1.11 Normality test

The normal distribution of data in this study is presented in Table 4.10. Skewness and kurtosis tests were used to examine the normalcy of the data. As explained by (Kline, 2005) an item/ a variable with skew-index value of more than 3.0 is extremely skewed whereas a kurtosis index value greater than 8.0 is extreme kurtosis. A tool with skewness and kurtosis value close to zero shows perfect normality or stability of the data. The results of skewness and kurtosis for all items are ranging from negative one to positive one implying that assumption of normal distribution was fulfilled.

Table 4. 10 Normality test

Variables	Items	Skewness	Kurtosis
<i>Kaizen</i> Implementation	Tool applied	-0.05	0.25
	Leadership commitment	-0.36	-0.3
	Empowerment	-0.08	-0.06
	Communication	0.09	-0.62
	Outside consultants	0.22	-0.76
	Overall implementation	-0.3	0.35
<i>Kaizen</i> Sustainability	Improved culture	-0.32	0.37
	Longevity	-0.17	-0.5
	Institutionalized change	-0.49	-0.31
	Sustainability Average	-0.45	0.53
Performance	Strategic performance	-0.03	-1.02
	Operational performance	-0.28	-0.66
	Overall performance	-0.16	-0.86

IV.1.12 Hypothesis testing results for hypothesis one (H1)

The first hypothesis states that *Kaizen* implementation activities significantly affect performance of the companies and the results are presented below.

IV.1.12.1 Correlation, collinearity and outlier tests for H1

The correlation analysis was carried out using Pearson correlation coefficient and p value to examine the degree/extent of association between *Kaizen* implementation and performance variables. Furthermore, the generated correlation matrix helped to determine direction of the relationship among each variable and/ or whether multi-collinearity existed between the variables under investigation (Table 4.11).

Strategic performance had a positive significant linear relationship with all *Kaizen* implementation activities (p value <0.01). Likewise, the study found that operational performance had a positive significant linear relationship with all *Kaizen* implementation activities at 0.01 significant level. In addition, the overall performance (average of strategic and operational performance) had a positive significant linear relationship with all *Kaizen* implementation activities at 0.01 significant level. These findings give initial support for hypothesis H1.

Multi-collinearity test which is used to measure the extent of correlation among the independent variables was tested to corroborate the regression analysis. It exists if the relationship value surpasses 0.90 among the independent variables and affects the multiple regressions results to be unreliable. According to this study, there was 0.947 correlation value between overall implementation and tools applied as presented in Table 4.11. This would affect the impact of the other independent variables on the performance (adversely affect the regression estimate). Therefore, the overall *Kaizen* implementation is removed in the multiple linear regression analysis.

Table 4. 11 Correlation matrix and collinearity between implementation and performance

	Strategic performa nce	Operatio nal performa nce	Overall perform ance	Tool applied	Leadership commitme nt	Empowe rment	Commu nication	Outside consultan ts	Overall implem entation
Strategic performance	1								
Operational performance	0.861**	1							
Overall performance	0.935**	0.986**	1						
Tool applied	0.513**	0.624**	0.607**	1					
Leadership commitment	0.380**	0.525**	0.494**	0.646**	1				
Empowerment	0.496**	0.571**	0.564**	0.637**	0.659**	1			
Communication	0.424**	0.518**	0.503**	0.680**	0.647**	0.663**	1		
Outside consultants	0.411**	0.340**	0.375**	0.410**	0.278**	0.357**	0.345**	1	
Overall implementation	0.559**	0.669**	0.654**	0.947**	0.791**	0.821**	0.779**	0.487**	1

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

Besides, both variance inflation factors (VIFs) and tolerance were examined to measure multicollinearity problems. According to (Field, 2009) , multicollinearity exists when tolerance values is less than 0.1 and VIF values is more than 10. There were no collinearity issues found in this study between the different outcomes and independent variables as tolerance was above 0.1 and VIFs below 10 (Table 4.12). Another parameter which is Cook's distance was estimated to determine whether there is any outlier and if it is greater than one, it indicates an outlier exist. The result in Table 4.12 shows that there is no outlier as all the Cook's distance values are less than one. Durbin Watson was used to check for autocorrelation that the residuals from linear regressions are independent. Durbin Watson with 0 indicates positive autocorrelation and 4 indicates negative autocorrelation while around two (1.5 to 3) indicates that the residuals are uncorrelated. As shown

in Table 4.12, there was no autocorrelation. Additionally, to validate the regression analysis, histogram and P-P plot presented in Figure 4.1 below show reasonable normality of data.

Table 4. 12 Collinearity statistics and outliers tests for H1

Independent variables	Dependent variable (Strategic performance)				
	Collinearity Statistics		Cook's Distance		Durbin-Watson
	Tolerance	VIF	Minimum	Maximum	
Tool applied	0.42	2.38			
Leadership commitment	0.45	2.22			
Empowerment	0.44	2.27	0.00	0.23	2.47
Communication	0.42	2.37			
Outside consultants	0.81	1.23			
	Dependent variable (Operational performance)				
	Collinearity Statistics		Cook's Distance		Durbin-Watson
	Tolerance	VIF	Minimum	Maximum	
Tool applied	0.42	2.38			
Leadership commitment	0.45	2.22			
Empowerment	0.44	2.27	0.00	0.32	2.14
Communication	0.42	2.37			
Outside consultants	0.81	1.23			
	Dependent variable (Overall performance)				
	Collinearity Statistics		Cook's Distance		Durbin-Watson
	Tolerance	VIF	Minimum	Maximum	
Tool applied	0.42	2.38			
Leadership commitment	0.45	2.22			
Empowerment	0.44	2.27	0.00	0.32	2.28
Communication	0.42	2.37			
Outside consultants	0.81	1.23			

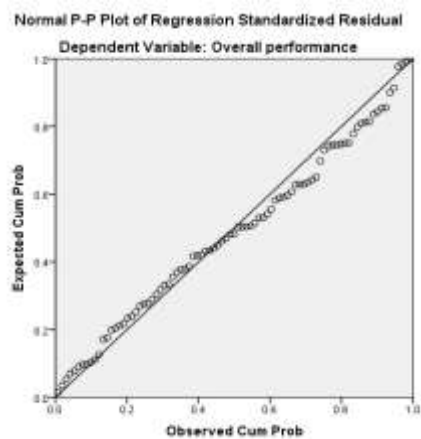
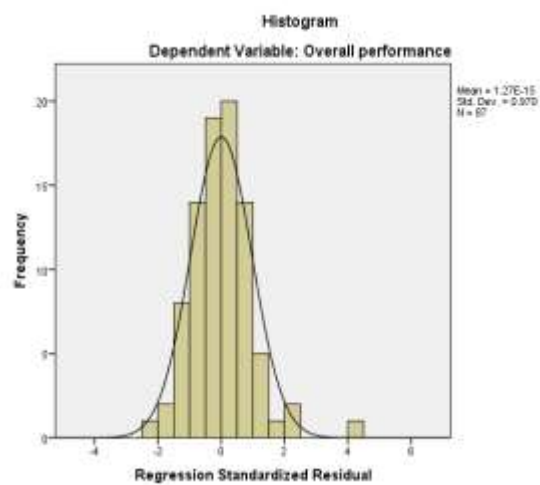
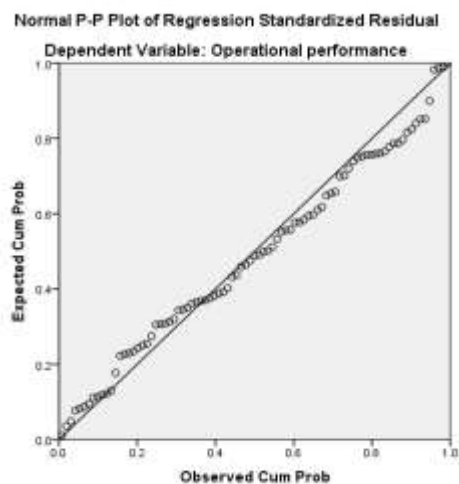
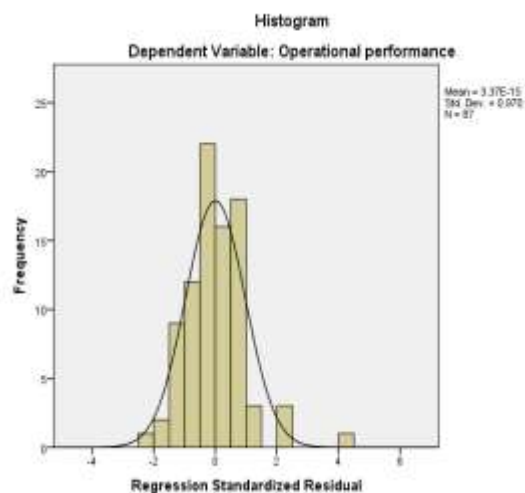
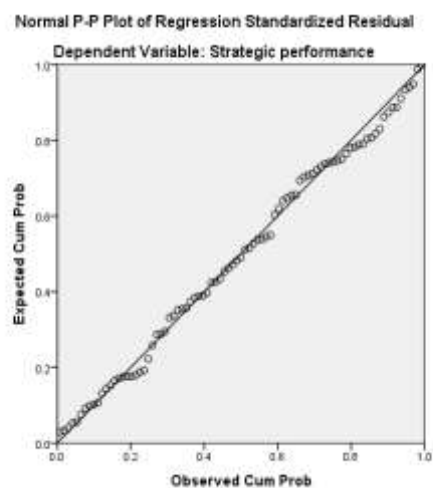
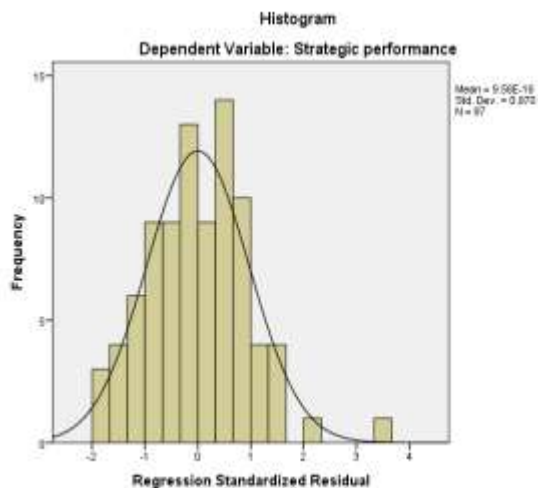


Figure 4. 1: Histogram and P-P plot for Hypothesis H1

IV.1.12.2 Regression analysis for H1

Table 4.13 summarizes the regression analysis (using forced enter method) of the correlation between the different outcomes (performance) and predictor variables (*Kaizen* implementation activities). The first dependent variable is strategic performance denoted as P_1 . The value of the coefficient of correlation R-value of 0.591 indicates a positive correlation between strategic performance and *Kaizen* implementation practices. The value of R-square of 0.349 displays that the level of variation in strategic performance contributed by the *Kaizen* implementation is 34.9%. The remaining 65.1% of the variation is contributed by other factors other than *Kaizen* implementation activities. The ANOVA test shows significant relationship between strategic performance and *Kaizen* implementation activities ($F= 8.68$; $Sig = 0.000$). This confirms that *Kaizen* implementation items significantly affect strategic performance.

The statistical coefficients on strategic performance showed that the value of standardized coefficient (Beta) for tools applied was 0.27 ($t=1.97$; $Sig = 0.042$), which implies that the influence of this item is significant. The value of standardized Beta for leadership commitment is equal to -0.04 ($t=-0.28$; $Sig = 0.780$), which designates that the effect of this element is insignificant. The value of Beta for empowerment reached 0.26 ($t = 1.93$; $Sig = 0.048$), which indicates that the influence of this item is significant on strategic performance. The value of Beta for communication of *Kaizen* is 0.02 ($t=0.13$; $Sig = 0.900$), which shows that the effect of this variable is insignificant. The value of Beta for outside consultants was 0.21 ($t = 2.11$, $Sig = 0.038$), indicating that the influence of this variable is significant. Moreover, the linear regression model equation is presented as follows; $P_1 = \beta_0 + \beta_1 I_1 + \beta_2 I_2 + \beta_3 I_3 + \beta_4 I_4 + \beta_5 I_5$; Where P_1 = strategic performance, I_1 = tools applied; I_2 = leadership commitment; I_3 = empowerment; I_4 = communication of *Kaizen*/results; I_5 = outside consultants. Therefore, $P_1 = 0.61 + 0.37 I_1 - 0.04 I_2 + 0.34 I_3 + 0.02 I_4 + 0.18 I_5$. From this equation, the model predicts that when all the *Kaizen* implementation variables are zeroes, the strategic performance is 0.61. It also predicts that for a one unit increase in tool applied, strategic performance increases by 0.37 holding the other predictors fixed.

The second dependent variable was operational performance represented by P_2 and the regression analysis is presented in Table 4.13. The value of the coefficient of correlation R-value of 0.671

indicates a positive association between operational performance and *Kaizen* implementation factors. The value of R-square of 0.450 shows that the level of variation in operational performance explained by the *Kaizen* implementation is 45.0%. The remaining 55.0% of the variation is contributed by other factors other than *Kaizen* implementation activities. The ANOVA test shows significant relationship between operational performance and *Kaizen* implementation ($F=13.26$; $Sig = 0.000$). This confirms that *Kaizen* implementation significantly affects operational performance.

The standardized coefficient Beta of the tools applied on operational performance was 0.37 ($t=2.87$; $Sig = 0.005$), which shows that the impact of this item is significant. The value of Beta for leadership commitment is 0.10 ($t = 0.82$; $Sig = 0.415$), which indicates that the influence of this variable is insignificant. The value of Beta for empowerment was 0.23 ($t = 1.83$; $Sig = 0.071$), which signifies that the impact of this item is significant (but marginally significant). The value of Beta for communication of *Kaizen* is 0.03 ($t=0.24$; $Sig = 0.814$), which shows that the influence of variable is insignificant. The value of Beta for outside consultants was 0.07 ($t = 0.77$, $Sig = 0.440$), indicating that the influence of this variable is insignificant. The linear regression model equation is presented as follows; $P_2 = \beta_0 + \beta_1 I_1 + \beta_2 I_2 + \beta_3 I_3 + \beta_4 I_4 + \beta_5 I_5$; Where P_2 = operational performance, I_1 = tools applied; I_2 = leadership commitment; I_3 = empowerment; I_4 = communication of *Kaizen*/results; I_5 = outside consultants. Therefore, $P_2 = 0.63 + 0.44I_1 + 0.11I_2 + 0.27I_3 + 0.03I_4 + 0.05I_5$. When all the *Kaizen* implementation variables are zeroes, the operational performance is 0.63 and when tools applied increases by one-unit operational performance increases by 0.44.

The regression analysis for the overall performance (average of strategic and operational; P_3) was also conducted and the results are presented in Table 4.13. The value of the coefficient of correlation R-value of 0.660 indicates a positive association between overall performance and *Kaizen* implementation practices. The value of R-square of 0.435 shows that the level of variation in overall performance contributed by the *Kaizen* implementation is 43.5%. The ANOVA test shows significant relationship between overall performance and *Kaizen* implementation activities ($F= 12.49$; $Sig = 0.000$). This confirms that *Kaizen* implementation items/activities significantly and positively affect the overall performance.

The statistical coefficients on overall performance showed that the value of standardized coefficient (Beta) for tools applied was 0.35 ($t=2.69$; $\text{Sig} = 0.009$), which implies that the impact of this item is significant. The value of Beta for leadership commitment is equal to 0.06 ($t = 0.46$; $\text{Sig} = 0.644$), indicating that the contribution of this variable is insignificant. The value of Beta for empowerment reached 0.25 ($t = 1.95$; $\text{Sig} = 0.054$), which implies that the impact of this item is marginally significant. The value of Beta for communication of *Kaizen* is equal to 0.03 ($t=0.21$; $\text{Sig} = 0.836$), that shows that the influence of this variable is insignificant. The value of Beta for outside consultants was 0.12 ($t = 1.29$, $\text{Sig} = 0.200$), showing that the impact of this item is insignificant. The linear regression model equation is presented as follows; $P_3 = \beta_0 + \beta_1 I_1 + \beta_2 I_2 + \beta_3 I_3 + \beta_4 I_4 + \beta_5 I_5$; Where P_3 = overall performance, I_1 = tools applied; I_2 = leadership commitment; I_3 = empowerment; I_4 = communication of *Kaizen*/results; I_5 = outside consultants. Therefore, $P_3 = 0.62 + 0.42I_1 + 0.06I_2 + 0.29 + 0.03I_4 + 0.09I_5$. For example, when all the *Kaizen* implementation variables are zeroes, the overall performance is 0.62 and when tools applied increase by one-unit overall performance increases by 0.42.

Table 4. 13 Regression analysis for H1

Independent variable	Strategic performance, P ₁ (Dependent variable)											
	Model Summary and ANOVA test						Coefficients					
							Unstandardized Coefficients			Standardized Coefficients		t
	R	R ²	Adj. R ²	Std. Error	F	Sig.	(Constant β)	B	Std. Error	Beta		
Predictors: (Constant), I ₁ , I ₂ , I ₃ , I ₄ , I ₅	0.591	0.349	0.309	0.75	8.68	0.000	(Constant)	0.61	0.46		1.33	0.189
							I ₁	0.37	0.19	0.27	1.97	0.042
							I ₂	-0.04	0.16	-0.04	-0.28	0.780
							I ₃	0.34	0.18	0.26	1.93	0.048
							I ₄	0.02	0.15	0.02	0.13	0.900
							I ₅	0.18	0.08	0.21	2.11	0.038
Operational performance, P ₂ (Dependent variable)												
Predictors: (Constant), I ₁ , I ₂ , I ₃ , I ₄ , I ₅	0.671	0.450	0.416	0.64	13.26	0.000	(Constant)	0.63	0.38		1.65	0.103
							I ₁	0.44	0.15	0.37	2.87	0.005
							I ₂	0.11	0.13	0.1	0.82	0.415
							I ₃	0.27	0.15	0.23	1.83	0.071
							I ₄	0.03	0.12	0.03	0.24	0.814
							I ₅	0.05	0.07	0.07	0.77	0.440
Overall performance, P ₃ (Dependent variable)												
Predictors: (Constant), I ₁ , I ₂ , I ₃ , I ₄ , I ₅	0.66	0.435	0.401	0.65	12.49	0.000	(Constant)	0.62	0.39		1.61	0.111
							I ₁	0.42	0.15	0.35	2.69	0.009
							I ₂	0.06	0.13	0.06	0.46	0.644
							I ₃	0.29	0.15	0.25	1.95	0.054
							I ₄	0.03	0.13	0.03	0.21	0.836
							I ₅	0.09	0.07	0.12	1.29	0.200

I₁ = tools applied; I₂ = leadership commitment; I₃ = empowerment; I₄ = communication of *Kaizen*/results; I₅ = outside consultants

IV.1.12.3 Multiple stepwise regression for H1

Multiple stepwise method was used to determine which items or dimensions of *Kaizen* implementation activities had the most significant impact on the dependent variables (strategic, operational and overall performance). Five factors of *Kaizen* implementation practices including tools applied, leadership commitment, empowerment, communication and outside consultants were considered together. Upon fitting these factors against the dependent variables using multiple linear regression and specifying 'stepwise' method, three factors (tools applied, empowerment and outside consultants) were the ones positively and independently affecting strategic performance. However, only tools applied and empowerment were the ones positively and independently affecting for both operational and overall performance. Leadership commitment and communication were not impacting independently the performance as indicated in Table 4.14.

Tools applied came out strongly significant in first place, and explained 26.3% ($R^2=0.263$) of the changes in the strategic performance. Empowerment is added in the second model which led to 31.1% ($R^2=0.311$) and outside consultants was added in the third model leading to 34.8% ($R^2=0.348$) of the variation in the strategic performance. Regarding the sensitivity of beta (β), the results show that tools applied had a strong relationship with strategic performance in that for one unit increase of tools applied, strategic performance improves by 69.0%, ($\beta = 0.690$, Sig. = 0.000). Moreover, the standardized coefficient (Beta) for tools applied, empowerment and outside consultants are 0.27, 0.25 and 0.21 respectively, which are statistically significant at probability value less than 0.05. The linear regression model equation is presented as follows; $P_1 = \beta_0 + \beta_1 I_1 + \beta_2 I_2$; Where P_1 = strategic performance, I_1 = tools applied; I_2 = empowerment; I_3 = outside consultants. Therefore, $P_1 = 0.58 + 0.36I_1 + 0.33I_2 + 0.18I_3$.

Similarly, tools applied came out strongly significant in the first place and explained 39.0% ($R^2=0.390$) of the changes in the operational performance and empowerment is added in the second model which led to 44.4% ($R^2=0.444$) variation in the operational performance. Regarding the sensitivity of beta (β), the results show that tools applied had a strong relationship with operational performance in that for one unit increase of tools applied, operational performance improves by 75.0%, ($\beta = 0.75$, Sig.=0.000). Moreover, the standardized coefficient (Beta) for tools applied and empowerment are 0.44 and 0.29 respectively, which are statistically significant at

probability value less than 0.01. The linear regression model equation is presented as follows; $P_2 = \beta_0 + \beta_1 I_1 + \beta_2 I_2$; Where P_2 = operational performance, I_1 tools applied, I_2 = empowerment. Therefore, $P_2 = 0.72 + 0.53I_1 + 0.35I_2$.

Likewise, tools applied came out strongly significant in first place, and explained 36.8% ($R^2=0.368$) of the changes in the overall performance and empowerment is added in the second model which led to 44.2% ($R^2=0.442$) variation in the overall performance. The sensitivity of beta (β), the results show that tools applied had a strong relationship with overall performance in that for one unit increase of tools applied, overall performance improves by 73.0%, ($\beta = 0.73$, Sig = 0.000). Moreover, the standardized coefficient (Beta) for tools applied and empowerment are 0.42 and 0.30 respectively, which are statistically significant at probability value of 0.01. The linear regression model equation is presented as follows; $P_3 = \beta_0 + \beta_1 I_1 + \beta_2 I_2$; Where P_3 = overall performance, I_1 tools applied; I_2 = empowerment. Therefore, $P_3 = 0.70 + 0.50I_1 + 0.36I_2$.

Table 4. 14 Multiple stepwise regression for H1

	Strategic performance, P1 (Dependent variable)													
Model	Independent variable	Coefficients							Model summary					
		Unstandardized Coefficients	Standardized Coefficients	Sig.	Correlations		Collinearity Statistics							
					B	Beta	Partial	Part	Tolerance	VIF	R	R2	Adj. R2	F
1	(Constant)	1.10		0.012										
	Tool applied	0.69	0.51	0.000	0.51	0.51	1.00	1.00	0.513	0.263	0.254	30.34	0.000	
2	(Constant)	0.65		0.155										
	Tool applied	0.44	0.33	0.006	0.29	0.26	0.59	1.68	0.558	0.311	0.295	19.00	0.000	
	Empowerment	0.38	0.29	0.017	0.26	0.22	0.59	1.68						
3	(Constant)	0.58		0.194										
	Tool applied	0.36	0.27	0.028	0.24	0.20	0.56	1.80						
	Empowerment	0.33	0.25	0.033	0.23	0.19	0.58	1.71	0.590	0.348	0.325	14.78	0.000	
	Outside consultants	0.18	0.21	0.033	0.23	0.19	0.82	1.23						
Operational performance, P2 (Dependent variable)														
1	(Constant)	1.13		0.002										
	Tool applied	0.75	0.62	0.000	0.62	0.62	1.00	1.00	0.624	0.39	0.382	54.27	0.000	
2	(Constant)	0.72		0.055										
	Tool applied	0.53	0.44	0.000	0.41	0.34	0.59	1.68	0.666	0.444	0.43	33.05	0.000	
	Empowerment	0.35	0.29	0.007	0.29	0.23	0.59	1.68						
Overall performance, P3 (Dependent variable)														
1	(Constant)	1.12		0.002										
	Tool applied	0.73	0.61	0.000	0.61	0.61	1.00	1.00	0.607	0.368	0.361	49.59	0.000	
2	(Constant)	0.70		0.066										
	Tool applied	0.50	0.42	0.000	0.39	0.32	0.59	1.68	0.649	0.442	0.408	30.62	0.000	

Empowerment	0.36	0.30	0.007	0.29	0.23	0.59	1.68
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IV.1.13 Hypothesis testing results for hypothesis two (H2)

The second hypothesis states that *Kaizen* implementation activities significantly affect *Kaizen* sustainability and the results are presented below.

IV.1.13.1 Correlation matrix, multi-collinearity tests and outliers test for H2

The correlation analysis was conducted using Pearson correlation coefficient and p value to examine the degree of correlation between *Kaizen* implementation and *Kaizen* sustainability. Furthermore, the generated correlation matrix helped to determine whether multi-collinearity existed between the variables under investigation.

As indicated in Table 4.15, there was a significant positive linear correlation between the *Kaizen* implementation activities and *Kaizen* sustainability practices at 0.01 significance level. However, there was no significant correlation between outside consultants and longevity as well as between outside consultants and institutional change. Collinearity test of the data was examined to validate the regression analysis. Concerning multi-collinearity, there was a correlation value above 0.90, which is 0.947 between overall implementation and tool applied as presented in Table 4.11. This would affect the impact of other independent variables on the *Kaizen* sustainability (adversely affects the regression estimate). Therefore, the overall *Kaizen* implementation is removed in the multiple linear regression analysis.

Table 4. 15 Correlation matrix and collinearity between implementation and sustainability

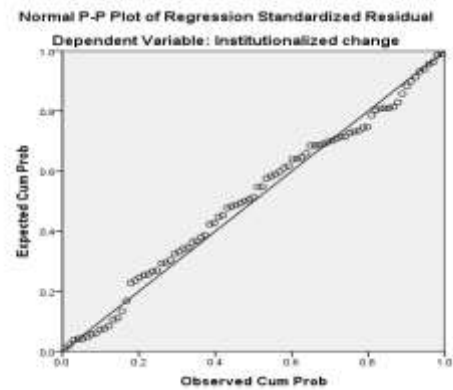
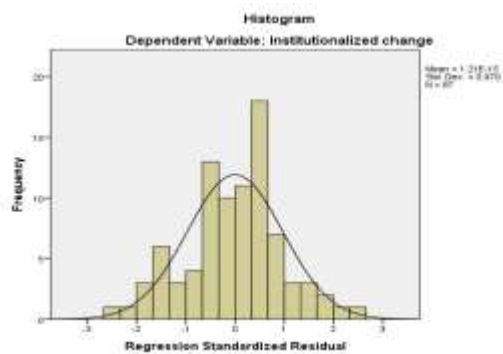
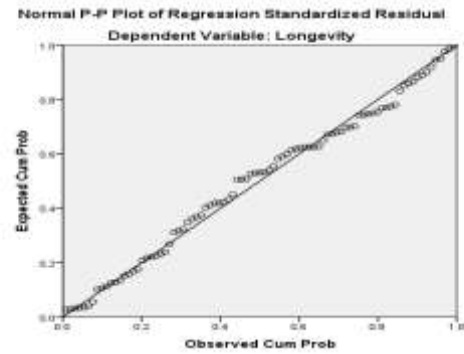
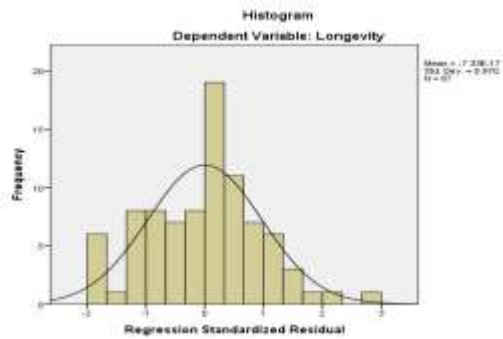
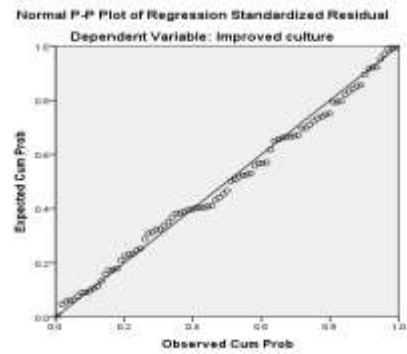
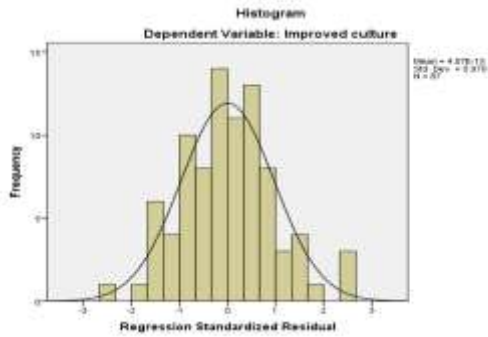
	Improved culture	Longevity	Institutionalized change	Overall sustainability	Tool applied	Leadership commitment	Empowerment	Communication	Outside consultants	Overall implementation
Improved culture	1									
Longevity	0.721**	1								
Institutionalized change	0.554**	0.563**	1							
Overall sustainability	0.973**	0.839**	0.677**	1						
Tool applied	0.707**	0.524**	0.434**	0.698**	1					
Leadership commitment	0.648**	0.424**	0.598**	0.655**	0.646**	1				
Empowerment	0.741**	0.484**	0.522**	0.725**	0.637**	0.659**	1			
Communication	0.686**	0.461**	0.473**	0.673**	0.680**	0.647**	0.663**	1		
Outside consultants	0.384**	0.202	0.185	0.352**	0.410**	0.278**	0.357**	0.345**	1	
Overall implementation	0.798**	0.553**	0.540**	0.786**	0.947**	0.791**	0.821**	0.779**	0.487**	1

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

Besides, multi-collinearity problems were assessed using tolerance and variance inflation factors (VIFs). As indicated above multicollinearity occurs when tolerance values are less than 0.1 and VIF values greater than 10. Table 4.16 shows that tolerance and VIFs between the different dependent and independent variables are above 0.1 and below 10 respectively. Therefore, no collinearity issues were found. Another parameter called Cook's distance was estimated to determine whether there was any outlier, if it is greater than one, it indicates that an outlier exists. The result in Table 4.16 shows no outlier as all the Cook's distance are less than one. Durbin Watson was used to check for autocorrelation that the residuals from linear regressions are independent. As shown in Table 4.16, there was no autocorrelation; the residuals were uncorrelated as the Durbin Watson is close to 2. Additionally, to validate the regression analysis, histogram and P-P plot presented in Figure 4.2 below show reasonable normality of data.

