

**Investigation of Kaizen Event Team Success Factors
In Kessem Sugar Factory**

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A Thesis Submitted to the School of Graduate Studies of Addis Ababa University in Partial
Fulfillment of the Degree of Master of Science in

Mechanical Engineering

Industrial Engineering Stream

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Addis Ababa University

Addis Ababa Institute of Technology (AAIT)

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October, 2018

ADDIS ABABA UNIVERSITY

ADDIS ABABA INSTITUTE OF TECHNOLOGY

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ACKNOWLEDGEMENTS

First of all, I am grateful to the almighty God for giving the strength to finish my MSc. Study. I would like to thank my advisor Dr. Ameha Mulugeta for his patient advice and encouragements. Also I would like to convey my gratitude to my co advisor Mr. Asfaw Regassa (PhD. candidate) for his support. My mother W/ro Mulu Sefiew deserves utmost thanks for her support through those difficult times. Finally, and most importantly, I would like to express my respect and love for my special man Cheney Aklilu. last but not least; I want to thank supervisors, employees and managers of kessem sugar factory for their adequate support.

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Addis Ababa

October 2018

ABSTRACT

Kaizen event team practices have been used by different manufacturing companies to lower manufacturing costs and increase product value. Kaizen event team activities are one way that sugar factories can increase their competitiveness. The success of Kaizen event teams have important to identify factors that contribute to Kazan's successfulness. However, a few researches have been focused on the Kaizen event team success within the sugar industry or on the perceptions of employees within this industry regarding either the challenges during the event or the main factors that are affecting Kaizen event teams. The goal of this research is to identify and analyze the success factor of Kaizen event team. To accomplish this research goal, a case study approach was used to identify kaizen event team success factors. As part of this case study, literature review was conducted concerning kaizen event teams; questionnaire and interviews were conducted with employee, supervisor, team leader and kaizen staff departments at the company. An improved kaizen event team implement framework was developed to measure the perceived successfulness of Kaizen event teams at the factory. From the analysis team formation with group composition have very strong positive correlation and significant. Management support with problem scope has strong positive correlation. Also the challenges that affect the kaizen event teams were analyzed. Then employ six factors extract from those criteria. Using AHP, construct evaluation frame with twelve evaluated criteria composed of extracted factors. Then fuzzy-AHP prioritizes the success of kaizen event teams. As a result, management support, team formation, and decision makings are the factors that affect the kaizen events. Based on those analyses the main factors have been clearly showed. Finally an improved kaizen event team implementation framework developed for the success of kaizen event team to be followed by other factories.

Key words: Kaizen, Kaizen event team, Fuzzy-AHP,

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LIST OF ABBREVIATION

GTP	Growth and transformation plan
TQM	Total quality management
TLI	Team Directed Learning and Development Inventory
TQC	Total quality circles
QC	Quality control
TPM	Total productive maintenance
EKI	Ethiopian kaizen institute
AHP	Analytical hierarchy process
TCD	Total crushing per
KET	Kaizen event team
BSC	Balanced score card
QCC	Quality control circle

CHAPTER ONE

1 INTRODUCTION

1.1. Background of the study

In Ethiopia one of the largest projects is the sugar industry to achieve the GTP plan of the government. Ethiopia has favorable weather condition, available water, and wide range of land scape (above 500,000hec.) for plantation of sugar cane. The country has been covering its sugar requirement through local production using nine sugar industries namely wenji-shoa, metehara, tendaho, arjo dedesa, kuraz, welkaite, beles, fincha, and kessem also there are four new constructing sugar factories. Those nine sugar industries are located in different region of Ethiopia. The factories engaged to nine month production time and four months service time overhaul maintenance. Currently, production of cane for commercial use is limited in four areas namely Wonji-Shoa, Methara, kessem and Fincha. Those sugar factories implement kaizen as a changing tool for smooth production process (corporation, 2015).