Table 4. 16 Collinearity statistics, autocorrelation test and outliers test

Independent variables	Dependent variable (Improved culture)				
	Collinearity Statistics		Cook's Distance		Durbin-Watson
	Tolerance	VIF	Minimum	Maximum	
Tool applied	0.42	2.38			
Leadership commitment	0.45	2.22			
Empowerment	0.44	2.27	0.00	0.16	2.20
Communication	0.42	2.37			
Outside consultants	0.81	1.23			
Dependent variable (Longevity sustainability)					
Tool applied	0.42	2.38			
Leadership commitment	0.45	2.22			
Empowerment	0.44	2.27	0.00	0.14	2.12
Communication	0.42	2.37			
Outside consultants	0.81	1.23			
Dependent variable (Institutionalized change sustainability)					
Tool applied	0.42	2.38			
Leadership commitment	0.45	2.22			
Empowerment	0.44	2.27	0.00	0.18	2.14
Communication	0.42	2.37			
Outside consultants	0.81	1.23			
Dependent variable (Overall sustainability)					
Tool applied	0.42	2.38			
Leadership commitment	0.45	2.22			
Empowerment	0.44	2.27	0.00	0.18	2.19
Communication	0.42	2.37			



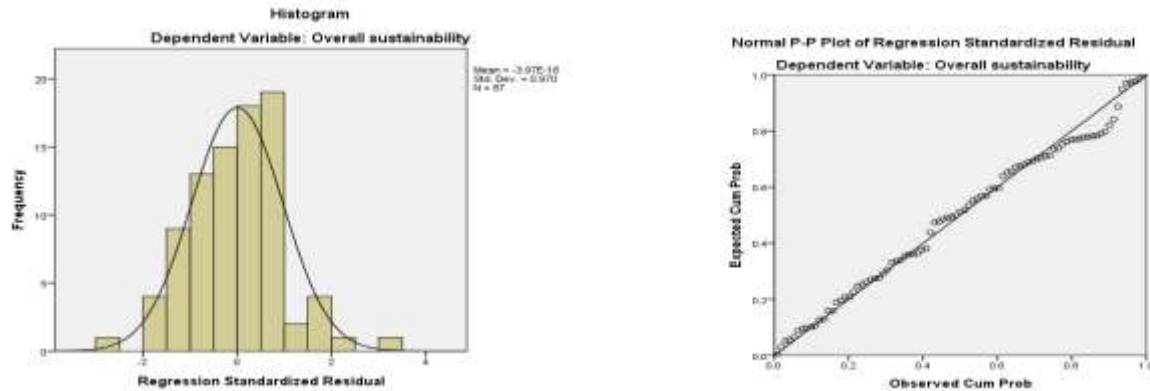


Figure 4. 2: Histogram and P-P plot for Hypothesis H2

IV.1.13.2 Regression analysis for H2

Regression analysis using the enter method was done to examine the association between the *Kaizen* sustainability as dependent variable and *Kaizen* implementation activities as independent variables (Table 4.17). The dependent variables are sustainable improved culture (S_1), sustainable longevity (S_2), sustainable institutionalized change (S_3) and overall sustainability (S_4). The predictors were tools applied, leadership commitment, empowerment, communication and outside consultants.

The value of the coefficient of correlation R-value of 0.818 indicates a strong positive association between sustainable improved culture (S_1) and *Kaizen* implementation practices. The value of R-square of 0.669 shows that the level of variation in sustainable improved culture contributed by the *Kaizen* implementation is 66.9%. The ANOVA test shows a significant relationship between the improved culture and *Kaizen* implementation ($F=32.74$; $Sig=0.000$). This confirms that *Kaizen* implementation significantly affects sustainable improved culture. The statistical coefficients on sustainable improved culture showed that the value of standardized coefficient (Beta) for tools applied was 0.261 ($t=2.65$; $Sig=0.010$) and for empowerment was 0.367 ($t=3.81$; $Sig=0.000$), which implies that the impact of these items is significant on sustainable improved culture. However, the value of standardized Beta for leadership commitment was 0.108 ($t=1.13$; $Sig=0.262$), for communication of *Kaizen* is equal to 0.177 ($t=1.80$; $Sig=0.076$) and for outside consultants was 0.055 ($t=0.78$, $Sig=0.441$) indicating that the influence of these variables were insignificant on improved culture. The linear regression model equation is presented as follows;

$S_1 = \beta_0 + \beta_1 I_1 + \beta_2 I_2 + \beta_3 I_3 + \beta_4 I_4 + \beta_5 I_5$; Where S_1 = Sustainable improved culture, I_1 = tools applied; I_2 = leadership commitment; I_3 = empowerment; I_4 = communication of *Kaizen*/results; I_5 = outside consultants. Therefore, $S_1 = 0.201 + 0.291I_1 + 0.105I_2 + 0.404I_3 + 0.159I_4 + 0.039I_5$. For instance, when all the *Kaizen* implementation variables are zeroes, the sustainable improved culture is 0.201 and when tools applied increases by one unit, improved culture increases by 0.291.

Likewise, there was a positive association between sustainable longevity (S_2) and *Kaizen* implementation factors as the value of the coefficient of correlation R-value was 0.565. The value of R-square of 0.319 shows that the level of variation in sustainable longevity explained by *Kaizen* implementation is 31.9% which is significant ($F = 7.62$; $Sig = 0.000$). This confirms that *Kaizen* implementation significantly affects sustainable longevity. However, the only significant factor was tools applied with the standardized coefficient Beta of 0.325 ($t = 2.30$; $Sig = 0.024$). But, the standardized value of Beta for leadership commitment was 0.022 ($t = 0.16$; $Sig = 0.873$), for empowerment was 0.213 ($t = 1.54$; $Sig = 0.127$), for communication of *Kaizen* is equal to 0.102 ($t = 0.72$; $Sig = 0.471$) and for outside consultants was -0.049 ($t = -0.48$, $Sig = 0.632$), indicating that the effect of these dimensions were insignificant. The linear regression model equation is presented as follows; $S_2 = \beta_0 + \beta_1 I_1 + \beta_2 I_2 + \beta_3 I_3 + \beta_4 I_4 + \beta_5 I_5$; Where S_2 = sustainable longevity, I_1 = tools applied; I_2 = leadership commitment; I_3 = empowerment; I_4 = communication of *Kaizen*/results; I_5 = outside consultants. Therefore, $S_2 = 0.905 + 0.418I_1 + 0.025I_2 + 0.271I_3 + 0.106I_4 - 0.040I_5$. For example, when all the *Kaizen* implementation variables are zeroes, the sustainable longevity is 0.905 and when tools applied increases by one unit, sustainable longevity increases by 0.418.

Regarding to sustainable institutionalized change, the value of the coefficient of correlation R-value of 0.624 indicates a positive association between sustainable institutionalized change (S_3) and *Kaizen* implementation practices. The value of R-square of 0.390 shows that the level of variation in sustainable institutionalized change contributed by the *Kaizen* implementation is 39.0% which shows significant relationship ($F = 10.36$; $Sig = 0.000$). This confirms that *Kaizen* implementation significantly affects sustainable institutionalized change. The statistical coefficients on sustainable institutionalized change showed that the value of standardized coefficient (Beta) for leadership commitment was 0.430 ($t = 3.32$; $Sig = 0.001$), which shows that the impact of this item is significant. However, the value of standardized Beta for tools applied is

equal to -0.020 ($t = -0.15$; $\text{Sig} = 0.881$), for empowerment reached 0.208 ($t = 1.59$; $\text{Sig} = 0.116$), for communication is 0.081 ($t = 0.60$; $\text{Sig} = 0.547$) and for outside consultants was -0.028 ($t = -0.29$, $\text{Sig} = 0.772$), indicating that the impact of these items was insignificant. The linear regression model equation is presented as follows; $S_3 = \beta_0 + \beta_1 I_1 + \beta_2 I_2 + \beta_3 I_3 + \beta_4 I_4 + \beta_5 I_5$; Where S_3 = sustainable institutionalized change, I_1 = tools applied; I_2 = leadership commitment; I_3 = empowerment; I_4 = communication of *Kaizen*/results; I_5 = outside consultants. Therefore, $S_3 = 0.077 - 0.031 I_1 + 0.580 I_2 + 0.317 I_3 + 0.100 I_4 - 0.027 I_5$. For instance, when all the *Kaizen* implementation variables are zeroes, the sustainable institutionalized change is 0.077 and when leadership commitment increases by one-unit sustainable institutionalized change increases by 0.580.

The regression analysis for the overall *Kaizen* sustainable (S_4 = average of sustainable improved culture, longevity and institutionalized change) was conducted and the results are presented in Table 4.17. The value of the coefficient of correlation R-value of 0.805 indicates a strong positive association between overall *Kaizen* sustainability and *Kaizen* implementation practices. The value of R-square of 0.647 shows that the level of variation in overall *Kaizen* sustainable contributed by the *Kaizen* implementation is 64.7% ($F = 30.33$; $\text{Sig} = 0.001$). This confirms that *Kaizen* implementation significantly affects the overall *Kaizen* sustainable. The statistical coefficients on overall *Kaizen* sustainable showed that the value of standardized coefficient (Beta) for tools applied was 0.263 ($t = 2.59$; $\text{Sig} = 0.011$) and for empowerment was 0.346 ($t = 3.48$; $\text{Sig} = 0.001$), implying that the effect of these dimensions was significant on the overall *Kaizen* sustainability. However, the standardized value of Beta for leadership commitment is equal to 0.144 ($t = 1.47$; $\text{Sig} = 0.146$), for communication of *Kaizen* is equal to 0.164 ($t = 1.61$; $\text{Sig} = 0.111$) and for outside consultants was 0.024 ($t = 0.33$, $\text{Sig} = 0.744$), indicating that the effect of these dimensions was insignificant. The linear regression model equation is presented as follows; $S_4 = \beta_0 + \beta_1 I_1 + \beta_2 I_2 + \beta_3 I_3 + \beta_4 I_4 + \beta_5 I_5$; Where S_4 = overall *Kaizen* sustainable, I_1 = tools applied; I_2 = leadership commitment; I_3 = empowerment; I_4 = communication of *Kaizen*/results; I_5 = outside consultants. Therefore, $S_4 = 0.329 + 0.284 I_1 + 0.136 I_2 + 0.368 I_3 + 0.142 I_4 + 0.016 I_5$. For instance, when all the *Kaizen* implementation variables are zeroes, the overall *Kaizen* sustainable is 0.329 and when tools applied increases by one unit, overall *Kaizen* sustainable increases by 0.284.

Table 4. 17 Regression Analysis for H2

Independent variable	Improved culture, S ₁ (Dependent variable)											
	Model Summary and ANOVA test						Coefficients					
							Unstandardized Coefficients			Standardized Coefficients		t
	R	R ²	Adj. R ²	Std. Error	F	Sig.	(Constant β)	B	Std. Error	Beta		
Predictors: (Constant), I ₁ , I ₂ , I ₃ , I ₄ , I ₅	0.818	0.669	0.649	0.46	32.74	0.000	(Constant)	0.201	0.27		0.73	0.465
							I ₁	0.291	0.11	0.261	2.65	0.010
							I ₂	0.105	0.09	0.108	1.13	0.262
							I ₃	0.404	0.11	0.367	3.81	0.000
							I ₄	0.159	0.09	0.177	1.80	0.076
							I ₅	0.039	0.05	0.055	0.78	0.441
Longevity, S ₂ (Dependent variable)												
Predictors: (Constant), I ₁ , I ₂ , I ₃ , I ₄ , I ₅	0.565	0.319	0.277	0.76	7.61	0.000	(Constant)	0.905	0.45		2.00	0.049
							I ₁	0.418	0.18	0.325	2.30	0.024
							I ₂	0.025	0.15	0.022	0.16	0.873
							I ₃	0.271	0.18	0.213	1.54	0.127
							I ₄	0.106	0.15	0.102	0.72	0.471
							I ₅	-0.040	0.08	-0.049	-0.48	0.632
Institutionalized change, S ₃ (Dependent variable)												
Predictors: (Constant), I ₁ , I ₂ , I ₃ , I ₄ , I ₅	0.624	0.390	0.352	0.86	10.36	0.000	(Constant)	0.077	0.51		0.15	0.881
							I ₁	-0.031	0.21	-0.020	-0.15	0.881
							I ₂	0.580	0.17	0.430	3.32	0.001
							I ₃	0.317	0.20	0.208	1.59	0.116
							I ₄	0.100	0.17	0.081	0.60	0.547
							I ₅	-0.027	0.09	-0.028	-0.29	0.772
Overall sustainability, S ₄ (Dependent variable)												
							(Constant)	0.329	0.27		1.20	0.232

Predictors: (Constant), I ₁ , I ₂ , I ₃ , I ₄ I ₅		I ₁	0.284	0.11	0.263	2.59	0.011
	0.805	I ₂	0.136	0.09	0.144	1.47	0.146
	0.647	I ₃	0.368	0.11	0.346	3.48	0.001
	0.626	I ₄	0.142	0.09	0.164	1.61	0.111
	0.46	I ₅	0.016	0.05	0.024	0.33	0.744
	29.76						
	0.000						

I₁ = tools applied; I₂ = leadership commitment; I₃ = empowerment; I₄ = communication of *Kaizen*/results; I₅ = outside consultants

IV.1.13.3 Multiple stepwise regression for H2

Multiple stepwise method was used to determine which items or dimensions of *Kaizen* implementation activities had the most significant impact on the dependent variable (sustainable improved culture (S₁), sustainable longevity (S₂), sustainable institutionalized change (S₃) and overall sustainability (S₄)). Five factors of implementation practices including tools applied, leadership commitment, empowerment, communication of *Kaizen*/results and outside consultants were considered together. Upon fitting these factors against the different dependent variables using multiple linear regression and specifying 'stepwise' method, three factors (empowerment, tools applied, and communication) were the ones positively and independently affecting both sustainable improved culture and overall *Kaizen* sustainability. Tools applied and empowerment were positively and independently affecting sustainable longevity and only leadership commitment was positively and independently affecting sustainable institutionalized change as shown in Table 4.18.

Empowerment came out strongly significant in first place and explained 54.9% (R²=0.549) of the changes in the sustainable improved culture. Tools applied is added in the second model which led to 64.2% (R²=0.642) and communication added in third model led to 66.2% (R²=0.662) variation in the sustainable improved culture. Regarding the sensitivity of beta (β), the results show that empowerment had a strong relationship with sustainable improved culture in that for one unit increase of empowerment, sustainable improved culture improves by 81.5%, ($\beta = 0.815$, Sig=0.000). Moreover, the standardized coefficient (Beta) for empowerment, tools applied, and communication are 0.409, 0.306 and 0.207 respectively, which are statistically significant at

probability value less than 0.05. The linear regression model equation is presented as follows; $S_1 = \beta_0 + \beta_1 I_1 + \beta_2 I_2 + I_3$; Where S_1 = sustainable improved culture, I_1 = tools applied; I_2 = empowerment, I_3 = communication. Therefore, $S_1 = 0.282 + 0.341 I_1 + 0.450 I_2 + 0.186 I_3$.

Tools applied were independently affecting sustainable longevity and explained 27.4% ($R^2=0.274$) of the changes in the sustainable longevity and empowerment was added in the second model which led to 31.2% ($R^2=0.312$) variation of the sustainable longevity. The beta (β) shows that tools applied had a strong relationship in that for one unit increase of tools applied, sustainable longevity improves by 67.4% ($\beta = 0.674$, Sig = 0.000). Moreover, the standardized coefficient (Beta) for tools applied and empowerment were 0.362 and 0.253 respectively which are statistically significant at probability value of 0.05. The linear regression model equation is presented as follows; $S_2 = \beta_0 + \beta_1 I_1 + I_2$; Where S_2 = sustainable longevity, I_1 tools applied; I_2 = empowerment. Therefore, $S_2 = 0.904 + 0.466 I_1 + 0.322 I_2$.

Leadership commitment was also independently affecting sustainable institutionalized change where 35.8% ($R^2=0.358$) of the institutional change is explained by leadership commitment implementation. The beta (β) shows that it had a strong relationship in that for one unit increase of Leadership commitment, sustainable institutionalized change improves by 80.7%, ($\beta = 0.807$, Sig=0.000). Moreover, the standardized coefficient (Beta) was 0.598, which is statistically significant at probability value at 0.001. The linear regression model equation is presented as follows; $S_3 = \beta_0 + \beta_1 I_1$; Where S_3 = sustainable institutionalized change, I_1 = leadership commitment. Therefore, $S_3 = 0.461 + 0.598 I_1$.

Regarding to the overall *Kaizen* sustainability, empowerment came out strongly significant in first place, and explained 52.6% ($R^2=0.526$) of the changes in the overall sustainability, tools applied is added in the second model which led to 62.2% ($R^2=0.620$) variation, then communication is added in the third model which led to 63.8% ($R^2=0.638$) variation of the overall *Kaizen* sustainability. Regarding the sensitivity of beta (β), the results show that empowerment had a strong relationship with overall *Kaizen* sustainability in that for one unit increase of empowerment, overall sustainability improves by 77.3%, ($\beta = 0.73$, Sig=0.000). Moreover, the standardized coefficient (Beta) for empowerment, tools applied, and communication are 0.395, 0.309 and 0.201 respectively, which are statistically significant at probability value of 0.05. The linear regression

model equation is presented as follows; $S_4 = \beta_0 + \beta_1 I_1 + \beta_2 I_2 + \beta_3 I_3$; where S_4 = overall *Kaizen* sustainable, I_1 = tools applied; I_2 = empowerment; I_3 = communication. Therefore, $S_4 = 0.422 + 0.334I_1 + 0.421I_2 + 0.175I_3$.

Table 4. 18 Multiple Stepwise Regression for H2

	Improved culture, S1 (Dependent variable)													
Model	Independent variable	Coefficients								Model summary and ANOVA test				
		Unstandardized Coefficients	Standardized Coefficients	t	Sig.	Correlations		Collinearity Statistics						
		B	Beta			Partial	Partial	Tolerance	VIF	R	R2	Adj. R2	F	Sig.
1	(Constant)	0.827		3.03	0.003					0.741	0.549	0.544	103.58	0.000
	Empowerment	0.815	0.741	10.18	0.000	0.74	0.74	1.00	1.00					
2	(Constant)	0.280		1.03	0.306					0.801	0.642	0.634	75.45	0.000
	Empowerment	0.538	0.489	5.78	0.000	0.53	0.38	0.59	1.68					
	Tool applied	0.441	0.396	4.68	0.000	0.46	0.31	0.59	1.68					
3	(Constant)	0.282		1.06	0.291					0.813	0.662	0.649	54.12	0.000
	Empowerment	0.450	0.409	4.51	0.000	0.44	0.29	0.50	2.02					
	Tool applied	0.341	0.306	3.31	0.001	0.34	0.21	0.48	2.10					
	Communication	0.186	0.207	2.18	0.032	0.23	0.14	0.45	2.23					
Longevity, S2 (Dependent variable)														
1	(Constant)	1.286		3.17	0.002					0.524	0.274	0.266	32.11	0.000
	Tool applied	0.674	0.524	5.67	0.000	0.52	0.52	1.00	1.00					
2	(Constant)	0.904		2.08	0.041					0.559	0.312	0.296	19.08	0.000
	Tool applied	0.466	0.362	3.09	0.003	0.32	0.28	0.59	1.68					
	Empowerment	0.322	0.253	2.16	0.034	0.23	0.20	0.59	1.68					
Institutionalized change, S3 (Dependent variable)														
1	(Constant)	0.461		1.05	0.297					0.598	0.358	0.350	47.38	0.000
	Leadership commitment	0.807	0.598	6.88	0.000	0.60	0.60	1.00	1.00					
Overall sustainability, S4 (Dependent variable)														
1	(Constant)	0.952		3.50	0.001					0.725	0.526	0.521	94.37	0.000

	Empowerment	0.773	0.725	9.72	0.000	0.73	0.73	1.00	1.00					
2	(Constant)	0.420		1.55	0.125					0.787	0.620	0.611	68.42	0.000
	Empowerment	0.504	0.473	5.42	0.000	0.51	0.36	0.59	1.68					
	Tool applied	0.428	0.397	4.55	0.000	0.44	0.31	0.59	1.68					
3	(Constant)	0.422		1.59	0.117					0.799	0.638	0.625	48.73	0.000
	Empowerment	0.421	0.395	4.21	0.000	0.42	0.28	0.50	2.02					
	Tool applied	0.334	0.309	3.23	0.002	0.33	0.21	0.48	2.10					
	Communication	0.175	0.201	2.04	0.044	0.22	0.14	0.45	2.23					

IV.1.14 Hypothesis testing results for hypothesis three (H3)

The third hypothesis states that *Kaizen* sustainability practices significantly affect performance and the results are presented below.

IV.1.14.1 Correlation matrix, multi-collinearity tests and outliers test for H3

Correlation analysis was carried out using Pearson correlation coefficient and p value to establish the degree of association between *Kaizen* sustainability and performance variables. Furthermore, the generated relationship matrix helped to determine whether multi-collinearity existed between the variables under investigation (Table 4.19).

Strategic performance had a positive significant linear relationship with all *Kaizen* sustainability activities. Likewise, the study found that operational performance had a positive significant linear relationship with all *Kaizen* sustainability activities at 0.01 significance level. In addition, the overall performance (average of strategic and operational performance) had a positive significant linear relationship with all *Kaizen* sustainability activities at 0.01 significant level. These findings give initial support for hypothesis H3.

Collinearity of the data was tested to validate the regression analysis. As indicated above, if the value of correlation does not exceed 0.90 among the independent variables, then collinearity does not exist. According to this study, there was 0.973 of correlation value, between overall *Kaizen* sustainability and improved culture and high correlation between overall *Kaizen* sustainability and longevity ($r=0.839$). This would affect the impact of the other independent variables on the

performance during regression analysis. Therefore, the overall *Kaizen* sustainability is removed in the multiple regression analysis.

Table 4. 19 Correlation Matrix and Collinearity Between Implementation and Sustainability

	Strategic performance	Operational performance	Overall performance	Improved culture	Longevity	Institutionalized change	Overall sustainability
Strategic performance	1						
Operational performance	0.861**	1					
Overall performance	0.935**	0.986**	1				
Improved culture	0.676**	0.763**	0.758**	1			
Longevity	0.577**	0.676**	0.664**	0.721**	1		
Institutionalized change	0.474**	0.576**	0.561**	0.554**	0.563**	1	
Overall sustainability	0.693**	0.795**	0.786**	0.973**	0.839**	0.677**	1

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

Furthermore, multi-collinearity problems were assessed using tolerance and variance inflation factors (VIFs). As indicated above multicollinearity exists when tolerance values are less than 0.1 and VIF values are greater than 10. Table 4.16 below shows that tolerance and VIFs between the different dependent and independent variables are above 0.1 and below 10 respectively. Therefore, no collinearity issues were found. Cook's distance was also calculated to determine whether there was any outlier and the result in Table 4.20 shows no outlier as all the Cook's distance are less than one. Durbin Watson was used to check for autocorrelation; that the residuals from linear regressions are independent. As shown in Table 4.20, there is no autocorrelation; the residuals are uncorrelated as the Durbin Watson is close to 2. Additionally, to validate the regression analysis, histogram and P-P plot presented in Figure 4.3 below show reasonable normality of data.

Table 4. 20 Collinearity Statistics, Autocorrelation Test and Outliers Test

Independent variables	Dependent variable (Strategic performance)				
	Collinearity Statistics		Cook's Distance		Durbin-Watson
	Tolerance	VIF	Minimum	Maximum	
Improved culture	0.449	2.23			
Longevity	0.442	2.262	0.00	0.12	2.37
Institutionalized change	0.638	1.568			
Overall sustainability	0.234	4.274			
Dependent variable (Operational performance)					
Improved culture	0.449	2.23			
Longevity	0.442	2.262			
Institutionalized change	0.638	1.568	0.00	0.09	2.06
Overall sustainability	0.234	4.274			
Dependent variable (Overall performance)					
Improved culture	0.449	2.23			
Longevity	0.442	2.262			
Institutionalized change	0.638	1.568	0.00	0.10	2.21
Overall sustainability	0.234	4.274			

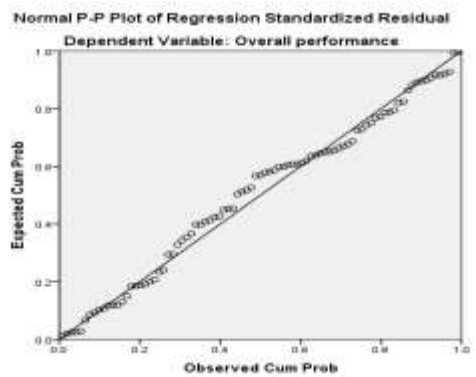
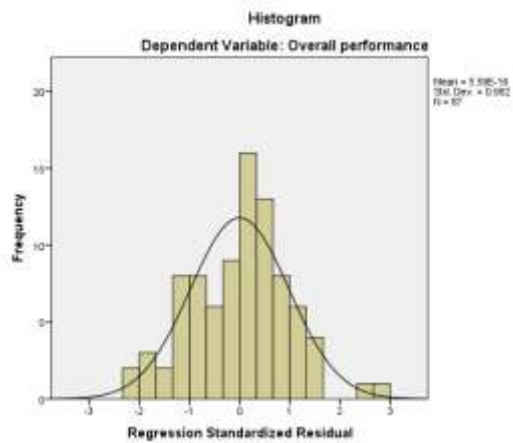
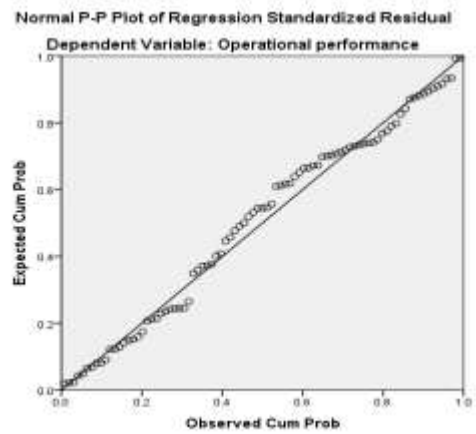
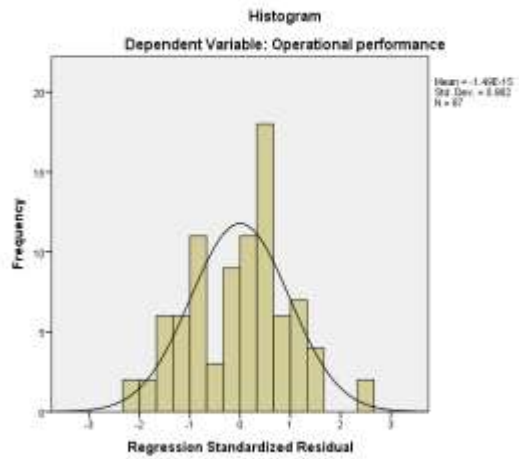
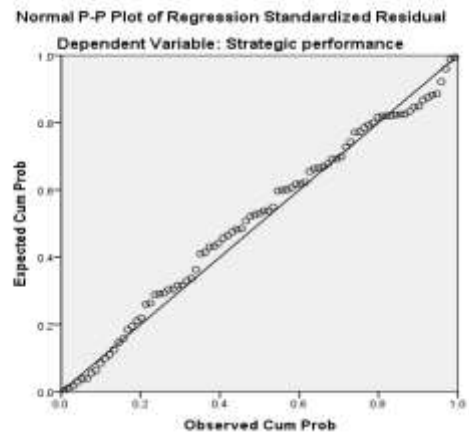
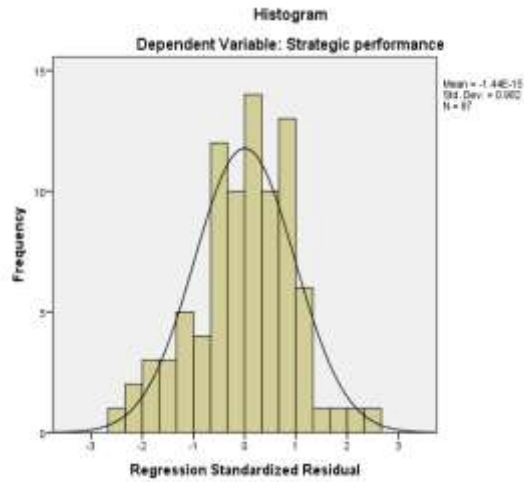


Figure 4. 3: Histogram and P-P plot for Hypothesis H3

IV.1.14.2 Regression analysis for H3

Table 4.21 demonstrates the regression analysis of the association between the different dependent (performance) and independent variables (*Kaizen* sustainability activities). The value of the coefficient of correlation R-value of 0.693 indicates a positive association between strategic performance (P_1) and *Kaizen* sustainability activities. The value of R-square of 0.481 shows that the level of variation in strategic performance contributed by the *Kaizen* sustainability activities is 48.1% which is significant ($F= 25.63$; $Sig =0.000$). This confirms that *Kaizen* sustainability activities significantly affects strategic performance. The statistical coefficients on strategic performance showed that the value of standardized coefficient (Beta) for sustainable improved culture was 0.508 ($t =4.30$; $Sig = 0.000$), that shows that the impact of this item is significant. However, the value of standardized Beta for sustainable longevity is equal to 0.149 ($t =1.26$; $Sig = 0.212$) and for sustainable institutional change was 0.109 ($t = 1.10$; $Sig = 0.276$), indicating that the effect of these dimensions was insignificant on strategic performance. The linear regression model equation is presented as follows; $P_1 = \beta_0 + \beta_1S_1 + \beta_2S_2 + \beta_3S_3$. Where P_1 = strategic performance, S_1 = sustainable improved culture; S_2 = sustainable longevity; S_3 = sustainable institutional change. Therefore, $P_1 = 0.353 + 0.611S_1 + 0.155S_2 + 0.094S_3$. For instance, when all the *Kaizen* sustainable activities are zeroes, the strategic performance is 0.353 and when sustainable improved culture increases by one unit, strategic performance increases by 0.611.

The second dependent variable was operational performance denoted by P_2 and regression analysis is presented in Table 4.21. The value of the coefficient of correlation R-value of 0.797 indicates a positive association between operational performance and *Kaizen* sustainability practices. The value of R-square of 0.635 shows that the level of variation in operational performance explained by the *Kaizen* sustainability activities is 63.5% and this is significant ($F=48.13$; $Sig =0.000$). This confirms that *Kaizen* sustainability activities significantly affect operational performance. The standardized coefficient Beta of the sustainable improved culture was 0.521 ($t =5.26$; $Sig = 0.000$), for sustainable longevity was 0.203 ($t = 2.03$; $Sig = 0.045$) and for sustainable institutional change reached 0.174 ($t = 2.10$; $Sig = 0.039$), which describes that the influence of all these dimensions were significantly affecting operational performance. The linear regression model equation is

presented as follows; $P_2 = \beta_0 + \beta_1 S_1 + \beta_2 S_2 + \beta_3 S_3$. Where P_2 = operational performance, S_1 = sustainable improved culture; S_2 = sustainable longevity; S_3 = sustainable institutional change. Therefore, $P_2 = 0.505 + 0.562S_1 + 0.189S_2 + 0.136S_3$. For example, when all the *Kaizen* sustainability variables are zeroes, the operational performance is 0.505 and when sustainable improved culture increases by one unit, operational performance increases by 0.562.

The regression analysis for the overall performance (average of strategic and operational) represented by P_3 was conducted and the results are presented in Table 4.21. The value of the coefficient of correlation R-value of 0.787 indicates a positive association between overall performance and *Kaizen* sustainable practices. The value of R-square of 0.620 shows that the level of variation in overall performance contributed by the *Kaizen* sustainability activities is 62.0%. The remaining 38.0% of the variation is contributed by other factors other than *Kaizen* sustainability activities. The ANOVA test shows significant relationship between strategic performance and *Kaizen* sustainability activities ($F = 45.15$; $Sig = 0.000$). This confirms that *Kaizen* sustainability practices significantly affect the overall performance.

The statistical coefficients on overall performance showed that the value of standardized coefficient (Beta) for sustainable improved culture was 0.533 ($t = 5.28$; $Sig = 0.000$), which implies that the impact of this variable is significant. The value of standardized Beta for sustainable longevity is equal to 0.192 ($t = 1.88$; $Sig = 0.063$), which shows that the effect of this item is insignificant (but shows marginal significance). The value of Beta for sustainable institutional change was 0.158 ($t = 1.86$; $Sig = 0.066$), which shows that the influence of this variable is insignificant (but shows marginal significance) on overall performance. The linear regression model equation is presented as follows; $P_3 = \beta_0 + \beta_1 S_1 + \beta_2 S_2 + \beta_3 S_3$. Where P_3 = overall performance, S_1 = sustainable improved culture; S_2 = sustainable longevity; S_3 = sustainable institutional change. Therefore, $P_3 = 0.460 + 0.577S_1 + 0.179S_2 + 0.123S_3$. For instance, when all the *Kaizen* sustainable activities are zeroes, the overall performance is 0.460 and when sustainable improved culture increases by one-unit, overall performance increases by 0.577.

Table 4. 21 Regression Analysis for H3

Independ ent variable	Strategic performance, P ₁ (Dependent variable)											
	Model Summary and ANOVA test						Coefficients					
							Unstandardized Coefficients			Standardized Coefficients	t	Sig.
	R	R ²	Adj. R ²	Std. Error	F	Sig.	(Constant β)	B	Std. Error	Beta		
	Predictors : (Constant) , S ₁ , S ₂ , S ₃	0.693	0.481	0.462	0.68	25.63	0.000	(Constant)	0.353	0.355		1.00
S ₁								0.611	0.142	0.508	4.30	0.000
S ₂								0.155	0.124	0.149	1.26	0.212
S ₃								0.094	0.086	0.109	1.10	0.276
Operational performance, P ₂ (Dependent variable)												
Predictors : (Constant) , S ₁ , S ₂ , S ₃	0.797	0.635	0.622	0.51	48.13	0.000	(Constant)	0.505	0.267		1.89	0.062
							S ₁	0.562	0.107	0.521	5.26	0.000
							S ₂	0.189	0.093	0.203	2.03	0.045
							S ₃	0.136	0.065	0.174	2.10	0.039
Overall performance, P ₃ (Dependent variable)												
Predictors : (Constant) , S ₁ , S ₂ , S ₃	0.787	0.62	0.606	0.52	45.15	0.000	(Constant)	0.46	0.273		1.68	0.096
							S ₁	0.577	0.109	0.533	5.28	0.000
							S ₂	0.179	0.095	0.192	1.88	0.063
							S ₃	0.123	0.066	0.158	1.86	0.066

S1 = Improved culture; S2 =Longevity; S3 = Institutional change

IV.1.14.3 Multiple stepwise regression for H3

Multiple stepwise method was used to determine which items or dimensions of *Kaizen* sustainable activities had the most significant impact on the dependent variables (strategic, operational and overall performance). Three (3) factors of *Kaizen* sustainability practices including improved culture, longevity and institutional change were considered together. Upon fitting these factors against each dependent variable using multiple linear regression and specifying 'stepwise' method, one factor (improved culture) was positively independently affecting strategic performance. However, all the *Kaizen* sustainability practices (improved culture, longevity and institutional change) were positively independently affecting operational performance. *Kaizen* sustainable improved culture and longevity were significantly and independently affecting the overall performance as indicated in Table 4.22.

Improved culture alone came out strongly and independently significant with strategic performance and explained 45.7% ($R^2=0.457$) of variation in the strategic performance. Regarding the sensitivity of beta (β), the results show that improved culture had a strong relationship with strategic performance in that for one unit increase of sustainable improved culture, strategic performance improves by 81.3%, ($\beta = 0.813$, Sig=0.000). Moreover, the standardized coefficient (Beta) for sustainable improved culture was 0.676, which is statistically significant at probability value less than 0.05. The linear regression model equation is presented as follows; $P_1 = \beta_0 + \beta_1 S_1$. Where P_1 = strategic performance, S_1 = sustainable improved culture. Therefore, $P_1 = 0.509 + 0.8136S_1$.

Improved culture came out strongly significant in first place and explained 58.3% ($R^2=0.583$) of the changes in the operational performance. Institutional change is added in the second model which led to 61.7% ($R^2=0.617$) variation in the operational performance and longevity is added in the third model which led to 63.5% ($R^2=0.635$) variation in the operational performance. Regarding the sensitivity of beta (β), the results show that improved culture had a strong relationship with operational performance in that for one unit increase of improved culture, operational performance improves by 82.4%, ($\beta = 0.824$, Sig = 0.000). In addition, the standardized coefficient (Beta) for improved culture, longevity and institutional change are 0.521, 0.174 and 0.203 respectively, which are statistically significant at probability value less than 0.05.

The linear regression model equation is presented as follows; $P_2 = \beta_0 + \beta_1 S_1 + \beta_2 S_2 + \beta_3 S_3$. Where P_2 = operational performance, S_1 = sustainable improved culture; S_2 = sustainable longevity; S_3 = sustainable institutional change. Therefore, $P_2 = 0.505 + 0.562S_1 + 0.136S_2 + 0.189S_3$.

Likewise, sustainable improved culture came out strongly significant in first place and explained 57.5% ($R^2=0.575$) of the changes in the overall performance and longevity is added in the second model which led to 60.4% ($R^2=0.604$) variation in the overall performance. Regarding the sensitivity of beta (β), the results show that sustainable improved culture had a strong relationship with overall performance in that for one unit increase of improved culture, overall performance improves by 82.1%, ($\beta = 0.821$, Sig =0.000). Furthermore, the standardized coefficient (Beta) for sustainable improved culture and longevity are 0.582 and 0.245 respectively, which are statistically significant at probability value less than 0.05. The linear regression model equation is presented as follows; $P_3 = \beta_0 + \beta_1 S_1 + \beta_2 S_2$. Where P_3 = overall performance, S_1 = sustainable improved culture; S_2 = sustainable longevity. Therefore, $P_3 = 0.516 + 0.630S_1 + 0.229S_2$.

Table 4. 22 Multiple Stepwise Regression for H3

	Strategic performance, P1 (Dependent variable)													
Model	Independent variable	Coefficients								Model summary and ANOVA test				
		Unstand ardized Coeffie nts	Standa rdized Coeffie nts	t	Sig.	Correlation s		Collinearity Statistics						
		B	Beta			Partial	Part	Tolera nce	VIF	R	R2	Adj. R2	F	Sig.
1	(Constant)	0.509		1.46	0.149									
	Improved culture	0.813	0.676	8.45	0.000	0.67	0.67	1.00	1.00	0.676	0.457	0.450	71.45	0.000
Operational performance, P2 (Dependent variable)														
1	(Constant)	0.709		2.58	0.012									
	Improved culture	0.824	0.763	10.89	0.000	0.76	0.76	1.00	1.00	0.763	0.583	0.578	118.66	0.000
2	(Constant)	0.59		2.20	0.031									
	Improved culture	0.692	0.64	7.90	0.000	0.65	0.53	0.69	1.44					
	Institutionalized change	0.173	0.222	2.74	0.008	0.28	0.18	0.69	1.44	0.785	0.617	0.608	67.60	0.000
3	(Constant)	0.505		1.89	0.062									
	Improved culture	0.562	0.521	5.26	0.000	0.50	0.34	0.45	2.23					
	Institutionalized change	0.136	0.174	2.10	0.039	0.22	0.13	0.64	1.57	0.797	0.635	0.622	48.13	0.000
	Longevity	0.189	0.203	2.03	0.045	0.21	0.13	0.44	2.26					
Overall performance, P3 (Dependent variable)														
1	(Constant)	0.649		2.34	0.022									
	Improved culture	0.821	0.758	10.73	0.000	0.758	0.75	1.00	1.00	0.758	0.575	0.57	115.13	0.000
2	(Constant)	0.516		1.87	0.064									
	Improved culture	0.630	0.582	5.88	0.000	0.54	0.40	0.48	2.08	0.777	0.604	0.595	64.11	0.000

IV.1.15 Overall regression analysis (average *Kaizen* implementation, sustainability and performance)

Regression analysis for the overall *Kaizen* implementation, overall *Kaizen* sustainability and overall performance was conducted, and the results are presented below;

IV.1.15.1 Correlation matrix, multi-collinearity tests and outliers test

The correlation analysis was conducted using Pearson correlation coefficient and p value to assess the degree of association between the overall *Kaizen* implementation, overall *Kaizen* sustainability and overall performance. Furthermore, the generated correlation matrix helped to determine whether multi-collinearity existed between the variables under investigation as shown in Table 4.23.

There was positive significant linear relationship between overall *Kaizen* implementation activities and overall performance ($r = 0.654$; Sig < 0.001). Similarly, there was a positive significant linear relationship between overall *Kaizen* sustainable activities and overall performance ($r = 0.786$; Sig < 0.001). To validate the regression analysis, collinearity test was examined. There was no multi-collinearity correlation (above 0.90) among the independent variables.

Table 4.23 Correlation Matrix and Collinearity Between implementation and Sustainability

	Overall implementation	Overall sustainability	Overall performance
Overall implementation	1		
Overall sustainability	.786**	1	
Overall performance	.654**	.786**	1

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

Moreover, the tolerance and the Variance Inflation factors (VIFs) were tested to determine multicollinearity problems. According to the results of the study, no collinearity issues were found among the overall sustainability, overall implementation and overall performance as tolerance was above 0.1 and VIFs were below 10 (Table 4.24). Cook's distance was also used to determine

whether there was any outlier and the results in Table 4.24 shows no outlier as all the Cook's distance are less than one. Durbin Watson was also used to check for autocorrelation and as shown in Table 4.24, there is no autocorrelation; the residuals are uncorrelated as the Durbin Watson is close to 2. Additionally, to validate the regression analysis, histogram and P-P plot presented in Figure 4.4 below show reasonable normality of data.

Table 4. 24 Collinearity Statistics and Outliers Tests

Independent variables	Dependent variable (overall performance)				
	Collinearity Statistics		Cook's Distance		Durbin-Watson
	Tolerance	VIF	Minimum	Maximum	
Overall implementation	0.426	2.349	0.00	0.98	2.28
Overall sustainability	0.463	2.16			

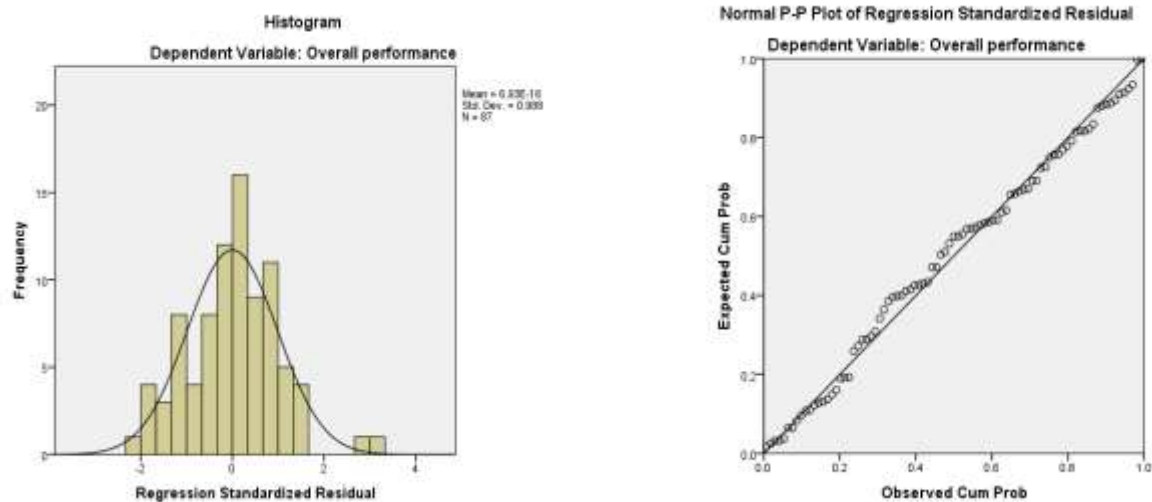


Figure 4. 4: Histogram and P-P plot for Hypothesis for the overall Kaizen implementation, sustainability and overall performance

IV.1. 15.2 Regression analysis for the overall *Kaizen* implementation, sustainability and overall performance

Table 4.25 presents the regression analysis of the relationship between the overall *Kaizen* implementation, overall *Kaizen* sustainability and overall performance. The value of the coefficient of correlation R-value of 0.789 indicates a positive association between overall *Kaizen* implementation, overall *Kaizen* sustainability and overall performance. The value of R-square of 0.622 shows that the level of variation in overall performance contributed by the *Kaizen* implementation and *Kaizen* sustainable is 62.2%. The ANOVA test shows significant relationship between the variables (F= 69.06; Sig =0.000). The standardized coefficient Beta of the overall *Kaizen* sustainability on overall performance was 0.713 (t =6.58; Sig = 0.000), which shows that the influence of this item is significant. The value of Beta for overall *Kaizen* implementation is equal to 0.093 (t = 0.86; Sig = 0.391), indication that the impact of this variable is insignificant. The linear regression model equation is presented as follows; $P = \beta_0 + \beta_1 I + \beta_2 S$; Where P = overall performance, I = overall implementation; S =overall sustainable. Therefore, $P = 0.332 + 0.124I + 0.796S$. For instance, when all the *Kaizen* implementation and sustainability variables are zeroes, the overall performance is 0.332 and when *Kaizen* sustainability variables increase by one-unit, overall performance increases by 0.796.

Table 4. 25 Regression Analysis for the Overall Kaizen Implementation, Sustainability and Overall Performance

Independe nt variable	Overall performance, (Dependent variable)											
	Model Summary and ANOVA test						Coefficients					
	R	R2	Adj. R2	Std. Err or	F	Sig.	Unstandardized Coefficients			Standar dized Coefficie nts	t	Sig.
							(Constant β)	B	Std. Error	Beta		
Predictors: (Constant), Overall sustainabili ty, Overall implementa tion	0.789	0.622	0.613	0.52	69.06	0.000	(Constant)	0.332	0.31		1.08	0.285
							Overall implementation	0.124	0.14	0.093	0.86	0.391
							Overall sustainability	0.796	0.12	0.713	6.58	0.000

IV.1.15.3 Multiple stepwise regression for the overall *Kaizen* implementation, sustainability and performance

Multiple stepwise method was used to determine the most significant impact of the *Kaizen* implementation or *Kaizen* sustainability activities on the overall performance. Both overall *Kaizen* implementation and overall *Kaizen* sustainability activities were considered together. Upon fitting these two factors against the overall performance using multiple linear regression and specifying 'stepwise' method, *Kaizen* sustainability activities were positively and independently affecting overall performance as indicated in Table 4.26.

Overall *Kaizen* sustainability activities alone came out strongly and independently significant in the first place and explained 61.8% ($R^2=0.618$) of variation in the overall performance. Regarding the sensitivity of beta (β), the results show that overall *Kaizen* sustainability activities had a strong relationship with overall performance in that for one unit increase of overall *Kaizen* sustainability activities, overall performance improves by 87.8%, ($\beta = 0.878$, Sig = 0.000). Moreover, the standardized coefficient (Beta) for overall *Kaizen* sustainability activities was 0.786, which is

statistically significant at probability value less than 0.001. The linear regression model equation is presented as follows; $P = \beta_0 + \beta_1 S$. Where P = overall performance, S = *Kaizen* sustainable. Therefore, $P = 0.459 + 0.878S$.

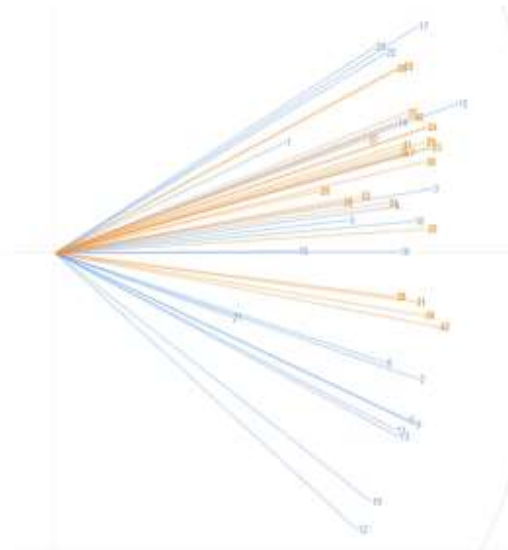
Table 4. 26 Multiple Stepwise Regression for the Overall Kaizen Implementation, Sustainability and Performance

	Overall performance, (Dependent variable)													
Model	Independent variable	Coefficients								Model summary and ANOVA test				
		Unstand ardzied Coeffici ents	Standar dized Coeffici ents	t	Sig.	Correlations		Collinearity Statistics						
						B	Beta	Part ial	Part	Toler ance	VIF	R	R2	Adj. R2
		1	(Constant)	0.459		1.70	0.093							
	Overall sustainability	0.878	0.786	11.74	0.000	0.79	0.79	1.00	1.00	0.786	0.618	0.614	137.80	0.000

IV.2 Individual Factor Analysis using Partial Least Square PLS- Path Modelling method. See Appendix Viii for questions in the questionnaire

The big picture:

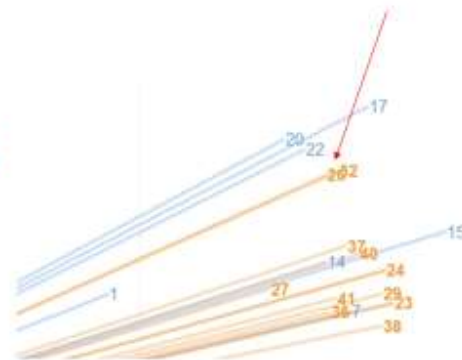
- Each line represents the answer to a question in the questionnaire
- Blue lines are predictors – what was done in the programme
- Orange lines are results – what was expected from the programme and how successful was the company in reaching this goal
- The numbers of the lines refer to the number of the question in the questionnaire



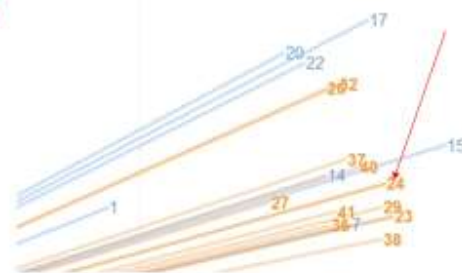
How to read the graph :

- The closer the lines are the higher the correlation between them.
- The greater the angle between lines the smaller the correlation.
- Lines that point in roughly the same direction are still correlated!
- Shorter lines signify a weaker correlation

- We see roughly two groups of expectations on the top of the graph
- Group 1 consisting of questions 26,32
- „Shop floor employees are fully committed to Kaizen“
- „Employees accept changes made as a result of Kaizen events.“
- These are correlated the strongest with the implementation steps number 20,22,17,1:
- „Kaizen was also applied in non-manufacturing areas such as human resources, finance and procurement.“
- "Key Performance Indicators(KPIs)were used to measure performance.“
- "Your company developed and relied on internal expertise.“
- „5S“



- We see roughly two groups of expectations on the top of the graph
- Group 2 consisting of the majority of expectations: 23,24,27,29,36, 37, 38, 40
- "Kaizen has become part of our organizational identity"
- "Team problem solving culture has been established"
- "Team problem solving duplicate of 24"
- "Working culture has been improved in your organization"
- "Reduction in lead time (from order to delivery)"
- "Improved manufacturing flexibility"
- "Improved product quality"
- "Improved productivity"



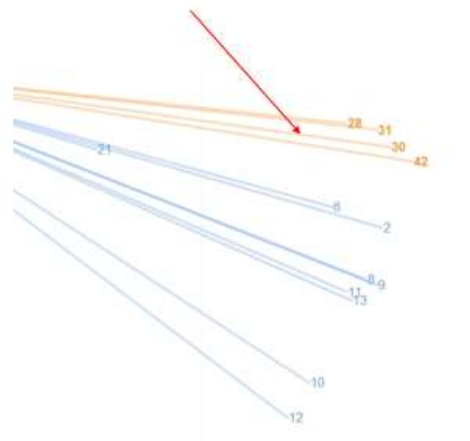
These are strongly correlated with 1,14,15

"55"

"Top management supported the organization's Kaizen initiative and activities"
 "There was clear and consistent communication on Kaizen stories and results/improvements achieved"

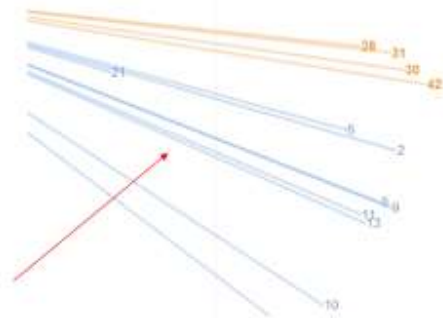
- There is a group of expectations that is not strongly related to any of the implementations 28,30,31,42

"Organizational structure and policies have enabled your organization to sustain Kaizen improvement outcome"
 "Kaizen has influenced our thinking to plan for long term rather than optimizing short-term performance"
 "Management accepts changes made as a result of Kaizen events"
 "Enhanced competitiveness"



- These refer to high level management goals behaviours and structures which are unlikely to be affected by Lean Kaizen predictors unless directly targeted.

- The group of implementation details below are not strongly related to any of the expectations. However as they are pointing in the same direction they are all positively correlated with all the expectations – just not as strongly as the other elements. We have the group :
2,6,8,9,10,11,12,13,21



"Visual Management"

"Quality Control Circles (QCC)"

"Process monitoring using statistical process control"

"Root cause analysis"

"Mistake proofing"

"TPM (Total Productive Maintenance)"

"Layout Improvement"

"Senior leaders and managers going to the production floor,"

"Your company didn't just apply Kaizen 'Tools,' but also promoted Kaizen 'Thinking'"

IV.3 The Group Factors Analysis

The PLS –Path Modelling analysis shows the input category (Implementation and Sustainability factors combined) on each output category (Impact Factors). See **Appendix Xiv** for Factor Analysis list

Eliminating the non-significant variables from the model, as we would do in “normal” regression the final model is shown with the graph below showing the influence of each input category on each output category.