Kaizen has been considered as a basis of Japan's competitive success. Kaizen assistance is one of the standard menu items of Japanese industrial support in developing countries. While such assistance initially focused on East Asia where Japan had active business partnerships, now it has been implemented widely in other regions including South Asia, Latin America and Eastern Europe. However, as far as Sub-Saharan Africa was concerned, knowledge sharing and implementation of *kaizen* has been rather limited except in a few notable cases. There are a lot of unexploited benefits of selective and well calibrated application of *kaizen* from which African countries can draw upon to improve their production and service units. (GRIPS, 2009; Imai, 1997)

In the case of Ethiopia, though some private companies have started to implement kaizen previously, most companies have begun the kaizen events as of the beginning of the National Movement for Quality and Productivity Improvement (*Kaizen*), based on the Ethiopia-Japan Industrial Policy Dialogue (2009-2011). Considerable improvements have been observed in Ethiopian organizations which have implemented kaizen. (EKI, 2009)

The term kaizen was first introduced by Imai and define 'KAIZEN' is “a means of continuing improvement in personal life, home life, social life, and working life. At the workplace, KAIZEN means continuous improvement involving everyone, including both managers and workers. It is a small, low-cost, low-risk improvement that can be easily implemented.

Today Organizations are facing an increasingly turbulent environment. Learning from concepts founded on Scientific Management such as TQM and Quality Control Circles, the Japanese philosophy of Kaizen has permeated numerous organizations across the world. Kaizen teams have been used across all levels of organizations to promote ideas and projects to aid in creating a flexible learning organization adept to survive in such chaotic and unpredictable environments. Although a plethora of successful projects and improvements have been reported and employed in organizations, most teams are usually temporary and disband after a project has been seen from conceptualization to implementation. However, in some organizations, not all teams are disbanded; they may go on to look at another project or projects that can help their organizations. Despite these teams to help with organizational learning and development, the teams themselves are not provided with understanding the complexity of the team experience in terms of internal processes and outcomes – a Kaizen system for Kaizen Teams. Teams in organizations need to have a method to understand the complex nature of its experience, measure and map out significant aspects and to be able to create concrete action steps for their own development as a team

KAIZEN is a never-ending journey towards waste elimination, productivity improvement, quality improvement and efficient utilization of resources. If done correctly, KAIZEN helps to humanize the workplace, eliminate hard work, and teach people how to perform to the best of their abilities and reduce waste in the manufacturing process. The study focused on investigates the existing system of Kaizen implementation using kaizen event teams on Ethiopian Sugar Company.

1.2. Statement of the problem

Kaizen has been originated in Japan and applied by many countries including Ethiopia (Tigist, 2015). The Ethiopian government is considering Kaizen short and long term advantages particularly in the manufacturing sector which is established at Federal level as KAIZEN Institute to carry out broad based activities of ongoing quality and productivity improvement and

expansion of competitive industries and supporting the implementation of GTP. Kaizen has been implemented successfully across different industries and manufacturing sectors in Ethiopia, as a result significant achievements have been attained through the implementation of the Kaizen concept using the kaizen event teams

Even though many organizations understand the need to implement Kaizen at their workplace, not all companies are successful with their implementation. The reason is because managing Kaizen event team's activities is not an easy task (Pullin, 2005).

Kaizen Implementation in Northern Ethiopia's Manufacturing by undertaking three pilot companies shows that Kaizen event is partially implemented in the factories. Lack of employee to accept kaizen as a changing tool and executive manager's (Asayehgn, 2013).

Some organizations have failed to motivate their employees to participate in the Kaizen event activities due to the absence of compensation or reward, lack of proper training for the employees and long delays in getting the suggestions processed (Robbinson, 2004).

There are good qualities of kaizen event that make it preferable especially in developing countries. It directly impacts workers and managers by making them more productive; and hence makes business enterprises several times more competitive. Also it is a low-cost approach that doesn't require huge capital investment (Asmare, 2013).

Kaizen has been implemented to Ethiopian sugar factories, as a result significant achievements have been attained through the implementation of the kaizen concept (EMOI, 2011). But the resistance of the workers against any change and lack of monitoring on kaizen event teams are factors that faced in the factories. For the successful implementation of Kaizen everyone in each department should be responsible and participate.

On the other hand, there are a number of serious challenges and problems occurred during implementation of the kaizen program for instant, lack of highly skilled human resources, differentiated managerial tools, organizational culture, employee motivation and commitment and so forth (Asayehegn, 2013).

1.3. Research questions

1. What was the role of the kaizen event team in the case company at the implementation program?
2. How can a kaizen event team be successful in kessem sugar factory?
3. What supportive action the organizations take for the success of kaizen event teams?

1.4 Objective of the study

The general objective of the research is to investigate success of kaizen event team in Kessem Sugar Factory and propose an improved kaizen event team implementation framework to be follow for other factories intending to use kaizen as a change tool.

Specific objectives include;

1. To identify the existing system of Kaizen event team in the kessem sugar factory.
2. To identify and analyze the factors that affect kaizen teams to be successful in the factory
3. To identify and analyze challenges encountered during formation of Kaizen event teams.
4. To proposed a solution to be followed by other factories during formation of their kaizen event.

1.5 Significance of the Research

This study is significant for kessem sugar factory because it tried to investigate the success of kaizen event team's on the company and suggests the way to be followed. Kaizen institute had their own measurement in evaluation system those factors are organizational, team individual, and team task. Concerning those measurements the study allocates the factors that are the main obstacles for the company. The result of this research could be applied by the Factory under study to realize its achievements, lessons drawn and ways of keeping up the improvement wheel to go forward on a continuous basis. In particular, the following significances are listed

- It is an opportunity for the factory to get recommendations on its kaizen event team success.
- The organizations which have been started to work through kaizen event teams can use the research findings to improve their means of kaizen team formations.
- It can be used as references for other students.

1.6 Scope of the Research

This research is focused on kaizen event teams and their success in kessem sugar factory which the researcher believes that it can reflect the cases of other organizations. Identified challenges for the success of kaizen event teams. The research also focused on the organizational, team formation and team task factors which had an impact for the measurement of the kaizen team in the factory.

Furthermore, though various success approaches have been used in kaizen event team, the researcher had chosen the kaizen event team formation; team task and organizational supports were the main problems in most organizations, in general, the factory under study, in particular. Also these factors are used by Ethiopian kaizen institute as an evaluation criterion except team formation.

1.7 Limitation of the study

Though maximum efforts have been made to successfully undertake the research, the following limitations affected the as-scheduled completion and/or quality of the research:

- Lack of sufficient information from respondents,
- Shortage of reference materials especially in Ethiopia, in particular, kaizen event teams
- shortage of time and finance,
- Lack of properly documented information about kaizen teams and access to the information and constraint getting key officials.

CHAPTER TWO

2 LITERATURE REVIEW

2.1 Basic Definition and principles of Kaizen

In the decade of 1980, management strategies were focusing on employee involvement, and empowerment through teamwork approach and communications and on improving job design were not new, but Japanese companies had seem to implement such techniques much more effectively than others .The business lesson of the 1980's was that Japanese firms, in their quest for global competitiveness, had been demonstrated a greater commitment to the philosophy of continuous improvement than Western companies did (Bowls, 1991). For such a philosophy the Japanese used the term Kaizen.

Kaizen means improvement, continuous improvement involving everyone in the organization from top management to workers. In Japan, the concept of Kaizen is so deeply engrained in the minds of both managers and workers that they often do not even realize they are thinking Kaizen as a customer-driven strategy for improvement (Imai, 1986). Kaizen is people-oriented and its application involves everyone in the organization from top management to workers at the shop floor (BergerA., 1997).

Kaizen is an effective approach to improve the productivity. There is a lot of controversy in the literature as well as the industry as to what Kaizen signifies. Kaizen is a Japanese philosophy for process improvement that can be traced to the meaning of the Japanese words 'Kai' and 'Zen', which translate roughly into 'to break apart and investigate' and 'to improve upon the existing situation' (Aasheet Kumar, 2014).

As Kaizen is a continuous improvement process involving everyone, managers and workers. Imai (1986) strategically explain the Kaizen concept as a strategy to include concepts, systems, and tools within the bigger picture of leadership.

Also explained improvement in Kaizen can be divided into Kaizen and innovation. According to Imai, Kaizen signifies small improvements as a result of ongoing efforts while, innovation involves a drastic improvement as a result of large investment of resources in new technology or equipment. Further Imai explained the relationship between management and Kaizen, for Imai,

management has two major functions maintenance and improvement (Imai, 1997). For this research purpose the researcher was discussed the two major functions.

Womack (1996) states Kaizen as a lean thinking help organizations systematically to reduce waste (muda, any activity that absorbs resources but creates or adds no value, the researcher will discuss the concept of muda on the next sections). They also stated the difficulty of muda recognition within the work area by the workers until they are told to perceive it.