IV.3.1 The PLS –Path Modelling

\$improvement culture

	Estimate	Std. Error	t value	Pr(> t)
Intercept	-3.834489e-17	0.04846853	-7.911297e-16	1.000000e+00
lead_comm	1.722851e-01	0.08531230	2.019464e+00	4.666593e-02
empow	2.463496e-01	0.08989163	2.740517e+00	7.509083e-03
comm	2.262421e-01	0.08045104	2.812171e+00	6.139590e-03
tools	3.501793e-01	0.08351089	4.193218e+00	6.843408e-05

\$institutional_change

	Estimate	Std. Error	t value	Pr(> t)
Intercept	6.910378e-17	0.07546262	9.157352e-16	1.000000e+00
lead_comm	7.143275e-01	0.07546262	9.465978e+00	5.537191e-15

\$longevity

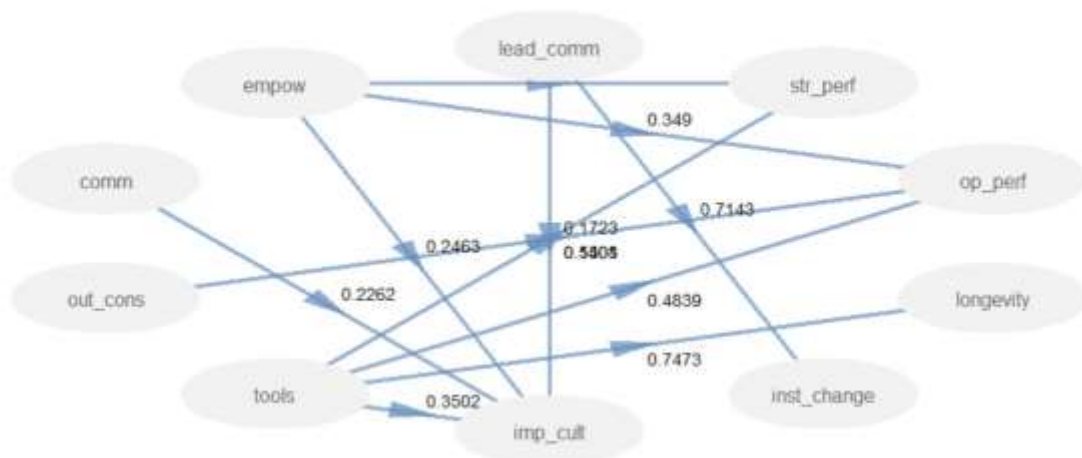
	Estimate	Std. Error	t value	Pr(> t)
Intercept	-1.780315e-16	0.07165603	-2.484528e-15	1.000000e+00
tools	7.472787e-01	0.07165603	1.042869e+01	6.184386e-17

\$operational perf.

	Estimate	Std. Error	t value	Pr(> t)
Intercept	-7.819281e-17	0.05784612	-1.351738e-15	1.000000e+00
empow	3.490197e-01	0.08895537	3.923537e+00	1.777762e-04
out_cons	1.401176e-01	0.06336586	2.211247e+00	2.973545e-02
tools	4.839164e-01	0.09226593	5.244800e+00	1.150933e-06

\$strategic_perf

	Estimate	Std. Error	t value	Pr(> t)
Intercept	1.086385e-16	0.06625382	1.639733e-15	1.000000e+00
empow	2.877498e-01	0.10186610	2.824784e+00	5.894154e-03
tools	5.507526e-01	0.10186610	5.406633e+00	5.791714e-07



Model: PLS path model shows the effects of the Input factors on Output Group Factors

Description on the model:

Both the input and the output variables are synthetic constructs from the results of the questionnaire, as per the PLS_SEM algorithm.

A path coefficient has a similar meaning as a standardized beta coefficient of an ordinary least squares regressions (Dijkstra & Henseler, 2015) cited (Hair et al., 2011). According to (Chin, 1998) a path coefficient may be considered meaningful if a critical value of 0.2 is exceeded. Therefore, a higher path coefficient means that the variable has a higher influence. Therefore, the higher the path coefficient the greater effect the variable has. As we can see the path coefficients have different values which indicate that some factors have a greater impact than others.

The connection between strength path coefficient represents of the dependent variable in an explanatory variable when other variables in the model are held constant (Hahbobi, 2015). The path coefficient of a structural equation model is similar to the correlation of regression coefficients and are interpreted as follows (McIntosh & Gonzalez-Lima, 1994);

- A positive coefficient means that a unit increase in the activity measure of one structure leads to a direct increase the activity measures of structures it projects to, proportional to the size of the coefficient.
- A negative coefficient means that an increase in the activity measure in one structure leads to a direct, proportional decrease in the activity measure of structure it projects

From the PLS_SEM algorithm model, we can clearly see that the output factors are influenced/affected by the input factors with different path coefficients as follows;

- Improved culture is influenced by the following input factors; ‘leadership commitment’, ‘empowerment’, ‘tools applied’ with path coefficient values of 0.1723, 0.2463 and 0.3502 respectively. We conclude that of the application of ‘tools’ had the greatest impact on culture.
- ‘Institutional change’ is significantly influenced by the input factor ‘leadership commitment’ with path coefficient value of 0.7143 which means a high influence.

- ‘Longevity’ is significantly influenced by the input factor ‘tools applied’ with path coefficient value of 0.7473.
- ‘Operational performance’ is significantly affected by three input factors; ‘empowerment’, ‘outside consultants’, and ‘tools used’ with path coefficient values of 0.3490, 0.14401, and 0.4839 respectively, tools having the highest influence.
- ‘Strategic performance’ is affected by two input factors; ‘empowerment’ and ‘tools used’ with path coefficient values 0.2877 and 0.5508 respectively.

The model also shows that the tools used in the Kaizen implementation influences more output factors than any other input group factors. It affects operational performance and strategic performance (performance factors) and longevity and improved culture (sustainability factors). While empowerment influences three output factors namely operational performance and strategic performance (performance factors) and improved culture, which is sustainability factor. The leadership commitment (input group factor) affects two output factors; improved culture and institutional change both sustainability factors.

The other two input factors; ‘communication’ and ‘outside consultants’ impact ‘improved culture’ and ‘operational performance’ respectively. The degree of the impact of input factors on output factors can be noted from the path coefficient values. The higher the path coefficient value the higher is the degree of the influence. From the values we can see that the most impactful relationships (path coefficient = 0.7143 ‘Leadership Commitment’ on ‘Institutional Change’ and ‘Tools Applied on ‘Longevity ‘with path coefficient of 0.7473).

The tools applied (how we apply and which tools are used) has large effect on several output variables. This is an important finding that rhythms Aristotle’s saying “*You are what you do repeatedly, so your excellence is not an act, it’s a habit*”. In Kaizen practices when the way we do things becomes a habit it becomes a culture. If the habit is continuous improvement, then it becomes excellence in all we do.

IV.4 Data Analysis by company using Excel

The average ratings of Implementation, or Sustainability and Impact, were taken and graphed them as scatter plots, and then determined the R^2 coefficient of correlation. The three hypotheses were proven so clearly.

Higher scores in Implementation lead to higher scores in Sustainability, and higher scores in Sustainability lead to higher scores in Impact. While higher scores in Implementation do also lead to higher scores in Impact, the correlation is not as strong between Implementation and Impact as they are between Implementation and Sustainability, and between Sustainability and Impact. This is a very interesting finding and it demonstrates the essential role of sustainability in achieving impact through Kaizen.

The correlations are even stronger when one does this analysis at the company level, rather than an individual respondent level. The only problem is that there are two outlier companies that distort the data and cause R^2 to be low because they rated their implementation too high. But, if the outliers are thrown out the R^2 numbers are quite high.

The R^2 Values calculated (for individual data and company aggregated data) for the Implementation Vs Sustainability, the Impact Vs Sustainability and Implementation Vs Impact are given below. The greater the R^2 the more is the correlation. From the R^2 values, we can see that the correlation between sustainability and impact is the strongest. From statistical meaning R-squared is a statistical measure of how close the data are to the fitted regression line. It is also known as the coefficient of determination, or the coefficient of multiple determination for multiple regression. ... 100% indicates that the model explains all the variability of the response data around its mean. The R^2 values for the implementation vs impact is lowest of the values among other factors. Whereas the R^2 for sustainability vs impact is the highest (0.806, which is closer to 100%). This confirm that variability of the response data is around the mean.

R² for individual data

Impl-Sust	0.697
Sust-Impact	0.666
Impl-Impact	0.581

R² for company-aggregated data (with two outliers)

Impl-Sust	0.798
Sust-Impact	0.526
Impl-Impact	0.455

R² for company-aggregated data (without two outliers)

Impl-Sust	0.801
Sust-Impact	0.806
Impl-Impact	0.659

R² Values for individual companies and company aggregated data.

The correlation among factors can be seen in the charts below. The higher the correlation the closer the data are to the fitted regression line. See the charts below plotted for Implementation Vs Sustainability, Sustainability Vs Impact and Implementation Vs Impact. The correlation is significantly high as seen in the charts that implies that the hypotheses made in the research are proven true.

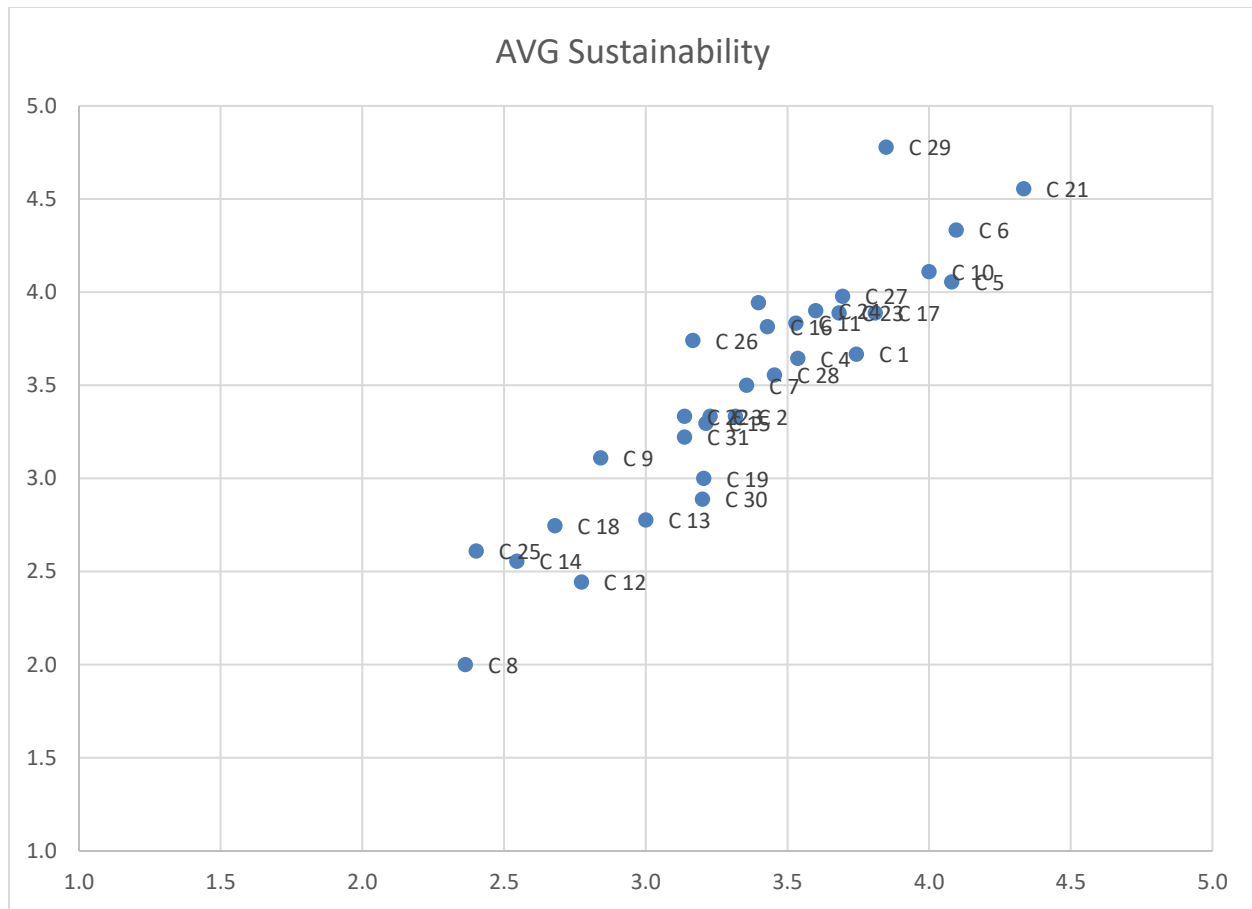


Figure 4. 5 Implementation Vs Sustainability by company

The variability of the response data (0.801 is closer to 1) is around the mean which proves Hypothesis I.

The horizontal axis is average implementation for each company and the vertical axis is average sustainability for each company.

The chart above shows the correlation between the average implementation and the average sustainability for each company participated in the survey. As can be seen from the chart the correlation is strong between implementation and sustainability with R^2 of 0.798 with the two outliers and 0.801 without the outliers. The high correlation implies that overall implementation variables have significant impact on the overall impact (performance) variables.

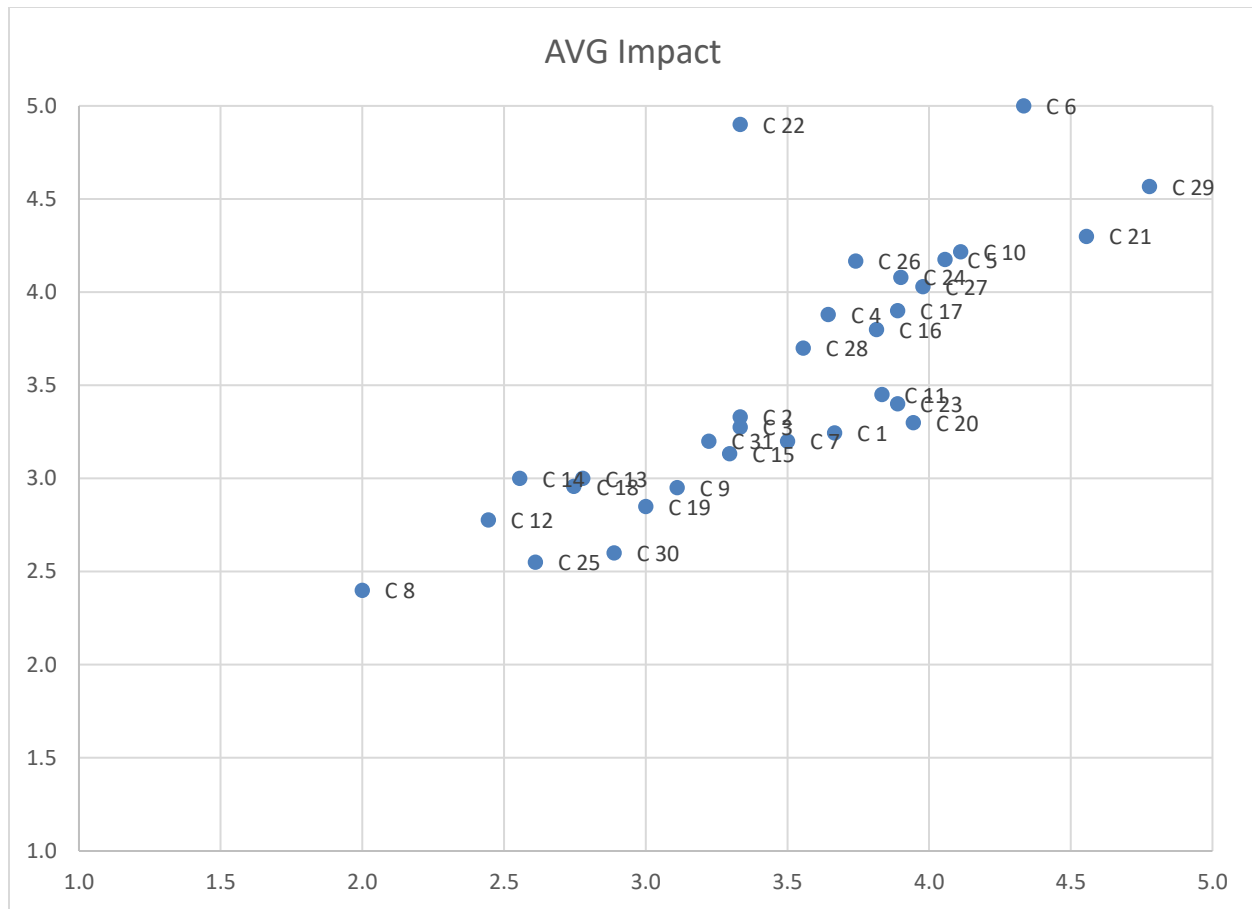


Figure 4. 6 Sustainability Vs Impact by company

The variability of the response data (0.806 is closer to 1) is around the mean which proves Hypothesis III.

The horizontal axis is average sustainability for each company and the vertical axis is average impact for each company.

The chart above shows the correlation between the average sustainability and the average impact for each company participated in the survey. As can be seen from the chart the correlation is strong between sustainability and impact with R^2 of 0.526 with the two outliers and 0.806 without the outliers. The high correlation implies that overall sustainability variables have significant impact on the overall impact (performance) variables. From the R^2 values we can see that the sustainability vs the impact correlation is the strongest. This implies that the higher the sustainability, the higher

is the impact that means for companies to have Kaizen with more impact on their performance it is critically important that sustainability is ensured. The sustainability factors need more attention as they are critical success factors for Kaizen implementation.

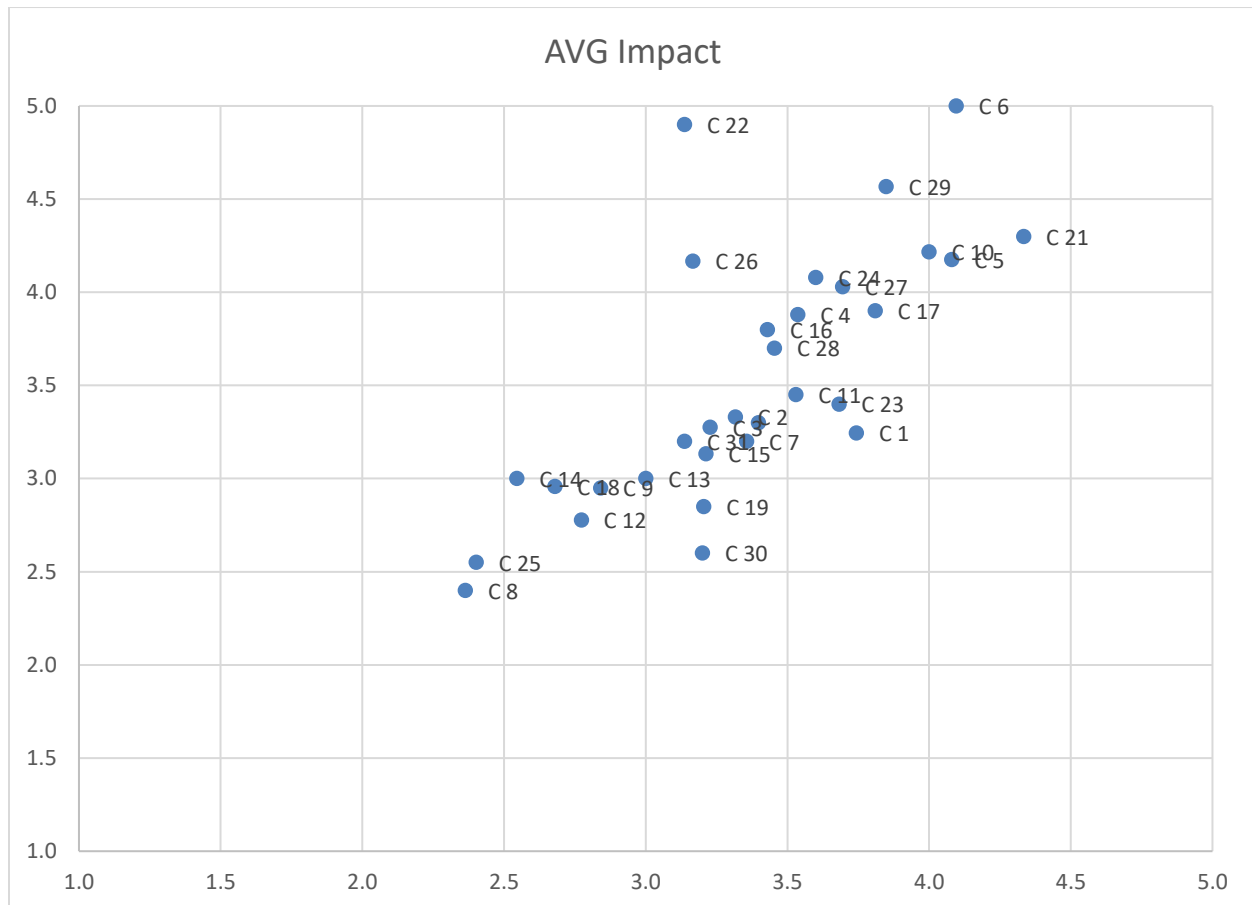


Figure 4. 7 Implementation Vs Impact by company

The variability of the response data (0.0.659) is slightly closer to 1) is around the mean which proves Hypothesis II.

The horizontal axis is average implementation for each company and the vertical axis is average impact for each company.

The chart above shows the correlation between the average implementation and the average impact for each company participated in the survey. As can be seen from the chart the correlation is strong between implementation and impact with R^2 of 0.455 with the two outliers and 0.659 without the outliers. The relatively high correlation implies that overall implementation variables have direct impact on the overall impact (performance) variables.

Five manufacturing subsectors were included in the survey and the results for the average group factors is given below on the chart.

Average Group by Sector

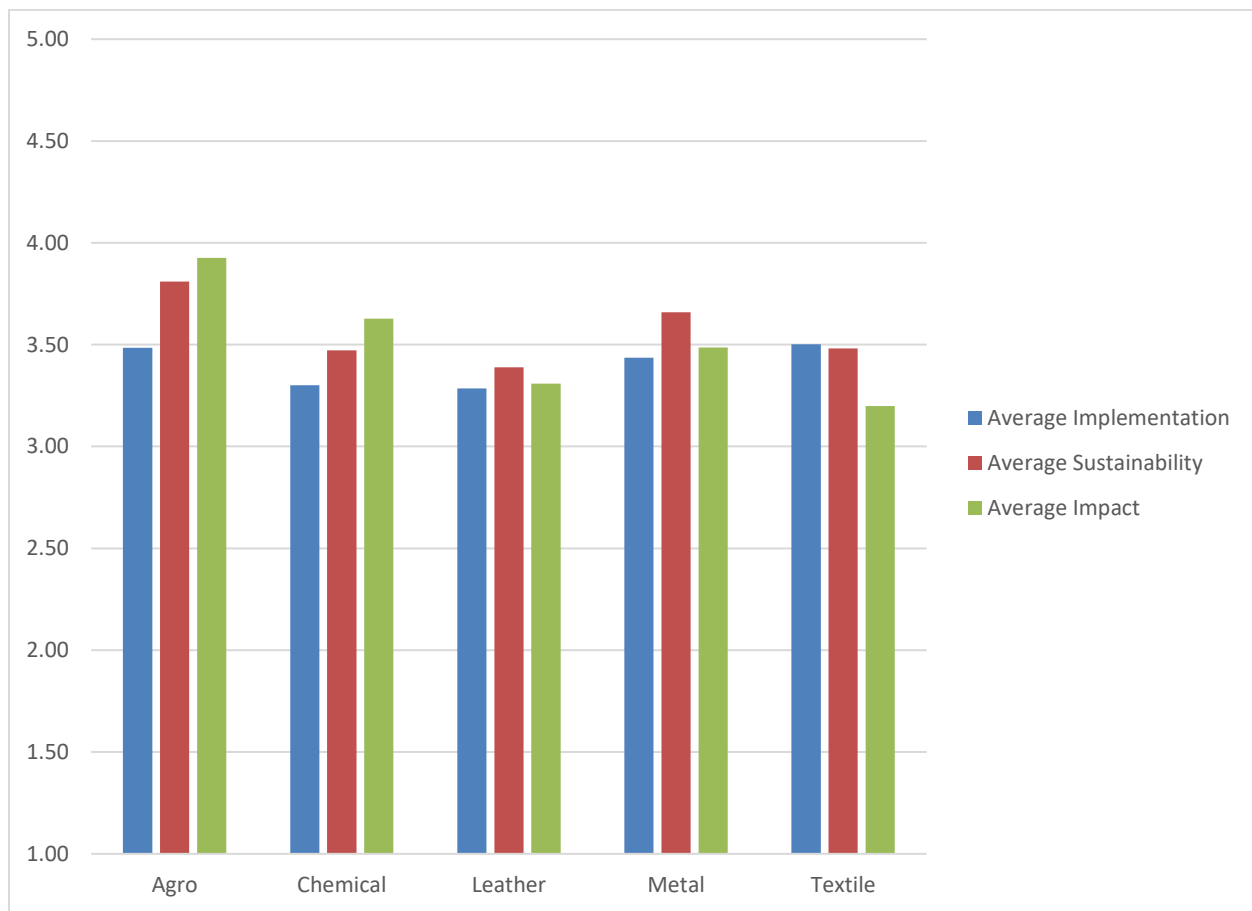


Figure 4. 8 Average group factors result for each subsector

From the chart, we can see that the level of scores for each group is almost close to be uniform for each subsector. The Agro subsector shows highest scores for average impact and average

sustainability. The scores for average sustainability are approximately same for all subsectors with scores ≥ 3.5 , which is between moderate and much extent of the how respondents described the Kaizen sustainability.

The scores for average impact are ≤ 3.5 for most subsectors except Agro which has higher scores for impact. Most of the respondents perceive the implementation level is moderate.

The scores are different for each group factors as the questions were different. As can be observed in the chart, the impact scores are higher or closer to the implementation and sustainability scores. Although no comparisons can be made among the results, it may indicate that people are more positive about the impact than they are about the implementation or the sustainability. However, the difference is not statistically significant. And, in three of five subsectors, the impact scores are lower than sustainability. This is all about how people see the specific questions they were asked on the factors. Generally, the correlation is the most important thing in the analysis among the factors.

Average of Tools applied (implementation Factors) analyzed by subsectors

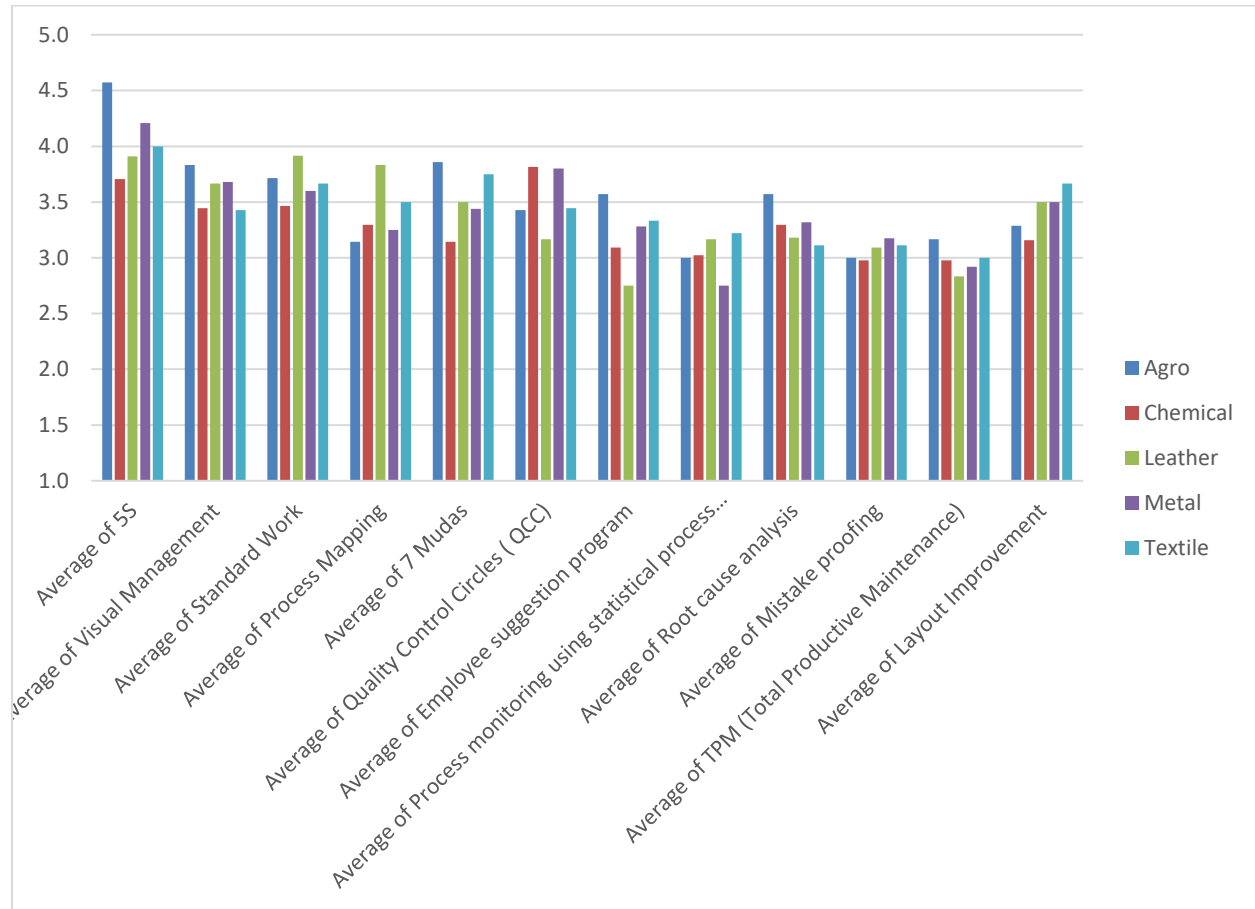


Figure 4. 9 Average of Tools applied (Implementation factors) by subsectors

From the chart on the average of implementation factors, the overall result shows consistency among subsectors. 5s, Muda, layout improvement, standard work and QCC are scored relatively high, while a few tools such as employee suggestions, processing monitoring, and TPM are scored relatively low.