Cheser, (1998) explain that, Kaizen is based on small changes on a regular basis eliminating waste and continuously improving productivity, safety, and effectiveness. Further Cheser discussed the concept of Kaizen have been applied in both manufacturing and service industries too.

The problem of traditionally managed organization will partly be avoided by the application of Kaizen management techniques (Assefa, 2010).

According to Thessaloniki, (2006), "the essence of Kaizen is that people that perform a certain task are the most knowledgeable about that task". This very notion helps to capitalize the requirement that implementation of kaizen involves employees at all levels.

As kaizen implies change and become good, after engage in kaizen, therefore, is expected to go beyond one's contracted role(s) to continually identify and develop new or improved processes to achieve outcomes that contribute to better realization of organizational goals (Newitt, 1996).

Kaizen is an umbrella concept covering most of those "uniquely Japanese " practices " like customer orientation ,TQC (total quality control) robotics, QC circles, suggestion system, automation, discipline in the workplace , TPM (total productive maintenance), Kamban, quality improvement, zero defects, small-group activities, cooperative labor management relations, productivity improvement and new-product development" these principles and tools significantly helped Japanese companies to develop process oriented way of thinking that assures continues improvement involving people at all levels. According to authors in the area; all activities that directly or indirectly involve improvement in productivity come under the Kaizen umbrella (Imai, 1986) (GRIPS, 2009).

2.2 The three pillars

There are three important kaizen rules which can be applied in Gemba are Housekeeping, waste elimination and standardization (Kr, 2011). Housekeeping is involved using 5S method. Waste is any cost raising activity without adding value for the organization. Standardization refers to doing certain job in best way; it ensures quality and avoids recurring problems. As a general rule standardization assure reduction of 50% failure rate and further 50% can be assure by implementing standardization.

Once the standards are in place and are being followed then if there are deviations, the workers know that there is a problem. Then employees will review the standards and either corrects the deviation or advice management on changing and improving the standard. It is a never-ending process and is better explained and presented by the PDCA cycle (plan-do-check-act), known as Demming cycle. To implement Kaizen, companies will adopt the Plan-Do-Check-Action (PDCA) cycle to solve both unit-functional and cross-functional problems in their activities.

A successful PDCA cycle then is followed by the SDCA cycle where 'S' stands for standardization and maintenance of the new situation. So, PDCA stands for improvement and SDCA stands for maintenance (Imai, 1986).

Thus the SDCA cycle standardizes and stabilizes the current processes, whereas the PDCA cycle improves them. SDCA refers to maintenance, and PDCA refers to improvement; these become the two major responsibilities of management.

(Masjuki, 2003)Suggested using Deming's PDCA which is an excellent technique in monitoring and problem solving for continuous quality improvement where any bright ideas of individuals can be accommodated.

2.3 Kaizen implementation process

Kaizen implementation is not once in a month or once in a year activity. It is continuous. Kaizen is based on making little changes on a regular basis namely, always improving productivity, safety and effectiveness while reducing waste. Suggestions are not limited to a specific area such as production or marketing. Kaizen is generally based on making changes anywhere that improvements can be made (Imai, 1997). In business Kaizen encompasses many of the components of Japanese businesses that have been seen as a part of their success. Quality circles,

automation, suggestion systems, Just-In-Time delivery, Kanban and 5S are all included within the kaizen system of running a business.

The study of Asayehgn, (2013) states systematic process of utilizing the Kaizen strategy, and to assess the steps used by the Company case to implement the 5S, lean thinking, and just-in-time strategies to improve quality and productivity outcomes. The researcher takes that 5S is a Kaizen system which applies for individual or in team at work place.

Kusni, (2016) States that kaizen implemented as 5S, Organizational Commitment, and 3M. The 5S concept is basically the process of changing attitudes by improving workplace arrangement, cleanliness, and discipline. It also includes 3M concepts, muda (eliminating the waste); mura (eliminating difference); muri (eliminating tense).

For successful kaizen implementation the Management-oriented kaizen activities, Group-oriented kaizen activities (5S and 3M), Individual-oriented kaizen activities, and Organizational capabilities are plays a great role (Suhaiza, 2015).

Effective kaizen team implementation led for success. According to Asayehgn, (2013) study effectiveness of kaizen used by the company case is to implement the 5S, lean thinking, and just-in-time strategies to improve quality and productivity outcomes.