Average of impact factors by Subsectors

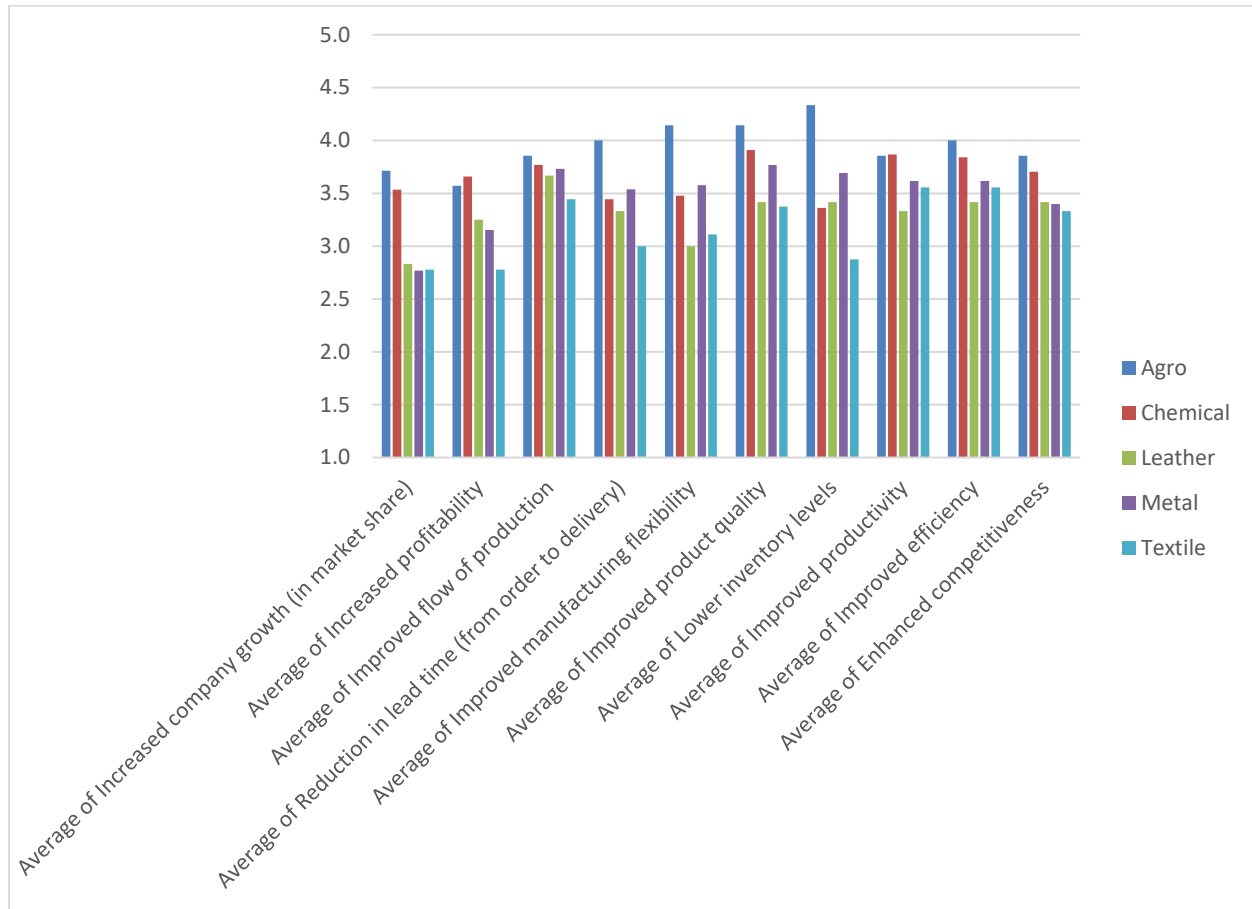


Figure 4. 10 Average of Impact factors by subsectors

Fig 4.10. shows that Agro and Chemical show higher scores for the Impact measures (both operational and strategic variables).

For strategic variables (Growth, Profitability and competitiveness), Textile, Metal and Leather sectors exhibit lower scores. Especially on company growth, the scores for these three subsectors are lowest compared to other strategic variables.

The textile subsector does not show consistency on the impact variables. On both operational and strategic variables, the score for the Textile subsector is lowest compared to others. Of course, for a few variables, it is on par with other subsectors. The lower score for the textile subsector

and others as well may be attributed to factors other than Kaizen initiatives like market challenges related inputs and export related challenges.

Part II: VISITS TO SAMPLED FACTORIES

Validation of the findings through field visit paid to sampled factories incorporated actual observation and primary data collected through focus group discussions and review of daily, weekly and monthly/quarterly reports.

This chapter presents a summary of the visits paid to five Factories sampled out of the Kaizen implementing companies included in the survey from February 10th -13th 2020. The main purpose of the visits was to validate the companies' survey responses. However, one of the companies visited was not among those which responded to the survey questionnaire but also served a useful learning purpose. During the visit, records, database on metrics, reports were verified and also charts and posters and changes around work area were observed. Discussions were conducted with the factory workers in the shop floor and the Kaizen team members.

The following were questions for assessment of Kaizen implementation during the visit and interviews conducted with the key Kaizen staff. How sustainable is Kaizen in the company? What has promoted or hindered sustainability? Any examples (evidence?) What metrics do they have on their Kaizen initiative? Numbers of people trained, Numbers of Kaizen events, Numbers of process maps, operational improvements by process, cost reduced, quality improved, productivity, are actual documented improvements (stories) available for review?

One company was visited for each of the subsector; textile, agro-processing, metal, leather, and chemical. (5 of 31 companies – 16%) and we met the General Director of the Ethiopia Kaizen Institute and his team and the Kaizen consultants. At the end of the field visit “Annual Best Practice – Experience” Workshop was organized by the Ethiopian Kaizen Institute where stakeholders, government officials and kaizen implementing companies (service and manufacturing, public and private) were present.

Each company visited had a unique context that made their application of Kaizen unique as well; they applied different tools, and they had different levels and types of impact. For confidentiality purposes, the names of the companies are coded as C0, C1, C5, C23 and C26. In the database for the survey responses, 31 companies were listed and C1 refers to company one, and C5 refers to

the fifth company and same for companies 23 and 26. There was only one company visited which was not included in the database of respondents and is coded as C0.

The visits observed significant improvements summarized as following:

Significant work area improvement, especially the first 3 S – Sort, Set in order and Shine. It was commonly observed for the companies visited that there are signs for work areas, items are labelled, shadow boards and floor marking. In addition, it was observed that there are clean and organized work areas, inventory and tools and there are standard procedures for processes.

Improvement in the 8 types of waste especially motion, transportation, elimination of old inventory and tools. For each company the following improvements were evident:

- **C0:** documentation of quality and work area improvement; standards; labelling of batches; 5S of spare parts room
- **C1:** 5S, waste elimination; visual indicator of batches
- **C26:** strong root cause analysis in company to renew old machines rather than replacing them
- **C23:** documented 90 employee ideas that were adopted; strong marking and labelling
- **C5:** strong floor marking, time studies and work balance, daily reporting, posted record of daily production targets and actual quantities (in some locations), documentation and posting of improvements and impact in each location.

It was commonly observed among the 5 companies that the following aspects tended to be missing; SPC charts or any trend data of performance, companies indicated that they were either on computers or in folders; KPIs of process performance on quality and productivity and lastly the flow of work in process through the factory.

The commonly observed Kaizen success factors included; Kaizen promotion in slogans, posters and statement of 5S and 8 wastes; Recognition of high-performing employees and teams; the practice of 5S and Muda elimination, high involvement of Senior management and their visiting of the shop floor, Standardization of work, training and QCC (KPT), identification of problems by Factory workers; use of 5S or 8 types of waste template/analysis. In companies where Kaizen

Officers are enthusiastic about it, the latter is well understood and taught. These Officers were ambitious to make more changes seeking to promote Kaizen sustainability.

Among Key challenges mentioned during the visits were, Employee turnover – needing to continuously train new employees, Low level of factory workers' education (including low level of language fluency for some) and work culture. External economic factors, including market challenges and money supply (foreign currency), uncertainty of getting raw materials and spare parts (need to store large quantities or end up stopping production)

IV.5 Visit to C0

Company C0:

No chart from the data analysis is attached to this company as the company did not respond to the questionnaire distributed. They were invited in the survey but no response was received and no statistical analysis was made.

IV.5.1 Observation during the tour

In company C0, we visited the product (N.B. for confidentiality purposes the type of product is not disclosed here) processing area. The main observations made include; they put lines and other 5S components. Separated on hold (for 24 hours) items from finished goods with a full floor-to-ceiling wall. Machine is largely automated with controls and sensors for a variety of things (temperature, humidity). The process of changing die takes five minutes and is done every after five hours. They make only one diameter of a product.

Among other aspects observed are that there are signs about handwashing, Inspirational quotes. Process flow maps (2) posted on the wall. We looked at how the mixing and extruding machine works, we discovered that the excess length after extrusion is chopped and mixed in with the fresh flour and water.

It was noticed that the sealing of the spaghetti bags has some defects (maybe ~ 5%). But the pasta is saved and repackaged. The financial cost of this is not significant, it seemed, and the factory manager was not concerned about it.

We also visited the macaroni production area. Of the three lines, only one was functioning at this time, making a product. The products are dried overnight in 50kg bags and the next day are packaged into small bags.

Some of the staff (one from the quality lab and two factory workers) were interviewed on whether processes have improved as a result of Kaizen implementation and they positively affirmed the change.

IV.5.2 Records verification

Among the records read is the book of QC meetings which contained the list of attendees, the meetings' minutes documenting problems identified and actions for expected improvements.

Company C0 has a Waste identification set of sheets, with around 10 points to look at on each type of waste. Many of these were filled in with actions to address the found waste.

It also has 5S assessment sheets, with around 5 points to look at on each, and a rating of 2, 1, or 0, depending on how well each item is. These assessment sheets are used to measure current state, estimate future state, and the future state for the improvements identified.

They also have training records for Kaizen related topics but also for elements such as hygiene and use of fire extinguishers. We also looked at and photographed a report to EKI, and that to the management. Both of the reports contained documentation of improvements and impact registered by the company.

IV.5.3 Primary challenges and reasons behind

Employee turnover was the first challenge identified; except for production managers and supervisors, companies have to train staff again and again. Especially in September which is the month that school starts and in November to December as they leave for harvesting. Turnover of employees is a big challenge.

The second Challenge mentioned was raw materials caused by shortage of foreign currency in Ethiopia. In this company the cartons used are produced locally, film is imported from abroad and the flour is local. Nearly all 20 raw materials used for the production of biscuits, sugar included

are bought abroad, mostly China and Middle East. The company uses machines made by Paven, from Italy and the spare parts are imported from Germany (Siemens) and Italy.

The third challenge identified was employee attitude and it is highly linked to low levels of literacy; it is hard for the majority of them to accept changes on their routine way of working and some do not want to adopt Kaizen. The last challenge highlighted was that local people speak different local languages not uniform to all employees, so they have challenge to intercommunicate; this leads to difference in understanding.

IV.5.4 Primary strengths, reasons for success

The fact that the initiative for Kaizen is from the owner and not from the Kaizen Institute gave the employees high level of engagement in the Kaizen implementation process. The Production Managers who are the facilitators of Kaizen, have high commitment to Kaizen (much higher than the laborers). The owner of the company invests in continuous capacity building on Kaizen Philosophy.

Resources are vital for Kaizen, and the owner of the company avails them to further strengthen improvements, these include but not limited to per diems, the purchase of tape, painting, the cost of moving things around and performance incentives for committed staff.

According to the Kaizen officer interviewed the next objective of the company is to promote Kaizen thinking among supervisors and managers. The supervisors and managers received training from EKI, and now it is planned to train managers and supervisors to do the training themselves (TOT). The Kaizen officer said, “We will be training all new labor employees and we have a goal of regularly providing training three times each year.”

IV.5.5 Impact on operations (quality, productivity, flexibility, inventory, time)

Quality – In company C0, Kaizen has helped with documentation, the company now documents data on quality and the reason for every defect sampled. The company now knows what parameters produce the highest quality product, this is a result of the fact that it records parameters of products on a daily basis, the company was not doing this before Kaizen. The quality checkroom has dramatically improved and the Cost saving was around 300-500K Birr/year.

Kaizen introduced recycling of the scrap and its reuse. Before Kaizen, the company used to sell all of it. Before Kaizen the situation was that 1 Kuntal which is equivalent to 100 kg costed 800 Bir; the price of 1 Kuntal of Macaroni was 2,700 Bir. On a monthly basis the company used to produce 219 Kuntal. Since electricity cuts cause production of scrap, the five minutes lost trying to switch to backup generator increases the quantity of scrap. The company still produces the same amount of scrap but reuse it all now. $219 \times (2,700 - 800) = \text{saving}$. The reused scrap used in the production of macaroni and not spaghetti as the latter would crack.

[$219 \text{ Kuntal} \times 100 \text{ kg/Kuntal} \div 30 \text{ days/mo} \div 24 \text{ hours/day} = 30 \text{ kg/hr waste}$. If they produce 1 kg/second, this is 3,600 kg/hr. $30/3600 = 0.84\%$ waste. It is surprising to us that this amount of waste was not reduced.]

Due to Kaizen implementation, the company rooms are clean, and this changes people's attitudes about their work. The Floor and everything on it are kept clean. Because of shortage of raw materials, can't reduce finished inventory so much.

The product from C0 is the best in the country because of Kaizen, leadership commitment to improvement, and quality control of raw materials. They have increased market share. 15 years ago, they started with flour production, then macaroni, then additional macaroni line, then pasta, and 2 years ago they introduced biscuits, because of the increased demand.

IV.5.6 Impact of Kaizen on strategic performance (growth, profitability, competitiveness)

To understand how Kaizen philosophy has impacted strategic performance we reviewed the Annual report, KPIs and quarterly management reports. In addition to that we wanted to know how the culture has changed from the 'before' to the 'after' introduction of Kaizen which mainly was translated into the creation of a suitable working environment for employees. We took the photos for each of the documents. We found that the thinking of employees on the quality and productivity is improving. The ability of measuring changes and recording and communicating the results has improved. Identifying problems and owning them and the motivation to find solutions has become a habit in the work culture among the employees. The photos clearly show significant differences between 'before' kaizen and 'after' Kaizen in work area improvement, cleanness, sorting and order in the storage and floor shops.

IV.5.7 Additional comments and observations

C0 is in the process of applying for a license to sell to other countries within Africa, and they are building a facility within their compound to produce their own cardboard boxes. They plan to sell 70% of the cardboard production and use 30% of the production. They are adding space by the biscuit production area for stock, to reduce wasted transport within their facility. We observed the spare parts shop, which also has been organized very nicely in a Lean/5S manner. Tools storage was also done with tools labeled and hanging on the wall (not shadowed).

Overall good impression. The posters/phrases in many places are from the Kaizen institute, they are in Phase 2 of implementation with the EKI.

IV.6 Visit to C1

Company C1: Primary product is Cotton Yarn

The charts below are from the survey respondents from C1. The visit was helpful to validate the results obtained through the survey analysis on the three factors (Implementation, Sustainability and Impact factors).

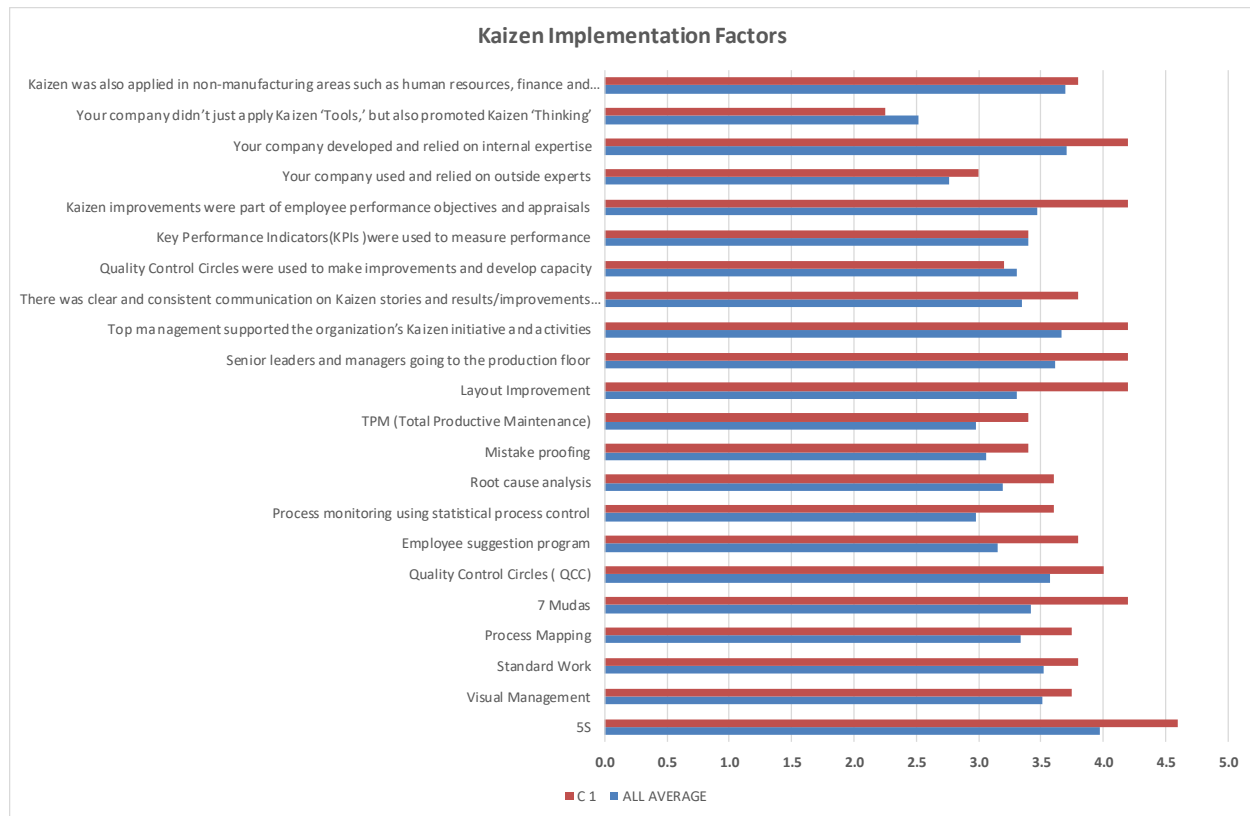


Figure 4. 11 Kaizen Implementation Factors for C1

Figure 4.11 shows that C1 is above the overall average on the factors of Tools applied 5s, 7 mudas, layout improvement, employee suggestion program. And on the approach of Kaizen implementation the 'Kaizen improvement part of the employee performance' 'developing internal expertise' are higher than the overall average. This was clearly validated during the visit and conversations with the Kaizen officer and management of the company and observation proved the statistical results.

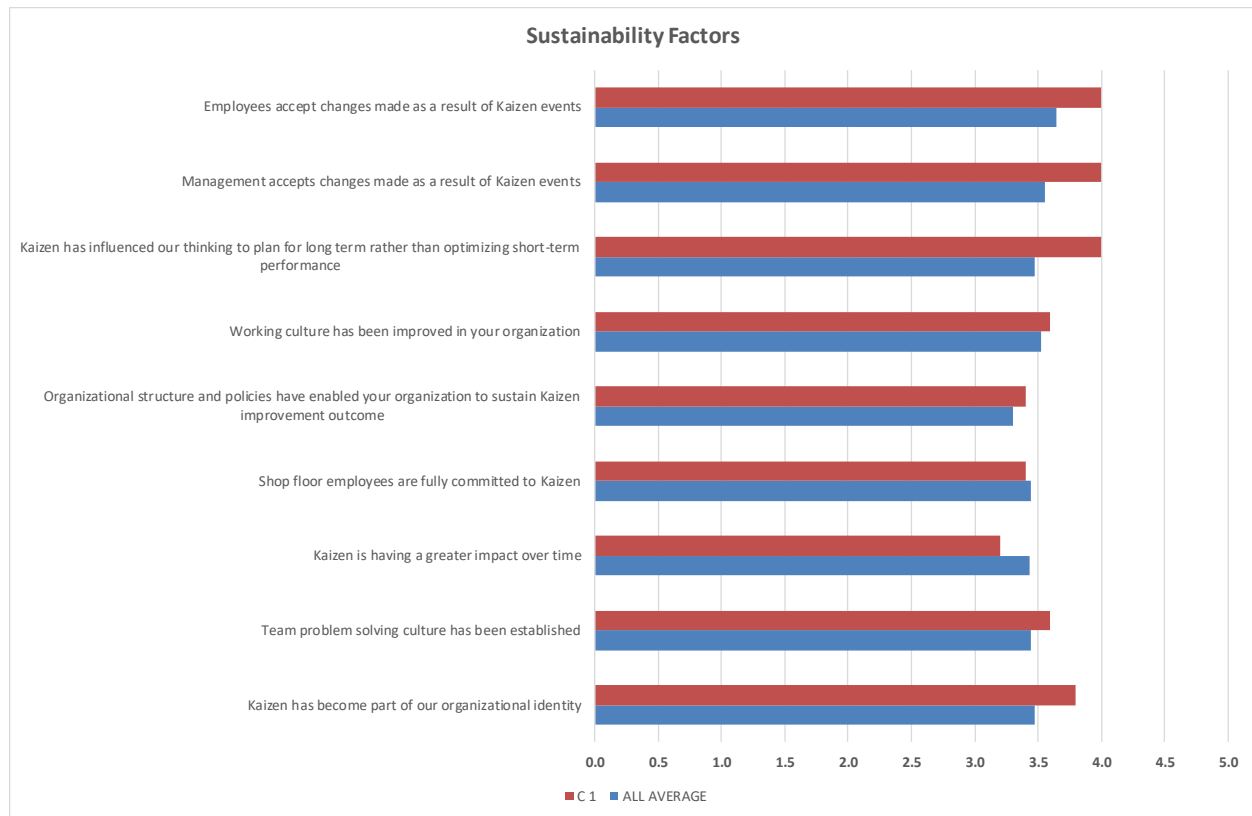


Figure 4. 12 Sustainability Factors for C1

Figure 4.12 above on the sustainability factor shows the company C1 is at par with the overall average in most factors. However, the factors ‘Kaizen influenced the thinking’, ‘Management accepts changes...’, and ‘employees accept changes...’ is a bit higher than the overall average. This is in alignment with the information received through conversations. Management has taken responsibilities and the Kaizen implementation strategy was well restructured and the QCCs were organized.

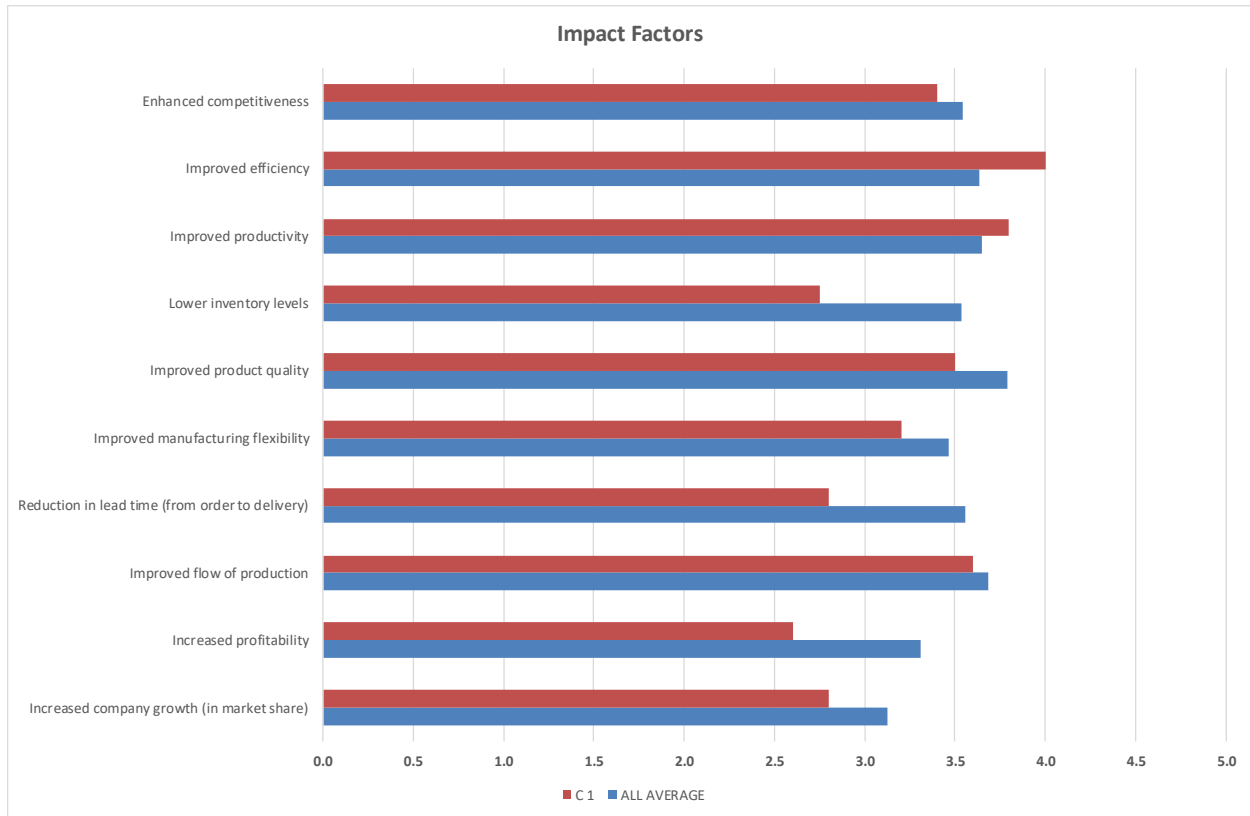


Figure 4. 13 Impact Factors for C1

Figure 4.13 above shows the results of C1 on the impact factors. As can be seen from the chart the company is above average on the following factors; improved efficiency and improved productivity. The result for the company for lower inventory levels, reduction in lead time and increased profitability is lower than the overall average. This is also confirmed by the results of primary data (observations, conversations, review of records).

IV.6.1 Observation during (C1) tour

Following observation, C1 showed good 5S improvement mostly outlines, sorting and cleaning. Different production areas were named/labelled. The place looked quite clean, and there was active cleaning going on. The rough thread-spinning machine was operating at about 78% availability, as one unit had a problem and was being fixed.