The above stated authors raise different systems used by different case which helps to identify the main systems used for kaizen implementation program. Kaizen event team members have their own role besides 5S and 3M mainly used in many organizations it helps the kaizen event program. The team members compute each other by modifying new design or by bringing consumable materials in to use. Also those activities for successful kaizen implementation program are more prospects if the employees are willing to put their impact for the sake of success. This study more focused on the kaizen event team's formation and tasks which was more effective and important for once industry.

2.4 Kaizen event teams

Kaizen events allow participants to analyze a process, identify improvements, develop a project implementation plan for change and give them the tool to measure their success. Following the event, team should hold regular progress status meetings using their kaizen implementation plan

as a guide; the frequency of the meetings change as project plan goals are met. Kaizen event use to

- Create rapid results
- make a difference to generate victories
- Attack Hanging fruits (inactive workers)
- Can be applied to any process
- Eliminating wastes and inefficiencies

A kaizen event teams, as task force, teams that do not form a permanent part of the organizational structure and has been involved in a secondary task for their members. The main difference with other group suggestion systems such as quality circles is it needs short period of time to accomplish the events. Kaizen Events normally last from four to five days, while quality circles and similar systems can be active for months or years. According to Cohen (1997) Team effectiveness encompasses three areas: performance, effectiveness, and member attitude.

Moreover, Kaizen Event teams are externally managed groups: they only have the responsibility of achieving specific improvements in specific areas and management designs the group task, selects the components, sets out the basic rules to achieve the objectives, etc. Management also guides the group task and supervises group results, as well as designs the organizational context the group is to work in and sets up the reward system and training or information that the group is to receive (Hackman, 1990; Montabon, 2005; Rees, 1997).

2.5 Kaizen event team effectiveness

Team effectiveness can inform the study of Kaizen events, by identifying the types of input factors and process factors that may be relevant to the study of Kaizen events (Cohen, 1997). The types of teams most relevant to the study of Kaizen events are parallel teams and project teams. Parallel teams are cross-functional teams focused on a specific task or problem that regular organizational structures are not well equipped to handle. As traditionally used in organizations, parallel teams often do not have authority to immediately implement changes but instead only have the power to recommend changes to senior management. “Traditional” CPI teams are often parallel teams. On the other hand, project teams are time-limited, cross-functional teams focused on a one-time product. The output of project teams may be an incremental improvement over an

existing design or idea, or a radically new design or idea. In contrast to “traditional” CPI teams, Kaizen events more closely fit the definition of a project team, in that they are clearly time-limited, focused on a one-time product, and typically have considerable implementation authority.

Team effectiveness can be measured through performance outcomes – such as the quality and quantity of the product/service provided, attitudinal outcomes – such as employee satisfaction and commitment, and behavioral outcomes – such as turnover and safety measures.

2.6 Critical success factors for success of kaizen event teams

According to Jennifer, (2006) identifies that kaizen event team success factors has been discussed

1. Goal clarity: - the team was not invited to discuss the goals with the sponsor or to ask questions to clarify the sponsor’s expectations. This method of communicating the goals to the team likely made it more difficult for the team to achieve improvements.
2. Lack of representation of the team from a key function, thus likely limiting the appropriateness of the teams solution and reducing the likelihood of post-event implementation, due to lack of input and buy-in from the function.
3. Decision- making authority: - when the authority to make decisions to improve the work area in the stated goals of the event entirely negated by management.

According to Cohen, (1997) Factors Groups for Kaizen Events

Table 1: Factors Groups for Kaizen Events

No		Factors
1	Task	Task Design Factors
		Team Authority
		Problem Scope
2	Team	Group Composition Factors
		Team size
		Use of Cross-Functional Teams
		Team Structure
		Functional Heterogeneity
		Team Member Problem-Solving Abilities
Team Member Attitudes		
3	Organizational Context Factors	Management Support
		Resource Support
		Rewards/Recognition
		Communication
		Event Planning Process
		Training
4	Event Process (Internal Process Factors)	Action Orientation
		Problem Solving Tools/Techniques
		Team Coordination
5	Broader Context	Kaizen Event Deployment
		Organizational Policies/Procedures
		Kaizen Program Support

Table 2: success factors

Authors	Factors
Jafri Mohd Rohania et.al (2015)	Tools and techniques, team work, goal clarity, communication, training and education
U. Dombrowski et.al(2014)	Employee thinking capability, problem solving, waste elimination process, work force management
P.G. Saleeshya et.al (2012)	Tools and techniques, work force empowerment, team work, goal clarity
Jeremy Huwe.et.al(2008)	Managerial involvement and support
Mefford (2009)	Management commitment communication, employee involvement

Different authors suggest criteria to measures the effectiveness of team outcomes. Cohen (1997) States measure of

- Performance effectiveness assess in terms of quantity and quality of outputs e.g. efficiency, productivity, customer satisfaction, and quality.
- Member attitude (employee satisfaction, commitment, and trust in management).
- Behavioral outcomes (absenteeism and safety)

On the other hand Hackman (1987) three criteria to evaluate team outcomes:

- The result of the teams' work
- The willingness and capability of the team to continue working together in future
- Individual consequences of collaboration i.e satisfaction, and physical and mental health.

Rasker, van Vliet, van den Broek, and Essens (2001) provided a comprehensive review of the team effectiveness literature, according to their framework the team effectiveness factors are stated in detailed

- Situational
- Organizational
- Team/ Individual
- Task

2.7 Kaizen event team formation and their roles

The most known small groups are the cross-functional teams which formed to conduct kaizen events. The team assembled for a kaizen event is responsible for attaining the results targeted by the team itself. A kaizen team typically consists of between five and ten members and is guided by a facilitator. These individuals perform the process analysis necessary to create an implementation plan for change. The kaizen event teams are formed with in the members that are included:

- a. **Sponsor:** - Sponsors have the power and/or influence to impact the success of a project. They are active champions visible to the rest of the organization. The project sponsor has ultimate accountability for program success, and will provide visible leadership through the organization in support of the initiative.
- b. **Process Facilitator:** - Manage meetings and adapt the meetings to meet evolving needs, changing circumstances, participant input, or recommendations of the sponsor and team leader.
- c. **Team Leader:** - Serve as the chief operating officer for the project. Responsibilities may also include implementing the new standard of work process and sustainability practices.
- d. **Team Members:** - Work with others to achieve or exceed project goals.
- e. **Role of Management:** Develop and promote a culture that values continuous improvement

Table 2: kaizen event team roles

No	Members	Responsibility
1	Sponsor	<ul style="list-style-type: none"> ➤ Determine the purpose, goal, scope of the work, and participant roles/responsibilities (complete Project Plan); ➤ Arrange for a process facilitator and team leader; ➤ Advise the team leader and assure that he/she understands his/her responsibilities before, during, & after the Kaizen Event; ➤ Invest the necessary time/oversight (e.g., participate in daily Kaizen progress reports, attend Report Out); ➤ Help the team obtain resources; Keep the team focused;
2	Process Facilitator	<ul style="list-style-type: none"> ➤ Time management – starts and end meetings on time, and manages discussions to achieve meeting objectives. ➤ Remain neutral and objective. ➤ Work with Team to develop and uphold ground rules. ➤ Overview participant responsibilities, Prepare meeting agendas. ➤ Facilitate the team and mediate conflicts Coach and educate team members/others.
3	Team Leader	<ul style="list-style-type: none"> ➤ Help lead team and guide process, Focus the team ➤ Negotiate with managers/supervisors for resources (with sponsor) ➤ Serve as a team member
4	Team Members	<ul style="list-style-type: none"> ➤ Develop and enforce team ground rules ➤ Document the current work process and develop a new standard work process ➤ Prepare and deliver a report out presentation to leaders & stakeholders ➤ Promote and support the implementation of the new standard work process.
5	Role of Management	<ul style="list-style-type: none"> ➤ Encouraging team members to work collaboratively and find creative solutions ➤ supporting the team in their ability to achieve short and longer term goals

		<ul style="list-style-type: none"> ➤ Visiting the team throughout the week and attending Friday afternoon's Final ➤ Presentation ➤ educating self and others about Lean principles, practices and results ➤ Advocating for continuous improvement and streamlining of agency processes
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Source: (Karen, 2007)

2.8 Background of Kesseme sugar factory

Kesseme Sugar factory: - located at afar regional state of Ethiopia near to metehara sugar factory. Kesseme sugar factory was an expansion from metehara sugar factory. Then after two years it starts its own production and co-generation in March, 2015; with land of 20000 hectares of cultivated canes.