Each bag of finished product is labelled, as is the area where they are being collected. Workers were putting various items within the marked areas, rather than outside. It was observed that there

is more discipline among workers. The general observations about C1 were that there is Standardized procedures and specifications for the quality of the cotton, there is no use of SPC charts, there were some posters up, and some stories of improvement. QCC teams were doing some root cause analysis, the maintenance staff were doing TPM, but we didn't see evidence of this. The batches were identified by colored bands and labelled in final goods; there were instructions on the humidifying oven that everything has to pass through; each of the machines had visual indicators when there was a problem. The outside area was quite clean and being beautified, so people can hang out outside. However, there were fewer Kaizen posters up, compared to C0.

IV.6.2 Records verification

We viewed the one-page report on daily production, which included comments from the shift about what happened. They measured themselves against performance standards. But they have not yet targeted improvement of efficiency and quality. So far, the company has focused on 5S and waste elimination.

There were a few improvements documented on a board in the production area and the company has documented before and after photos of 5S improvements, together with the improved 5S ratings.

Company C1 piloted Kaizen in 2011 and furthermore expanded it into the whole factory in 2014. However, the company was not successful then as it had to revamp the process again in 2018. At the time of the observation, the company was at the first level of Kaizen. The main Cause for failure in 2014 was attributed to the fact that Kaizen structure was not in place. The company later created a new structure with input from EKI and made all managers responsible for Kaizen implementation. They established QCC with 3-8 members from different departments, and sub-QCC with workers on same teams.

Whenever the machines stop, they take two hours to restart. In order to ensure business continuity, the sub-QCC team leader talks to staff while they are working on the line and then generates solutions with the QCC which are brought back to the team. We noticed that this does not seem to be very empowering to the workers that solutions are brought to them. It was confirmed in C1 that management does visit the shop floor.

IV.6.3 Implementation

In the survey, it was observed that C1 was strong in 5S, in eliminating waste, in layout improvement, including Kaizen in performance management and in developing internal expertise.

The visit confirmed the following which in turn validates the findings in the analysis; Training is given to all employees about Kaizen from managers to line workers. After training done on 5S assessment, waste identification and self-rating, C1 set a goal to improve from 55% to 90% or so. We photographed “before” and “after” situations for a variety of improvements and generally on issues of sort, set in order, and standardize. The company earned a certificate of 5S from the Ministry of Trade and Industry and Textile Trade Association. It was observed that C1 had Lots of cleaning and organizing. Interestingly, older companies have lots of old items that they have identified to reduce, and thus reported very large savings; newer companies didn’t have so many old things stored and reported lower savings. People were rewarded for improved performance.

IV.6.4 Sustainability

From the chart on sustainability, it is clear that C1 is characterized with strong willingness to accept change by both employees and management; strong influence thinking and planning for the long term; C1 was observed to mostly be on average with others.

IV.6.5 Impact of Kaizen

Efficiency was the biggest improvement, it was not confirmed overall, however, there were specific examples including the reduced time in finding replacement spools. Other aspects were on or below average; an example is on TQM; It was confirmed that they had already been doing TQM before, so introducing Kaizen did not lead to such significant changes compared with companies that were not previously applying Kaizen.

IV.6.6 Challenges

Less growth and profitability, Level 1 Kaizen implementation phase focused on 5S tools. So far it has not registered any impact on growth or profitability. This again was connected to the fact the company was already implementing some of the 5S components, which imply that the impact might not appear to be significant.

Less lead time and inventory reduction, Cotton has a growing and harvesting season in the summer. Stock is in the market. The company keeps a three-month minimum stock, due to uncertainty of supply. The company projects a possibility of growing some cotton in the future despite the fact they once tried, and it did not work. The company also plans to produce medical textiles – surgical gauze. At the time of the visit, the company had stopped producing socks. It was confirmed that from start of production to coarse count yarn takes a span of 3-4 days; from the latter to fine lines, may take 7-10 days and finally, steaming everything, about 30 minutes.

In the conversation it was mentioned that in the second level of Kaizen implementation the company will focus more on productivity and efficiency.

IV.6.7 Primary challenges for C1 on Kaizen Implementation

The first challenge highlighted was the lack of commitment from leadership to front line workers. Initially there was energy and excitement, but it waned over time. The second challenge was the inconsistent support from EKI. It was mentioned that they give training when there is a request, but they don't continue to follow-up, however, it has been realized that Kaizen systems need consistent follow-up to be a success.

IV.6.8 Primary strengths of C1

Among top strengths identified in the visit for C1 include but not limited to; Immediate acceptance at the start; Leadership support and rewards to high performance; Leaders come to the Gemba; the focus is on the tools, and they have gotten good at using the tools. However, Kaizen thinking still needs to be developed.

As part of cost optimization, the company does modification of the tools on its own at lower cost rather than buying expensive replacement parts. Making it costs 20 birr as opposed to buying it which costs 400 birr. \$1 = 30 birr. On the complaint that it takes too long to buy replacement parts, the company was advised to buy extra spare parts and have them in stock, and therefore avoid trying to buy them under pressure when a replacement is urgently needed.

IV.6.9 Company Future plans

The respondents during the visit indicated that the company is planning to move to the next level of Kaizen implementation, Level 2. Focusing on quality, productivity and cost reduction. They have identified four thematic areas to improve: machine availability, defect reduction (from 99.1% to 99.5%, for example), flat waste reduction (they want to remove more short fibers) and cost reduction.

IV.6.10 Impact on operations (time, quality, efficiency, inventory...)

During the tour the following were discovered concerning the impact of Kaizen in C1; the significant improvement has been on the time it takes to find items, i.e: before it used to be 5-10 minutes and now it has gone down to 5-30 seconds to find cones/spare parts to supply the machines. Among other impacts highlighted included; Customers can give specifications, separate from their own standards, there is 99.9% conformity to the standard and it is planned that Kaizen second level will focus more on quality, Availability is set at 78.5% and standard set at 90%; the machine's design capacity performance was at 94.55% and standard at 95%. Through analysis of down time problem; supervisors discover from workers what problems they are facing; there are daily reports of machine performance, and every shift reports of primary problems. To date the company does not do any SPC, but they could do if they wanted to.

IV.6.11 Impact on Strategic Performance (growth, profit, competitiveness)

Kaizen has not yet registered any strategic impact for the company although this is mainly due to the fact that they already had a culture of TQM that was already helping to achieve high quality and good results.

IV.7 Visit to C26

Company 26: Primary product is Plastic Bottles

For company C26, the analysis from the responses through the survey on Implementation, Sustainability and Impact factors is shown below respectively. The tour in the company validates the findings as discussed later in this report.

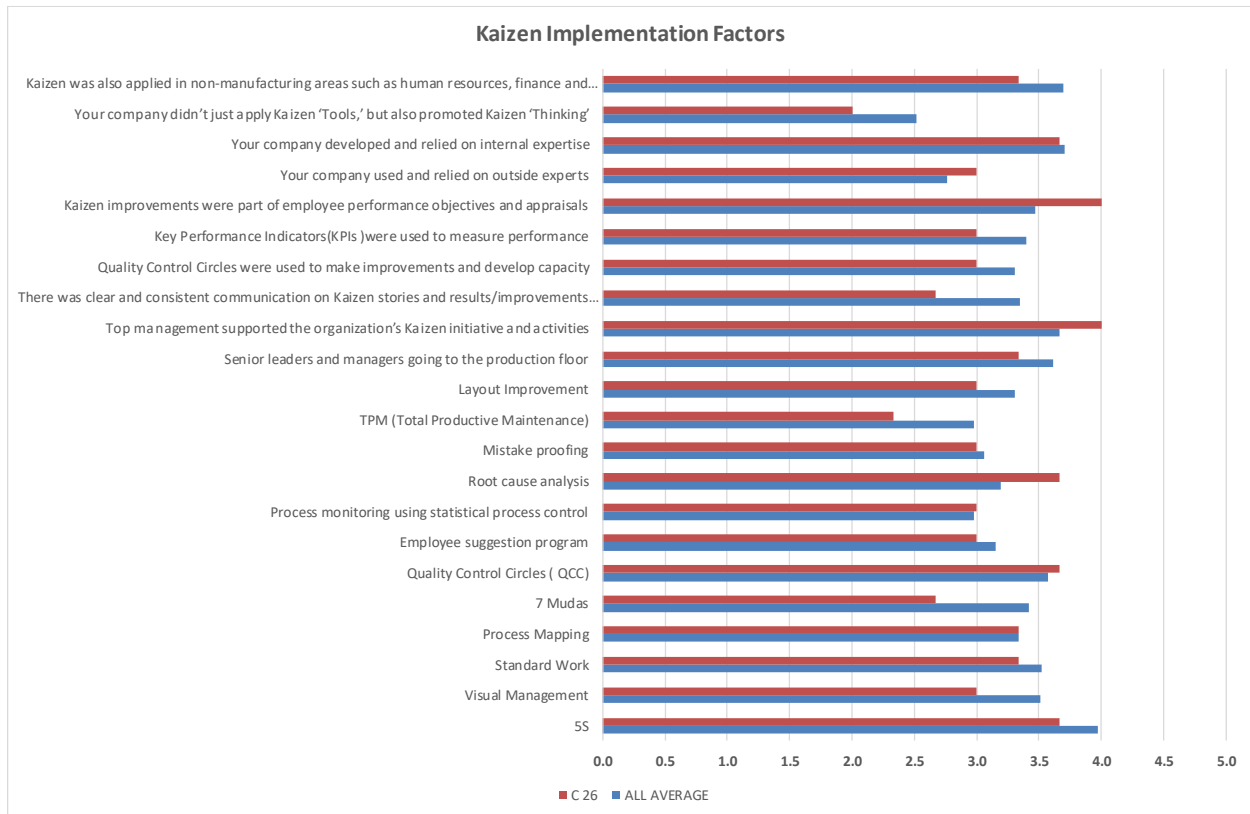


Figure 4. 14 Kaizen Implementation for C26

Figure 4.14 above shows the results of implementation factors compared to the average results. As seen in the chart the results are mostly on par with the average. Kaizen 'implementation part of employees' performance' 'top management support' and 'root cause analysis' are slightly higher than the average value, while 'your company did not just apply...', 'there was a clear and consistent ...', 'TPM', '7 mudas' and 'visual management' are at lower values than the average.

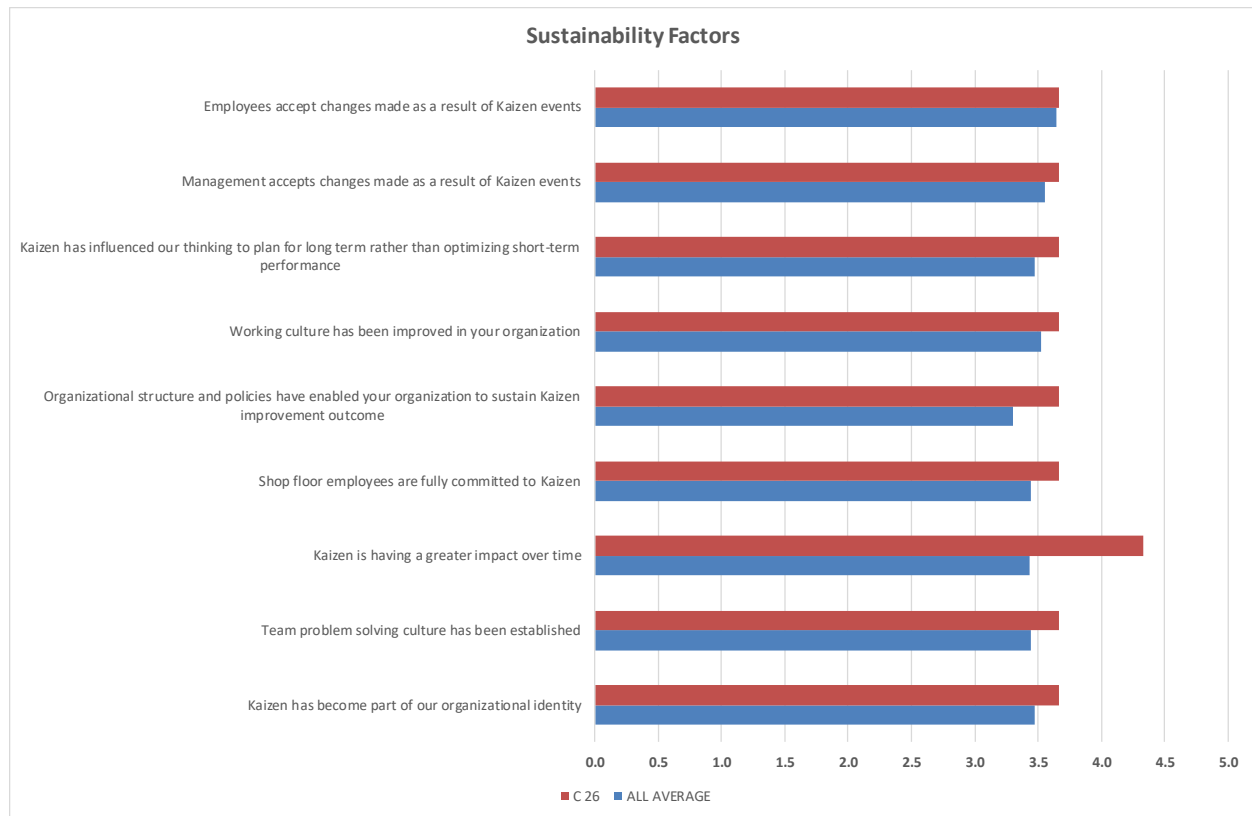


Figure 4. 15 Sustainability Factors for C26

Figure 4.15 shows the result of sustainability factor for Company 26. As clearly seen in the chart the factor ‘Kaizen is having greater impact over time’ stands out to be rated higher than the average scores. All other sustainability factors the values are on par with the average. This finding was also confirmed during the visit as discussed in the field report below.

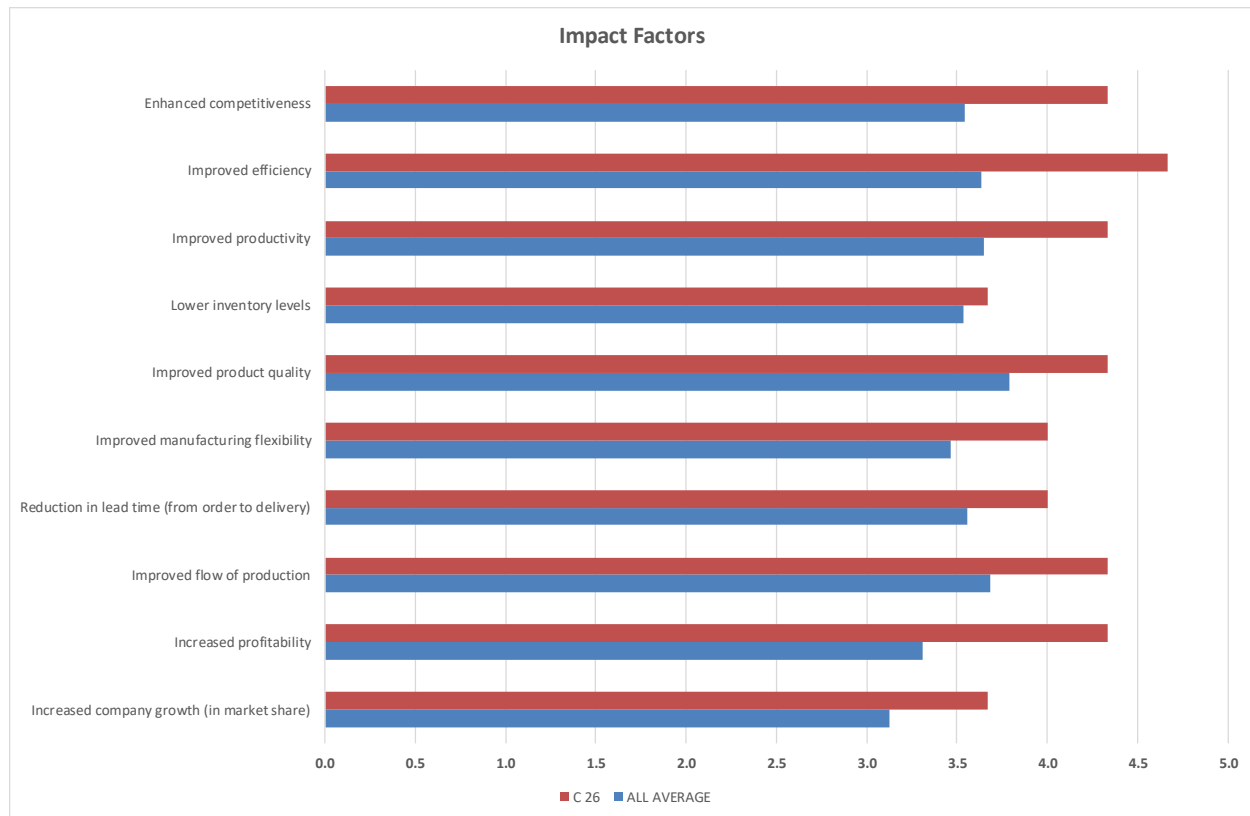


Figure 4. 16 Impact Factors for C26

Figure 4.16 shows the findings of the statistical findings on impact factors. From the chart it is clear that all factors of impact show higher results than the average with ‘company growth’, ‘increased profitability’, ‘improved flow of production’, ‘improved productivity’, ‘improved product quality’, ‘improved efficiency’ and ‘enhanced competitiveness’ being significantly at values higher than the average. This is completely confirmed with the results of the primary data (observation, record review, conversations). Hence the findings are truly validated.

IV.7.1 Observation during C26 tour

IV.7.1.1 Implementation

As shown in the chart (Implementation factor) C26 is strong in Root Cause Analysis. This was highly observed in the way the company improved the reliability of the machines and quality. Company C26 as indicated in the Chart is also strong in including Kaizen in performance

management, it was confirmed in the tour that the management rewarded two mechanics, a junior mechanic, and an electrician following their great effort on performance improvement.

In the analysis on Implementation, C26 was found to be weak on factors of eliminating waste. The visit investigated the reasons behind that scenario and the findings were that there is no evidence of 5S, workers highlighted the issues of space causing many goods to be stored in the factory.

The analysis showed that C26 is also weak in TPM, however, in the tour we realized that C26 seems to be strong on this point through observation of this factor's variability. In terms of C26 being weak in communication and stories' sharing, this was observed to be true in many ways; workers said that there have been efforts in this regard but there was no evidence found. As per the analysis C26 is weak in promoting Kaizen thinking compared to other companies in the survey. It was observed that they trained many people on kaizen and organizational behavior and have conducted several discussions on Kaizen but Kaizen thinking has not yet been cultured among its employees.

IV.7.1.2 Sustainability

It was confirmed that C26 is strong in increasing impact over time by preventive maintenance and involving operators in maintenance. For the rest, C26 is mostly on average with others

IV.7.2 Impact of Kaizen

The impact of Kaizen for C26 includes: Higher increase in growth, profitability and competitiveness; it was confirmed that after Kaizen, the company's machines doubled productivity; staff did more Preventive Maintenance; machine operators also did more to better maintain the machines; the workforce is more engaged.

Kaizen has also helped to expand the customer base – According to respondents, the company is increasing every day and there is increased market share in Ethiopia. The company plans to expand and acquire more Husky machines.

IV.7.3 Overall higher operational performance (time, quality, cost, efficiency...)

Inspired by Kaizen, the company segregates storage of the 20-liter water jars, the cycle time has reduced significantly from 170 to 132 seconds for one machine, making it more productive. Improvements were made on the blowing machines hence improvement of the quality. On the machinery side, before Kaizen one machine used to produce 7,000 pieces per day but now it produces 14,000 pieces per day. There has been reduction of defect rate by 50%, breakdowns also decreased and frequencies of machine stoppage and needing spare parts have reduced. There has been decrease in the bubbles on injection molding machine (machine on end of line, producing big blue vials). The company received support of consultants from EKI and from Japan to share expertise on the initial machine, then the company applied the same approach learnt to improve other machines. It was in that regard that the company trained all employees especially the mechanics.

The machine operators collect data on quality and use the data to do root cause analysis. Currently Machine operators are actively involved in improvement, there is a form they fill in and send to the production manager to be addressed. The senior management is committed, and departments are also supportive and helping with embracing change. In each office, Kaizen is implemented to sort things more easily, e.g.: sorting files and writing indexes on files. The Management frequently comes to the factory to see how things are going and talk with workers. All the points mentioned above validates the findings of the survey.

IV.7.4 Primary challenges

In Company C26, the biggest challenge identified was space, in addition to that, limited awareness among the operators, technicians (mechanics and electricians) on the Kaizen Philosophy generally, and lastly the high rate of turnover which implies that the company has to train the new staff all the time.

IV.7.5 Primary strengths

Among the strengths, C26 analyzed, fixed and improved maintenance of the machines. There is a developing culture to do root cause analysis, there is increased teamwork within the Kaizen teams; each department has a Kaizen team with an internal facilitator. In addition to the EKI training, C26

provides training internally to its workers and the company has some KPI charts, in the production department.

IV.7.6 Company Future plans


The company plans to do more training for the operators to involve them in the maintenance activities and they plan on using the space more efficiently by sorting things properly.

IV.7.7 Metrics about the Kaizen initiative

The company stated that the Kaizen initiative has reduced costs and improved productivity. While we were not shown the numbers, this seems reasonable based on the improvements we were shown.

IV.8 Visit to C23

Company 23: Manufacturer of steel products

We paid visit to Company 23 to validate the results obtained through the survey. The results of the survey are shown in the charts below on Implementation, Sustainability and Impact respectively. Figure 4.17 below shows the results for implementation factors for company 23 compared to the average of all companies included in the survey. For company 23 it is clearly seen from the chart that for all implementation factors, the scores are higher than the average. However, ...', 'top management supports...', '5s', 'layout improvements', and 'senior leaders and managers go to shop floor', 'root cause analysis' and 'process monitoring...' indicate significant difference. The company has shown significantly lower scores than the average in the factors such as 'Kaizen was also applied in non-manufacturing...', 'your company didn't just apply...' and 'your company used outside consultants...'.


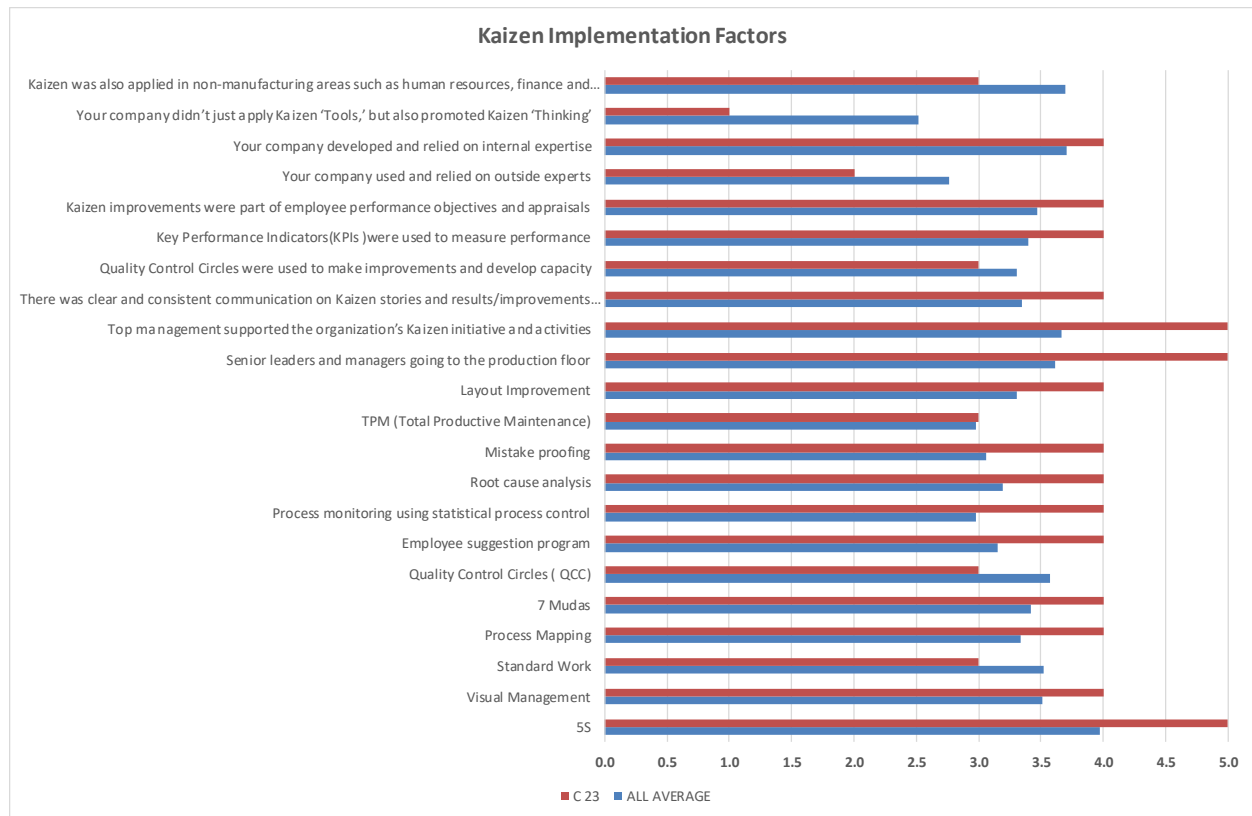


Figure 4. 17 Kaizen Implementation Factors for C23

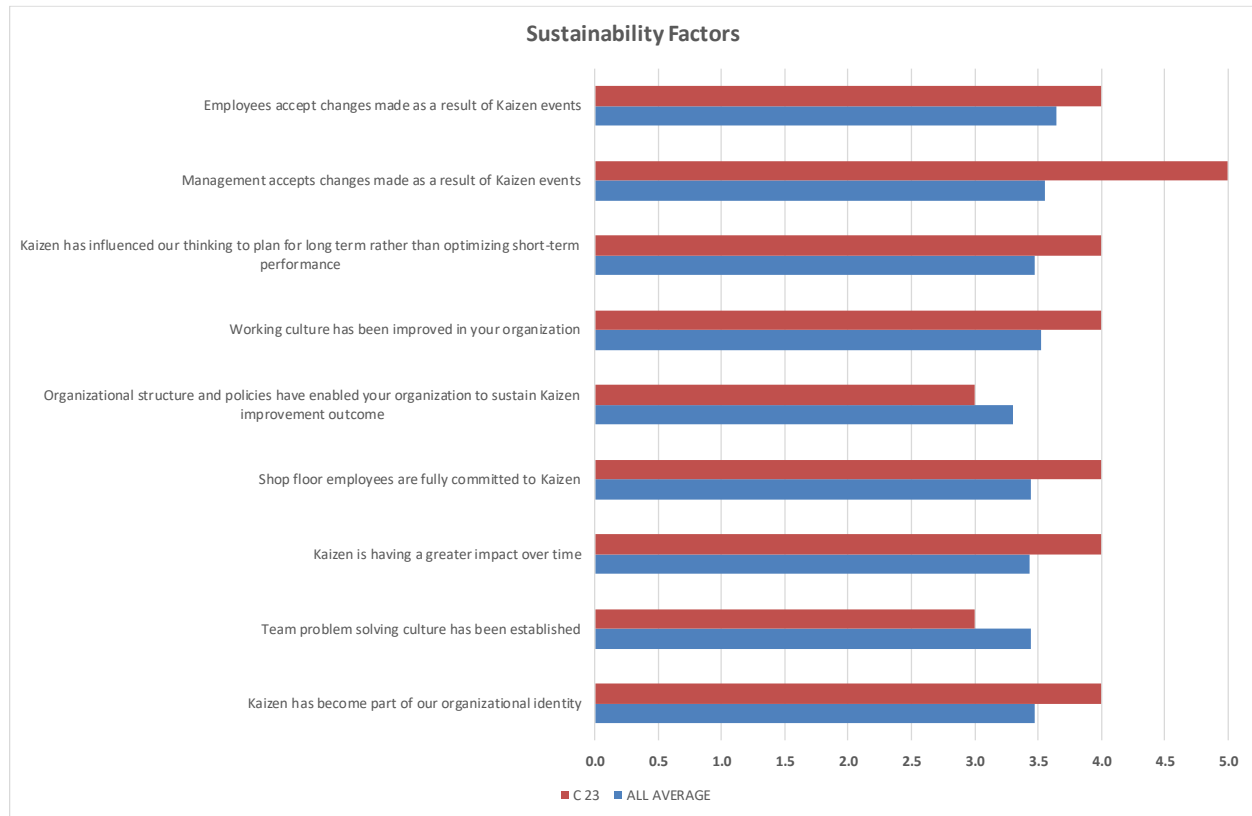


Figure 4. 18 Sustainability Factors for C23

The above chart shows the statistical results for company 23 compared to all other companies included in the survey. The comparison is made between the average for all companies and the scores for each variable for sustainability group factor. As seen in the chart most of the variables are rated around the same to the average with slightly higher values for some. However, ‘management accepts changes as a result of Kaizen events’ is significantly higher than the average. This was also confirmed during the visit.

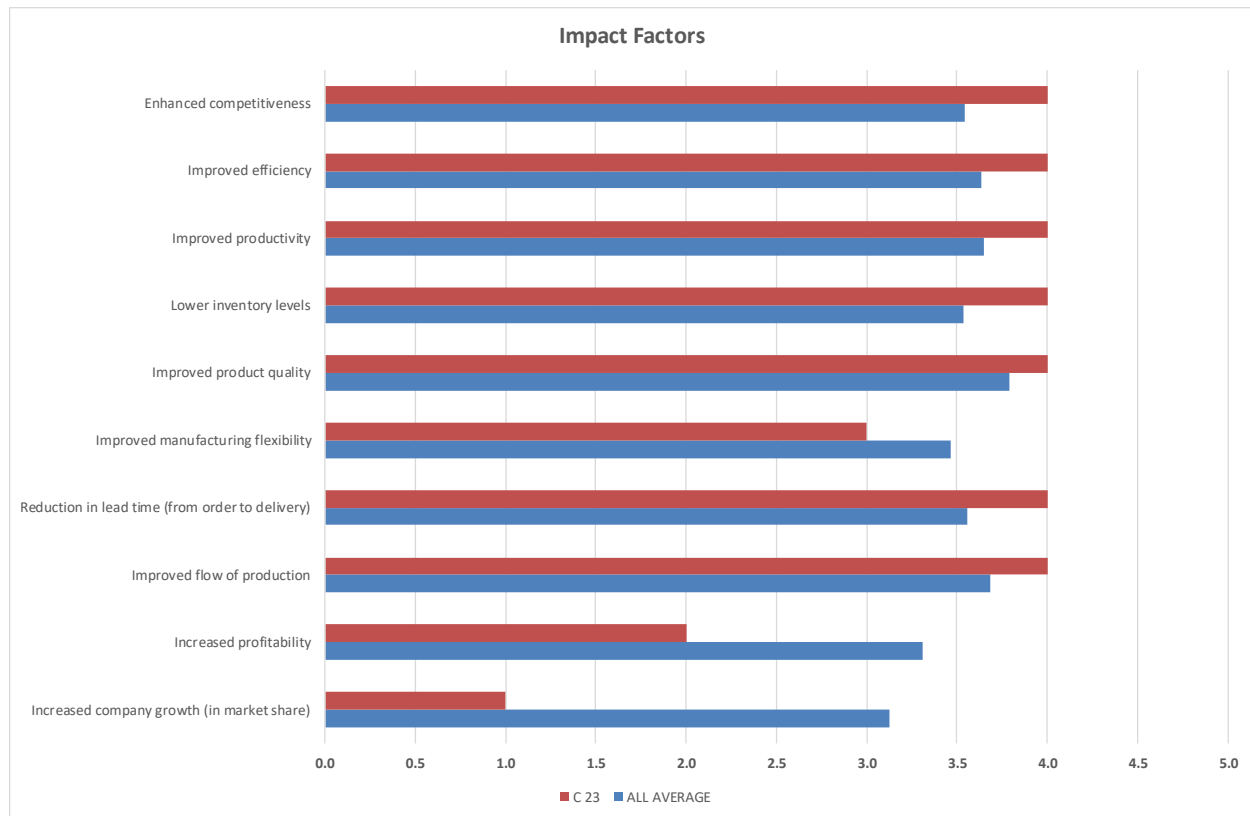


Figure 4. 19 Impact Factors for C23

Figure 4.19 shows the comparison of the results for impact group factor with all other companies included in the survey. The chart shows that ‘increased company growth’ ‘improved manufacturing flexibility’ and ‘increased profitability’, are with significantly lower scores than the overall average. And the ratings for all most other variables are slightly above the average results.

IV.8.1 Observation during C23 tour

The visit to C23 observed and confirmed that there is very good labelling and marking of the floor, very nice areas for KPTs (Kaizen Promotion Teams) to meet with plants, benches and story boards, communication of documented improvements and of Kaizen in many places, posters and signs in many places promoting Kaizen DNA, 5S, PDCA and thinking. There are tools and parts holding devices created to reduce time spent looking for things and to reduce stress of the workers from lifting heavy items, there is an assembly line as items that will be put on the product are moved to the appropriate side of the line based on what side of the product they are put on. Mostly everything seemed to be very well organized.

IV.8.2 Records verification

Through review of records, it was observed that Kaizen started 2 years ago in 2018 with 5S assessment. Then the results were at 38%, with Kaizen implementation, there was improvement up to 92%. C23 prepared action plans with follow up actions; the whole process started with the sort, set in order and shine and it is now working on standardization and sustainability.

C23 has reports on Kaizen team promotion for the different departments implementing Kaizen including HR department. The reports highlight implementation results including many “before” and “after” photos.

C23 has freed more than 375 m2 of space from Kaizen implementation. As a result of Kaizen, 2-3 machines were fixed and started to be used again. Another major finding was that 4,192 Kgs of metal were reused for other processes rather than being scrapped off.

Searching time has changed from 7.3 minutes to 30 seconds for parts and tools, this is an overall average. Transportation reduced from 190m to 157m and motion for operators reduced from 70cm to 7cm. More than 95 new ideas from workers have been implemented. They suggest ideas, present them to the design engineers for implementation. Some example of innovative ideas helped to produce some items like trailers, and automotive assembly.

The management evaluates individual workers and teams, it gives some rewards based on the findings; rewards are given to top team members scoring highly on about 15 aspects/items; but also for individuals scoring well on a good number of items less than 15.

KPT were used in workers’ weekly meetings. This is however going down since the company is downsizing due to shrinkage of their market.

C23 continues to document its Kaizen initiative year by year. At the time of the tour, the company had already given training to workers.

IV.8.3 Implementation

Through conversation and observation, the following results were validated for C23; It is strong in 5S and their labelling is very well done, strong leadership support as leaders go to the Gemba, there is strong employee suggestion program, SPC, root cause and mistake proofing and tools to store and help people to lift things. There was low level in use of outside Kaizen expertise, however, there is also low levels of promoting Kaizen thinking and not just tools.

IV.8.4 Sustainability

The tour confirmed that there is strong management acceptance of changes from Kaizen events enabling workers to succeed and it was found that C23 is mostly on average with others

IV.8.5 Impact of Kaizen

The respondents highlighted that at the time of the tour there was no impact on growth, and only little impact on profitability. Among the reasons provided were that there has been market decrease as the company had to lay off 50% of its workers. This was mainly due to currency fluctuations and other challenges in the country. However, the company is optimistic as of recent the economy has been improving. The company's market is Ethiopia and East Africa as a whole.

The company believes that Kaizen has registered much impact on competitiveness as productivity has improved and cost reduced.

IV.8.5.1 Impact on operations (flow, cost, productivity, efficiency)

C23 is mostly on average with others flow, cost, productivity and efficiency. C23 is an example on 5S impacting quality – they can now find and use the right tool to tighten a bolt. The company, however, is slightly performing lower on flexibility.

IV.8.6 Primary challenges

Among top challenges highlighted included; drop in the market; the fact that when implementing 5S at first the company was lacking standardization; this implied that different workers had to make different changes which was resulting in double work on some ideas. To cope with that, the company ensured review and standardization of ideas, e.g.: painting on the floor. Sustaining

Kaizen was another big challenge due to downsizing and commitment of workers; the latter were very motivated at the start but less now. This is illustrated for example with the fact that workers at first wanted to buy things to make aids; but now the company is ending up using scrap to make some things.

IV.8.7 Primary strengths

All senior management members are committed, monthly management meetings take place including top manager and owner of the company. The Owner of the company discusses with shop floor workers in meetings on their challenges, the workers are also committed in that they bring new ideas to improve things which make the whole process a success.

IV.8.8 Company Future Plans

The company plans to advance Kaizen in general to Level 2, around TPS, TPM and Lean, the company plans to focus on TPM to improve maintenance of machines at the same time willing to implement other improvement methods.

IV.9 Visit to C5

Company 5: Primary product is leather shoes

Company C5 was one of the companies sampled for the visit. The tour in the company helped to validate the findings on the implementation, Sustainability and Impact factors as shown in the charts below respectively.

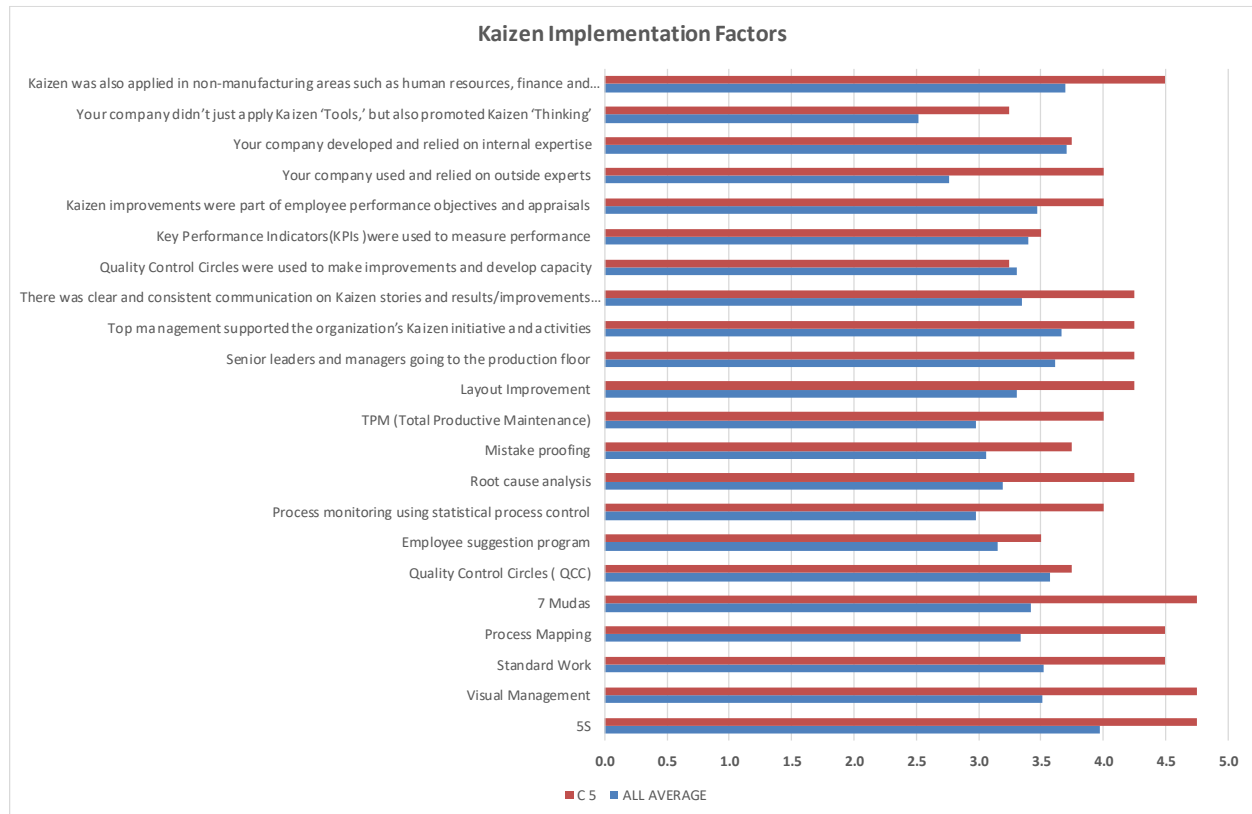


Figure 4. 20 Kaizen Implementation for C5

Figure 4.20 shows the comparison of the scores on implementation factors with the average of all companies included in the survey. The overall result shows that the scores for each variable is with higher score than the average with some variables with significant difference with the average values, such as 'visual management', '5s', 'standard work', 'process mapping', '7 mudas', 'root cause analysis', 'TPM' and 'layout management'. These factors are on 'tool used' in the implementation of Kaizen. On 'the how of the implementation' factors; 'Kaizen also applied...',

‘your company just did not apply’..., ‘your company used and relied ...’ and ‘there was clear and consistent’... the results were significantly above the average.

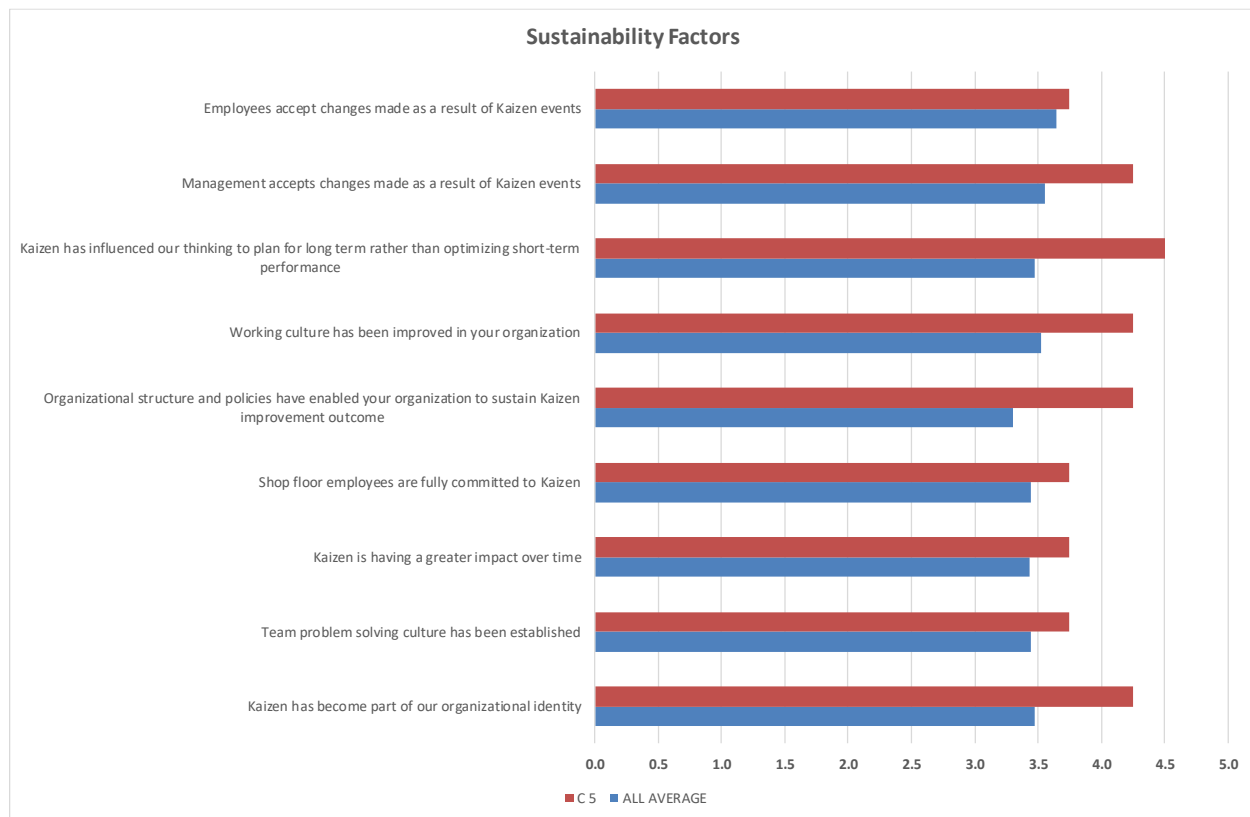


Figure 4. 21 Sustainable Factors C5

Figure 4.21 above compares the survey results on sustainability factors for company C5 with the results for all other companies participated in the survey. As can be seen in the chart, the company shows higher results than the average. Significant difference is observed on the factors such as ‘Kaizen has become part of our organization identity’, ‘Kaizen has influenced ...’, ‘management has accepted changes’, and ‘organization structure and policies...’.

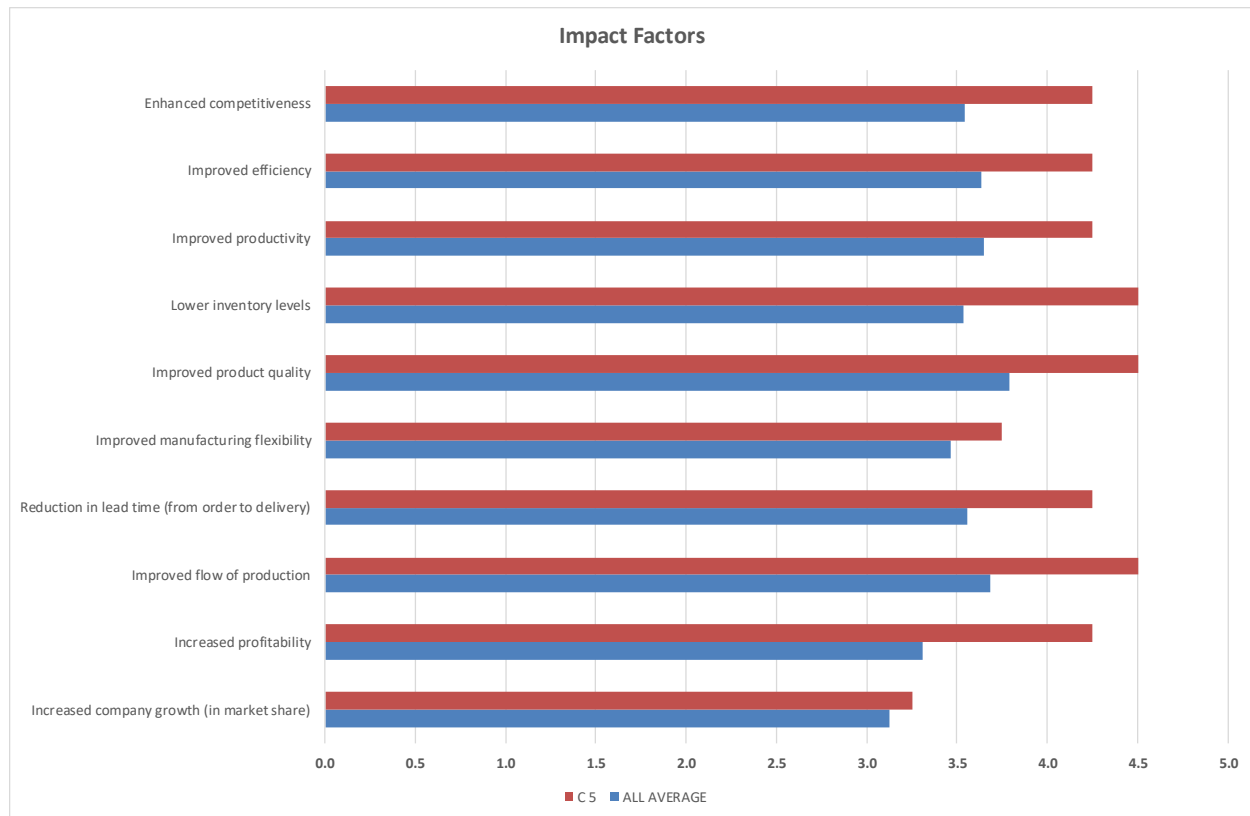


Figure 4. 22 Impact Factors for C5

Figure 4.22 is a comparison of the results on Impact factors with the overall average of the companies in participated in the survey. Significant difference is observed in the impact factors such as ‘enhanced competitiveness’, ‘improved efficiency’, ‘improved productivity’, ‘lower inventory levels’, ‘improved quality product’, ‘improved flow of production’ and ‘increased profitability’. The company growth is nearly on par with the average. The field visit confirmed the above results in the chart, as discussed below.

IV.9.1 Observed during C5 tour

As observed during the tour, Company C5 is strong on 5S with mainly labelling, marked walkways and borders of areas although these do not indicate exactly what they are. C5 has stand-by employees available to fill in the positions when normal employees are absent; each factory worker can perform different and multiple tasks and so have more flexibility; there is lots of empty space in the office enabling easy movement; there are records of daily charts on production, procedures are written and followed for all processes; Kaizen promotion is strong although there are not as

many posters as in other locations; at the time of the tour Inventory was not clearly labelled from the outside. The company holds consistent daily standup meetings in the factory and also with the board (who are the owners). C5 also receives support from the Ethiopia leather institute.

IV.9.2 Sustainability

C5 was found to be mostly slightly above average compared to others. The tour found out that the company is strong on the parts of identity, organizational structures and policies supporting Kaizen. As a result of Kaizen events, there have been improvements on the working culture, long term planning, and management's acceptance of change.

IV.9.3 Impact of Kaizen

C5's Growth is on average with others, but profitability is significantly higher. The company has weekly quality standards and measures defect rates, they document defects on paper/boards and translate them to Excel. The company focuses on ensuring quality processes rather than inspection. Operators spend 15 minutes each day on improvement. The company uses time study methods to see where there are bottlenecks and make work balance evenly for each step (sometimes adding someone if necessary). "Sunrise meetings" discuss problems from the prior day, quantity produced and other issues; the company takes countermeasures for the top 5 quality defects every day and reports to management, which sees improvement over time.

IV.9.4 Reasons for success (Primary strengths)

Strong Management commitment, all 12 top senior managers are strongly committed and have all taken training by JICA and EKI. The company gives training about Kaizen to all new employees, at the time of the tour 92.3% of employees had been trained on Kaizen. There is provision of performance incentives for staff when they exceed their daily quota; names of highly performing staff are posted on performance boards monthly; all factory workers are expected to make improvements; employee involvement seems high.

The company holds external audits from customers, 5S and Muda audit are conducted every day, the company has an action plan for each work area, these action plans are audited each week by the Kaizen Officer and is reported to management. Daily and weekly internal meetings with board

members and owner about action plan implementation status are held; Daily operation “sunrise” (stand up) meetings at 8 AM to discuss achievements, safety, quality and other issues for 15 minutes. At 10 AM they hold a stand up meeting with the board.

The company receives support from EKI and the Leather Institute. It has a culture of CI – the company’s audit systems require it and so do their corporate customers. Procedures for every operation are audited to see whether there is Muda in them; also, various audits about safety, quality and risk management and responsible sourcing are conducted for continuous improvement. Audits were started when Kaizen was introduced.

The company has a waste removal committee of 10 members for red card (red tag disposition of items to be removed that need decision on how to dispose them off), there is Visual management – outlining and labeling of areas; the company uses “30 second rule” – things should be labeled and indexed, so one can get what they need in 30 seconds. Kaizen roles are documented with clear guidelines on who is responsible of what for all the categories of staff – managers, supervisors and workers; Kaizen promotion posters are present.

The company is certified by ISO 9001:250 Quality Management System; it has 88 QCCs (KPTs); 5S score originally 49%, improved to 78% last year, now 85% as a result of Kaizen, and also 967.3 m² area was saved by sorting materials.

The company has an annual plan broken down into quarterly and monthly plans; it reports every month to the top management and board members; there are also weekly reports, quarterly and yearly summaries.

The company gives 5S training every 3 months; it trains workers before starting to serve the company. The focus of the training is on 5S and problem solving. There is an annual training plan based on departmental needs.

IV.9.5 Primary challenges

At the start, commitment of supervisors was difficult to have, but now they are on board. The company is faced with a challenge of poor work culture/limited industrious work culture and absenteeism; this is made worse by the fact that it is hard to get skilled employees. The company

gives initial technical training for 21 days; they train workers on the working culture and technical skill but since employees are from the local area with lower education level, their level of understanding is not very high.

IV.9.6 Impact on operations (time, quality, efficiency, inventory...)

The company has more than 300 models of a product although the tour did not capture the number of active models. It has several shops across Ethiopia and uses a pull system to fulfill and satisfy customer orders received in batches. Although the time to produce the product was not clearly communicated, company workers receiving raw materials can cut up to 2,500 products per day. (N.B. for confidentiality purposes the type of product is not disclosed here).

IV.9.7 Impact on Strategic performance (growth, profit, competitiveness)

C5 is doing well on cost optimization; efficiency at operational level has been realized through proper utilization of manpower and materials which resulted in reduction of costs and increase of profits.

IV.9.8 Areas of improvement

The tour members realized that reject rates in Excel seemed to be high (5-10%), the company was advised to do more with SPC charting of the defect or production rates. The company should also improve on visual management of inventory in process.

IV.9.9 Company Future Plans

The company is likely to move to cellular manufacturing.

CHAPTER V: CONCLUSION AND RECOMMENDATION

V.1 Findings

It is evident from the analysis that the findings from the survey emphasizes on the importance of sustainability, on the importance of empowering people in applying the kaizen tools, on the importance of the value of external coaches for operational impact.

It is also noted that the different companies have different contexts, and so the application looks different and the impact will be different depending on the individual company. But, overall, there is a strong correlation between higher level of implementation and higher sustainability, leading to higher impact both in operational and strategic indicators.

The idea that the companies are starting with first level kaizen; starting with 5S and eliminate waste, identification and elimination is a good one as it begins to install discipline and start to get people to have kaizen thinking. One of the weaknesses observed was the people rated themselves weaker on developing kaizen thinking so one of the challenges would be how to do that better.

In the field visit, significant impact, significant changes, successful applications of kaizen in these different companies were noted. Thus, the findings of the visits validate the findings of the survey, for these companies that rated themselves higher. It can be concluded that implementing companies take it seriously. The people who are in the role of kaizen officer were excited, were informed, were giving training, were facilitating teams and were empowering people.

The leaders in these each of the companies visited were involved leading kaizen, guiding it and visiting the factory floor, so that it was seen those things were all very impactful and beneficial for the organization.

From the analysis of individual responses, the finding on the ‘tools applied’ in the implementation of Kaizen in all companies show that on average the extent of Kaizen tools applied is moderate. However, among the tools applied standard work (40.2%), process mapping (43.7%), 7 Mudras (47.1%), root cause analysis (41.4%), layout improvement (44.8%), visual management (39.1%), employee suggestion program (35.6%), process monitoring using statistical process control (36.8%), mistake proofing (36.8%), and total productive maintenance (34.5%) were rated

moderate. However, 5S and Quality Circles are rated ‘much extent’ and ‘very much extent’ respectively. From this it can be understood that all the tools were applied in the implementation process with ‘moderate extent’ except the 5S and Quality circles, which respondents recognized as being applied much more than tools.

Most companies performed very well in 5s tools and establishing Quality circles, which have significantly influencing variables on the output variables (sustainability and performance variables). This was also observed in companies visited and was witnessed by companies which presented their best practices. Most companies started Kaizen implementation with application of 5s, QCC and the 7 muda practices as important steps in phase I level of implementation.

Among the implementation factors, ‘tools applied’ and ‘empowerments’ have stood out to be significantly influencing the output variables sustainability factor and strategic performance and operational performance (impact factors). The how and the extent the ‘tools applied’ determines the level of sustainability most importantly the longevity factor and performance of the companies. Likewise, the ‘empowerment’ factors influence the ‘improved culture’ (variable of sustainability) and the overall impact factors, both strategic and operational performance.

The important finding here, therefore, is that which tools are applied and to what extent we use them in the implementation of Kaizen determines the sustainability of Kaizen activities in companies. The operational and strategic performance of companies will also be highly influenced by the how tools are applied.

Empowerment factors include all variables that measure thinking and culture. The variables are critical for sustaining Kaizen in terms of maintaining improved culture. For Kaizen to be sustainable, employees need to be empowered to learn, apply and own the changes. When QCCs are more empowered, employees will be more innovative and better at problem solving, rather than followers of guidance from experts or leaders. Empowerment includes the opportunity employees are given to be able develop their ability to identify problems and suggest solutions.

The results from the PLS path model analysis indicate that the dependent variable (improved culture) is found to have strong relationship with two implementation variables (independent variables): empowerment and leadership commitment. Therefore, the success of Kaizen

implementation will have higher influence when leadership is committed to the implementation and employees are empowered to think and practice Kaizen activities to identify and solve problems. The leadership commitment to allow employees develop their skills and freedom for innovation is key for the sustaining the changes.

V.2 Implications and Discussion

The results of PLS path analysis and regression analysis indicate the strong link between Kaizen implementation and sustainability of Kaizen and performance of manufacturing companies in Ethiopia. The implementation of such Kaizen practices as Kaizen tools, employee empowerment (thinking and problem-solving culture) and leadership commitment are key success factors for sustaining Kaizen culture. The data suggest that application of Kaizen tools and ensuring employee involvement in decision-makings on solutions to problems observed should be encouraged and become key focus areas to yield the higher performance.

The results also confirm that the two factors ‘commitment of Shop floor employees to Kaizen’ and ‘Change acceptance of employees’ are strongly related to implementation steps ‘Kaizen application in none operation functions’, ‘Key Performance Indicators (KPIs) were used to measure performance’, and ‘companies’ reliance on internal expertise’, ‘5S’. Among the tools applied ‘QCC’, ‘5s’ and ‘Muda’ have greater impact on the output factors compared to other variables.

Kaizen is process-oriented, that is before results can be improved, process must be improved (Imai, 1986). Improvement begins with measuring or defining the current process using value stream mapping to map the current state and future state map so as to identify the gap. The analysis results reveal that process mapping and visual management, standardization, layout and root cause analysis have greater impact on the effectiveness of Kaizen implementation.

This means that such Kaizen practice should be implemented in the organization to increase the sustainability of Kaizen. It is worth noting that other Kaizen tools such as ‘Process monitoring using statistical process control Mistake proofing’, ‘TPM (Total Productive Maintenance’ and ‘Layout Improvement’ also have significant influence on result of Kaizen implementation. This

implies that Kaizen tools tend to be dependent on each other and thus they should be implemented together to enhance the effect on the sustainability and performance of companies.

The results of the research show that empowerment had a strong relationship with overall Kaizen sustainability in that for one unit increase of empowerment, overall sustainability improves by 77.3%, ($\beta = 0.73$, Sig=0.000). Considering the impact of empowerment on the sustainability and impact, employee's suggestions in problem identification, solving the problem and generating small improvement at shop floor level has significant contribution to boost morale of employees and hence enhances positive employee participation. In a culture like in Ethiopia where power distance is high, employee engagement and satisfaction have great impact on Kaizen implementation. Kaizen practice should be implemented with consideration of cultural factors in the organization to generate higher performance.

The results also indicate the strong link between Kaizen sustainability and organizational performance. One factor (improved culture) was positively and independently affecting strategic performance. However, all the Kaizen sustainability practices (improved culture, longevity and institutional change) were positively and independently affecting operational performance. Although Kaizen sustainability is found to have greater impact on organizational performance (both operational and strategic) compared to the implementation factors, companies should apply and implement Kaizen flexibly and effectively to yield the highest performance.

Sustainability of Kaizen is measured by the factors such as improved culture, longevity, and institutional change. Improved culture is influenced by the following input factors: 'leadership commitment' with path coefficient value of 0.1723, 'empowerment' with path coefficient value of 0.2463 and 'tools applied' with path coefficient value of 0.3502 while 'Institutional change' is influenced only (but strongly) by the input factor 'leadership commitment' with a coefficient path value of 0.7143. From this we can infer that leadership commitment has stronger influence on longevity than any other factors while its impact is insignificant to the improved culture with the value of 0.1723(<0.2).

The PLS model in this research also shows that the tools used in the Kaizen implementation and empowerment influence more output factors than any other input group factors. Tools applied

affects operational performance and strategic performance (performance factors) and longevity and improved culture (sustainability factors). While empowerment affects improved culture, operational and strategic performance. This implies tools used and empowerment are critical success factors for implementation of Kaizen in Ethiopian Manufacturing context. The leadership commitment (input group factor) affects two output factors; improved culture and institutional change both (sustainability factors). Therefore, from the results of the analysis we can conclude that the role of leadership is critical to the sustainability of Kaizen.

V.3 Conclusion

This research examines the effect of the how and the context of Kaizen implementation on the sustainability and the performance of manufacturing companies in Ethiopia. The study follows the framework of the Kaizen practices implemented in Ethiopia as application of Kaizen tools, the kaizen thinking and EKI capacity building initiatives. Statistical techniques such as SPSS, PLS path analysis and regression analysis are applied to analyze the data collected from Kaizen implementing Ethiopian manufacturing companies through a questionnaire survey. The findings indicate that there is positive correlation on Kaizen Implementation factors (input factors) and sustainability factors in relation to performance of manufacturing companies in Ethiopia. The results of the study suggest that manufacturing companies in Ethiopia should emphasis working on promoting the Kaizen culture and empowerment of employees coupled with use of the Kaizen tools effectively and adapted to the context of each company to enhance the performance and achieve competitive advantage.

The study enriches the literature of Kaizen from the employee engagement perspective. Kaizen literature indicates that employees' involvement and ownership of the work they do and the thinking and organizational culture affect the success of Kaizen implementation. Context and organizational culture determine why certain Kaizen practices may or may not be effective, and in turn how they influence the sustainability and performance of companies.

Leaders in the manufacturing sector need to understand the dynamics of organizational culture and focus on the kaizen practices that will have greater impact in the future and that are more effective in a given organizational context. For any organization, the Kaizen tools applied and Kaizen thinking (lean thinking) become critical to success of Kaizen in terms of influencing organizational performance. The conclusion will benefit Kaizen consultants and leaders working in Ethiopia or those working with their Ethiopian partners who want to enhance the manufacturing sector in terms of improving quality, productivity and cost to make Ethiopian manufacturing sectors more competitive in local and global markets.

Although this research makes a significant contribution to Kaizen research only in the context of the manufacturing sector in Ethiopia, there is certain limitation we would like to recognize. First,

the survey respondents consisted of only manufacturing companies implementing Kaizen for at least three or more years through EKI support. Companies implementing Kaizen without direct support from EKI are not included in the survey as it was not possible to get information about them. Second, the research focused on the effect of the Kaizen implementation on sustainability and performance of companies without considering the culture effect on the transferability of Kaizen Culture, which is primarily Japanese culture and philosophy. National culture, as indicated in literature part of this research, has effect on the success of Kaizen implementation. As such, it would be strongly recommended to add an aspect of organizational/ national culture in the future research related to Kaizen sustainability in Ethiopian manufacturing sector in particular and in Kaizen implementation in Ethiopia in general. Third, the statistical analysis and relationships between factors were based only on the survey, which asked for employees to self-assess the goodness and extent of their Kaizen implementation, the sustainability of Kaizen, and the impact of Kaizen on their companies. While we wrote the statements that respondents were asked to rate in such a way as to make the ratings as objective as possible, we acknowledge that the survey results are based on personal assessment, rather than objective data. Two things especially strengthen our conviction that the findings are trustworthy: (a) that the data confirmed findings and conclusions of others (for example, on the importance of sustainability) and (b) that we were able to largely confirm the ratings in the companies we visited.

Future studies should expand the sample to have better and more comprehensive data and information. Scholars should also consider and analyze organizational culture as an important factor in the implementation of Kaizen culture in a different cultural context. Future studies should also attempt to explore the adoption of Kaizen practices and national culture(nationwide culture) in manufacturing companies in Ethiopia to understand the challenges and opportunities of transferability of Kaizen culture within Ethiopian culture.

V.4 Recommendations

The Ethiopian Kaizen Institute has future strategic plans to be center of excellence in Kaizen for Africa. To meet the intended ambition, EKI should learn about Kaizen from countries, practitioners and thinkers outside of their borders – as they are already planning to do. For that to happen, EKI should seek support through various forms of partnership from more experienced institutes globally. It would also be valuable to study the successes and failures of other countries in Kaizen implementation.

In Ethiopia, with huge opportunity in other sectors like tourism and agriculture, enhancing Kaizen culture and Kaizen thinking would be an important endeavor to improve competitiveness of Ethiopian manufacturing and non-manufacturing industries in the global market. Lean- Kaizen is very mature in the manufacturing sector but is also becoming essential management tool in services and other sectors. One more reason to invest in the application of lean- Kaizen thinking in Ethiopia is that as the economy is growing and facing challenges of competition in the global market. Young industries in Ethiopia will not be able to compete successfully in the global market unless improvements are made in the productivity, cost, and quality of their products and services.

In Ethiopia today, tourism is picking up. The hotel and restaurant industries are a few areas of big opportunities for lean –Kaizen thinking to be applied. Lean –Kaizen can also be practiced in Agriculture sector. More than 80% of the population of Ethiopia still lives on agriculture, and the sector is a primary contributor to the GDP of the country (34.8%; Wikipedia,2020).

To sustain the growth of Ethiopian economy and to make it competitive in the global market, strong leadership coupled with Kaizen is highly recommended to be adopted in the Ethiopian management approach, in the private sector, and also in the public sector such as education and governmental administration and services.

V.5 Key suggestions for Kaizen Implementation and Sustainability

In Ethiopia, Kaizen practices shall be applied as a management philosophy and leadership wisdom in all sectors to sustain changes achieved and to continuously improve the work culture and enhance operational excellence. The following are specific suggestions for all Kaizen implementing programs:

- Ethiopian Kaizen Institute is facilitating Kaizen implementation in Ethiopia. The institute should align Lean/Kaizen thinking with country strategy and priorities. Align Kaizen culture with Ethiopian cultural practice is also essential for the success of Kaizen as a culture to be transferred to Ethiopia;
- Measure, document and display operational performance (KPIs) to promote, encourage and communicate the results achieved;
- Emphasize Kaizen culture promotion and Lean-thinking leadership approach at countrywide level;
- Train and enhance empowerment (thinking, responsibility and authority) of employees;
- Exchange ideas and experience within and outside the country.

The recommendation from the research is to obviously continue Kaizen, to expand it, to promote Kaizen thinking, to emphasize Kaizen leadership and to really encourage leaders of all organizations to take it seriously. The success stories achieved through Kaizen Implementation in manufacturing sector can be scaled up to other sectors as well. Kaizen can and should be applied to the larger societal transformation. This research indicates that it is a fascinating idea and worthy of further research, further exploration and further development.

The idea of contextualization should be given attention for the success of Kaizen implementation and consequent sustainability. This research strongly suggests that finding similarities between Ethiopian culture, values and wisdom, and connecting those with Kaizen concepts would be a valuable area for exploration. It is also essential to identify and share success stories and to encourage people to learn from these achievements as part of expanding Kaizen more broadly in Ethiopia.

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APPENDIX

a. Questionnaire for data collection

Dear sir/madam,

I kindly request your kind cooperation to complete the questionnaire below designed for a PhD thesis. The purpose of the research is to study the **Effect of Kaizen Implementation and Sustainability on Operational Performance in your organization.**

Part I: General Information (profile of the respondents)

Please note that the information that you will provide shall be treated with utmost confidentiality and are for academic purpose only. Your honest participation in this survey will be highly appreciated.

1. Kindly indicate your gender (please tick appropriately).

Male ()

Female ()

2. Which one best describes your age?

18-25 years ()

26-35 years ()

36-45 years ()

46-55 years ()

Above 56 years ()

3. Kindly indicate the highest level of your education.

Basic Education ()

Diploma/Tertiary ()

Undergraduate ()

Masters & above ()

4. For how long have you worked for your current employer/Company?

0 – 5 years ()

6 – 10 years ()

11 – 15 years ()

15 – 20 years ()

Above 20 years ()

5. For how long has your organization been in the business?

0 – 5 years ()

6 – 10 years ()

11 – 15 years ()

15 – 20 years ()

Above 20 years ()

6. Please tick the subsector in which your firm belongs and the level of Kaizen Implementation (Level I or Level II)

subsector	Tick		
	Your company belongs to	1 st level implementation	2 nd level implementation
Agro			
Chemical			
Leather			
Metal			
Textile			

7. How long has your company been implementing Kaizen?

0 – 5 years ()

6 – 10 years ()

Above 10 years ()

PART II: *kaizen* Implementation (the tools, approaches and the context Kaizen has been implemented)

1. Please give your opinion to what extent you rate how **the tools** were used in Kaizen implementation in your company.

Indicate the extent to which the following tools were successfully applied in your Kaizen implementation	Not at all	Little	Moderate	Much	Very much
5S					
Visual Management					
Standard Work					
Process Mapping					
7 Mudass					
Quality Control Circles (QCC)					
Employee suggestion program					
Process monitoring using statistical process control					
Root cause analysis					
Mistake proofing					
TPM (Total Productive Maintenance)					
Layout Improvement					

Please give your opinion to what extent you rate how **the overall approach** of Kaizen implementation in your company.

Indicate the extent to which the following statements describe your Kaizen implementation	Not at all	Little	Moderate	Much	Very much
Senior leaders and managers going to the production floor					
Top management supported the organization's Kaizen initiative and activities					
There was clear and consistent communication on Kaizen stories and results/improvements achieved					
Quality Control Circles were used to make improvements and develop capacity					
Key Performance Indicators(KPIs)were used to measure performance					
Kaizen improvements were part of employee performance objectives and appraisals					
Your company used and relied on outside experts					
Your company developed and relied on internal expertise					
Your company didn't just apply Kaizen 'Tools,' but also promoted Kaizen 'Thinking'					
Kaizen was also applied in non-manufacturing areas such as human resources, finance and procurement					
Employees' suggestions were taken in my company					

We used ‘ problem solving’ teams before					
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Why did your company start its Kaizen journey?

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PART III: Kaizen Sustainability

2. To what extent have the following dimensions been sustained by *kaizen* improvement outcome?

Indicate the extent to which the following statements describe your Kaizen sustainability	Not at all	Little	Moderate	Much	Very much
Kaizen has become part of our organizational identity					
Kaizen is having a greater impact over time					
Shop floor employees are fully committed to Kaizen					
Team problem solving culture has been established					
Organizational structure and policies have enabled your organization to sustain Kaizen improvement outcome					
Working culture has been improved in your organization					
Kaizen has influenced our thinking to plan for long term rather than optimizing short-term performance					
Management accepts changes made as a result of Kaizen events					
Employees accept changes made as a result of Kaizen events					

PART IV: Operational performance

3. To what extent have the following operational performance dimensions been improved by *kaizen*?

Indicate the extent to which Kaizen contributed to these improvements since your company started Kaizen...	Not at all	Little	Moderate	Much	Very much
Increased company growth (in market share)					
Increased profitability					
Improved flow of production					
Reduction in lead time (from order to delivery)					
Improved manufacturing flexibility					
Improved product quality					
Lower inventory levels					
Improved productivity					
Improved efficiency					
Enhanced competitiveness					

Thank you very much for answering the questions

Abebe Nigatu Endalew

b. Factor Groups

Questions	Type of factor in the model	Factor Group
5S	tools	Implementation
Visual Management	tools	Implementation
Standard Work	tools	Implementation
Process Mapping	tools	Implementation
7 Mudas	tools	Implementation
Quality Control Circles (QCC)	tools	Implementation
Employee suggestion program	tools	Implementation
Process monitoring using statistical process control	tools	Implementation
Root cause analysis	tools	Implementation
Mistake proofing	tools	Implementation
TPM (Total Productive Maintenance)	tools	Implementation
Layout Improvement	tools	Implementation
Senior leaders and managers going to the production floor	leadership commitment	Implementation

Top management supported the organization's Kaizen initiative and activities	leadership commitment	Implementation
There was clear and consistent communication on Kaizen stories and results/improvements achieved	communication	Implementation
Quality Control Circles were used to make improvements and develop capacity	empowerment	Implementation
Key Performance Indicators(KPIs)were used to measure performance	Empowerment	Implementation
Kaizen improvements were part of employee performance objectives and appraisals	empowerment	Implementation
Your company used and relied on outside experts	outside consultants	Implementation
Your company developed and relied on internal expertise	empowerment	Implementation
Your company didn't just apply Kaizen 'Tools,' but also promoted Kaizen 'Thinking'	empowerment	Implementation
Kaizen was also applied in non-manufacturing areas such as human resources, finance and procurement	leadership commitment	Implementation
Kaizen has become part of our organizational identity	Improved culture	Sustainability
Team problem solving culture has been established	Improved culture	Sustainability
Kaizen is having a greater impact over time	longevity	Sustainability
Shop floor employees are fully committed to Kaizen	Improved culture	Sustainability
Team problem solving culture has been established	Improved culture	Sustainability

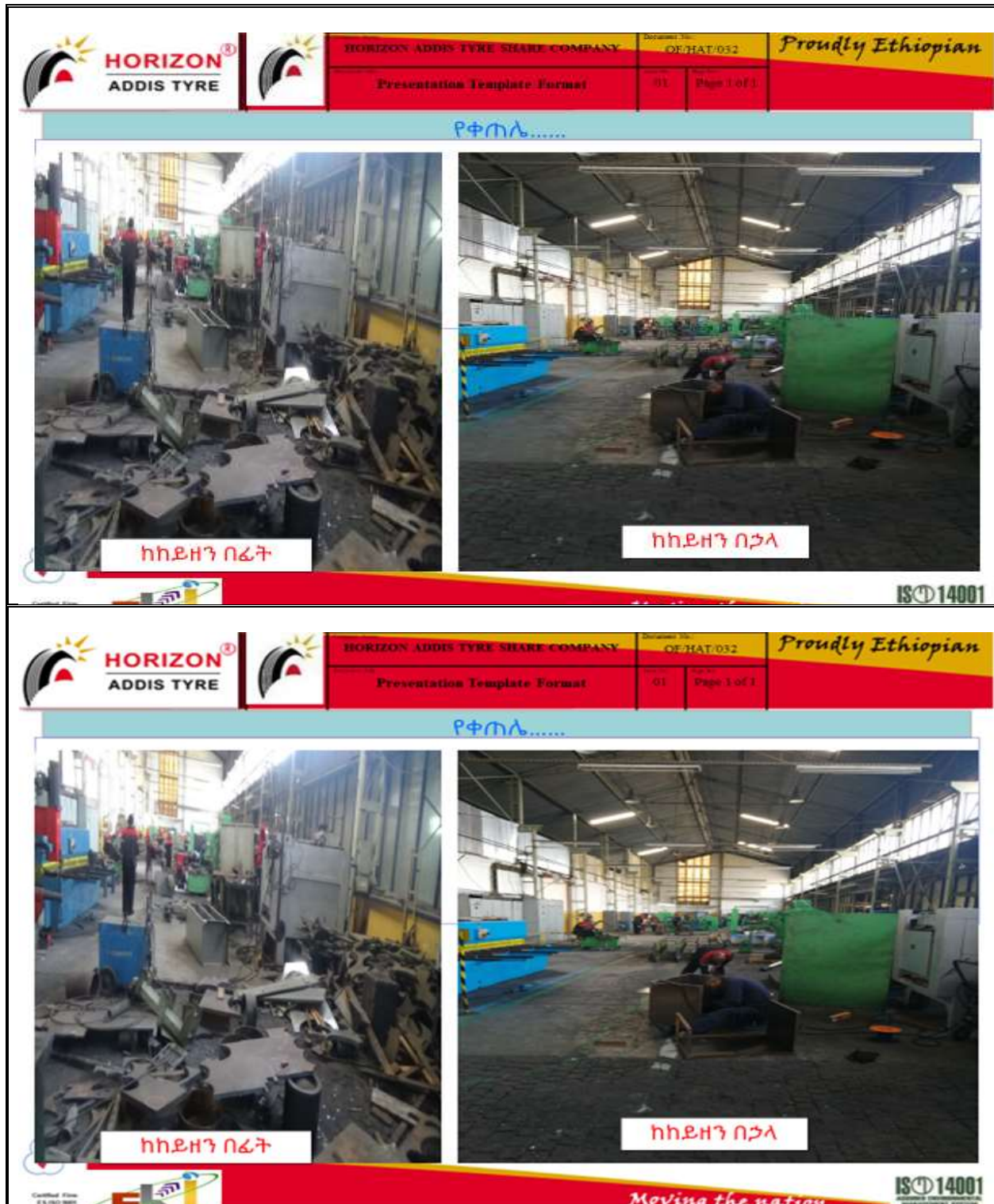
Organizational structure and policies have enabled your organization to sustain Kaizen improvement outcome	Institutionalized change	Sustainability
Working culture has been improved in your organization	Improved culture	Sustainability
Kaizen has influenced our thinking to plan for long term rather than optimizing short-term performance	Longevity	Sustainability
Management accepts changes made as a result of Kaizen events	Improved culture	Sustainability
Employees accept changes made as a result of Kaizen events	Improved culture	Sustainability
Increased company growth (in market share)	Strategic performance	Impact
Increased profitability	Strategic performance	Impact
Improved flow of production	operational performance	Impact
Reduction in lead time (from order to delivery)	Operational performance	Impact
Improved manufacturing flexibility	Operational performance	Impact
Improved product quality	Operational performance	Impact
Lower inventory levels	Operational performance	Impact
Improved productivity	Operational performance	Impact
Improved efficiency	Operational performance	Impact
Enhanced competitiveness	Strategic performance	Impact

c. Photos taken during company visits



Discussion with research adviser during field visits, this photo was taken at Company C5.

The 'Before' and 'After' Kaizen photos



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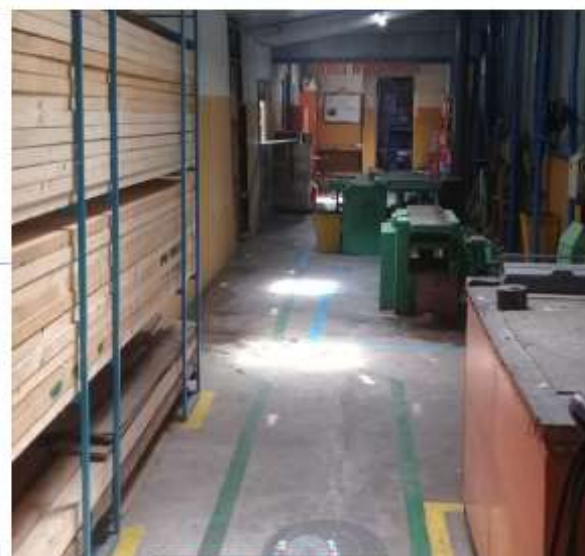
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		Presentation Template Format		01	Page 1 of 1

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ከካይዘን በፊትና በኋላ ፎቶ



ከካይዘን በፊትና በኋላ ፎቶ

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18 05 2018

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ከካይዘን በኋላ



ከካይዘን በፊትና በኋላ ፎቶ

ከካይዘን በፊት



ከካይዘን በኋላ



በክልቡ የተሰሩ አዳዲስ ፈጠራዎች ክልቡ ኤ

ሰከንደሪ ኮንታምነት ታንክ

በፊት ፎቶ



- ብዙ ማስቲሽ ወለል ላይ በመፍሰስ ይባከን ነበር፤ የህንጻ ለማስለቀቅ ተጨማሪ ሰራተኛ ይፈልግ ነበር
- ወለል ላይ በመፍሰስ አካባቢን ይበክል ነበር

በኋላ ፎቶ



- ምንም እይነት ማስቲሽ ወለል ላይ አይፈስም
- በሰራተኛው ላይ ይደርስ ነበረውን የሰራተኛ ደህንነትና ጤንነት ጉዳት ችግሩ ሊፈታ ችሏል።

ከካይዘን በፊትና በኋላ ፎቶ

ከካይዘን በፊት



ከካይዘን በኋላ



ከካይዘን በፊትና በኋላ ፎቶ



Kaizen Practices Training

የፈጻሚ ሰራተኛ ስልጠና		
ወንድ	ሴት	ድምር
258	548	806
አፈጻጸም 92.33%		

ስልጠና ለአዲስ ሠራተኞች		
ወንድ	ሴት	ድምር
109	198	317
አፈጻጸም 100%		



Employees Cleaning

ይፋዊ መከፈቻ ሥነ ሥርዓት





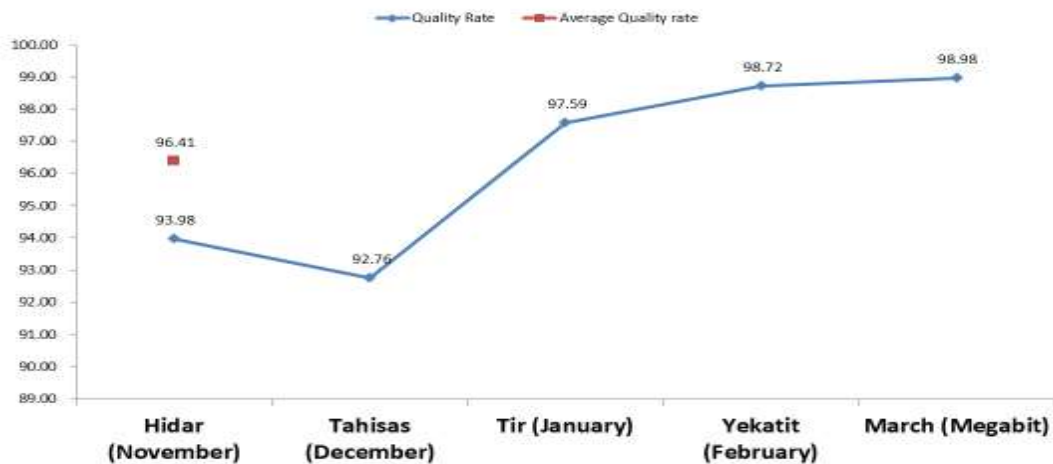
5S Application

Theme Selection Matrix

Evaluation items		Necessity				KPT Capability		Overall evaluation	Priority to table
		Importance	Urgency	Feasible for tackling	Upper Policy	Is the timing right?	Is the work possible to cope with		
1	Improve production planning.	5	3	5	5	3	4	25	2
2	Reduce cycle time	5	5	3	3	5	4	25	2
3	Increase employee skills	3	3	2	5	3	3	19	5
4	Reduce waste (Energy, leakage, rework	5	5	4	5	5	3	27	3
5	Improve production Process	5	5	2	3	5	2	22	4
6	Increase Machine efficiency	5	5	4	5	5	3	27	1

➤ Based on the above data of theme selection matrix ,increase machine efficiency in blowing and eko section has been selected as a Theme for the project

CODE-16 BM –Quality rate



Identifying Major Causes for (Av. Qu & Ef. loss)

Code- 16 Blowing M. Prioritizing the Availability loss



Mechanical Fault, machine setting, Mold Change & Electrical fault are the major contributors

Major problems in the Machines

Machines	KPI	Major Problems
Code 1- Molding Machine	Availability	❖ Mechanical, ❖ Electrical ❖ RM Heating
	Quality	❖ Bubble
	Performance	❖ Speed loss
Code 16- Blowing Machine	Availability	❖ Mechanical ❖ Fault, machine setting, ❖ Mold Change ❖ Electrical fault
	Quality	❖ Neck deformation, ❖ Base deformation ❖ Poorly shaped
	Performance	❖ Speed loss

Root cause analysis [Code 1 and code 16](#)

Cause Analysis

- ☐ Why-Why Analysis was used to find root causes of the major problems identified above
- ☐ Analysis was done by brainstorming with CFT members
- ☐ Critical root causes were selected by discussion using the following criteria
 1. Frequency
 2. Level of Effect
 3. Difficulty of Detection
 4. Cause for other effect
 5. Easiness of countermeasures
- ☐ Critical root causes were confirmed on ground

Kaizen Practice and its effect on improving work area



Improved Work Area ...

- ☐ Green and Clean Area

Sorting items – easy to locate



Layout and simple area movement



5S implementation results in one of the visited companies ' (obtained in the data base)

5S implementation results

	sort	Set in order	shine	Standardize	Sustain
ከ 5-ቀማ ትግበራ በፊት	33.83%	41.89%	41.63%	27.97%	24.47%
ግብ	82.62%	88.05%	83.29%	80.63%	72.84%
ከ 5-ቀማ ትግበራ በኋላ	85.71%	87.73%	92.85%	60%	50%
ግብን ከግሳካት አኋላ በመቀነስ	103%	99.63%	111%	74.4%	68.6%

[illegible]