It has been the capacity of 6000 tons of cane crushing per day which gives 153,000 tons of sugar & 12,500 meter cube ethanol. Moreover, the factory out of the total 26 megawatt electric power it generates 15 megawatts to the national grid. (corporation, 2015). The factory creates job opportunities for the local communities. Also Infrastructures available like hospitals, schools, and road and so on.

The factory currently has 1500 permanent employees. In addition to permanent employees the organization had also casual and seasonal (monthly) workers. The factory has one general manager and six Deputy General Managers (DGM's) i.e. (agricultural operation, civil agriculture infrastructure construction and maintenance, factory operation, human resources, finance and supplies and facility management). The kaizen team within the change management and human resource development department found under the deputy general manager human resources, The Kaizen unit is responsible to disseminate and follow-up Kaizen activities in the factory, jointly with the human resources. Besides, the Kaizen/change management section organize teams or in Amharic (KELIBU) members and follow performance of team members activities.

The organization has 81 registered (KELIBU) teams

Kesseme sugar factory emerge the kaizen implementation practice at 2015. The study criteria for selecting this new factory is: -

- Through the challenges of successful kaizen teams in new factories
- Lack of organizational measurement of kaizen event teams
- Lack of culture of award and recognition for the team
- Also less production rate from other factories

2.9 Summary

From the above literature survey on kaizen event team success especially top management support, it could be concluded that different studies have been done to the successful of kaizen event concerned different ideas. Most of the studies focused on kaizen event team effectiveness, kaizen event team's role, and kaizen event team evaluation. Thus, from the literature out puts, it could be concluded that kaizen implemented in the manufacturing sectors. But, study on the kaizen event team successful implementation, which were not given due attention in different reviewed literatures. Hence, further investigation was needed to successful kaizen implementation by focusing on the kaizen event team issues especially on their effectiveness which were not previously given thorough attention.

Table 3: Summary of Literature review

Authors	Objective	Outcomes
Manuel F.	Kaizen with in kaizen teams: continuous and process improvements in a Spanish municipality	The study focused on kaizen teams in public sector also such teams should practice kaizen philosophy of continuous improvement and process improvement processes
Wiljeana Jackson G lover: 2010	Critical success factors for sustaining kaizen event outcomes	The factors that were most strongly related to sustainability outcome were identified: - work area characteristics and post-event characteristics
Sevtap Erdogan: 2016	Measuring effectiveness of kaizen events within the wood products industry	The study finds out sustainability of kaizen events are affected by motivators, barriers, and drivers to

		kaizen (such as employee awareness, training, and teamwork so on) also nonparametric and parametric statistics were used to measure the effectiveness
Jennifer A. 2006	Learning from less successful kaizen events	Focused on giving attention for less successful kaizen event also present a set of methods and measures to evaluate and analyze kaizen event performance.
Jennifer A. 2008	Critical success factors for human resource outcomes in kaizen events	The study identifies the set of input and process factors that most strongly relate to the development of employee attitudinal outcomes and problem-solving capabilities in kaizen events
Rasker, 2001	Effectiveness of teams	The study list out the factors of effectiveness of team Situational Organizational Team Individual Task

From the above reviewed selected literatures on kaizen event team's success in manufacturing company's concept of Critical success factors for sustaining kaizen event outcomes, measuring effectiveness of kaizen events, and Kaizen with in kaizen teams was the main outcome of those literatures. So this study has been made out concept of kaizen event team's success.

The result of measurement is mostly used for control purpose and not actively used for kaizen event teams, this study putout key kaizen team measurements. Those measurements will help the team sustained their success. Such as (Cohen, 1997; Glover, 2010; Jennifer, 2006) literatures according to kaizen teams are more concerned on structure, factors that were most strongly related to sustainability, activity and organization of the team also kaizen teams engage in kaizen process were briefly discussed current study will focus on kaizen team formation, kaizen team

monitoring and evaluation, which are process that lead to successes and sustainability of kaizen events.

This research aimed to assess existing practices in kaizen event team evaluation, and measurement systems. After measuring the kaizen event teams it would be analyzed the literature gap. Finally the study proposed appropriate measurement and improvement framework so as would see one step increment in global competitiveness of the sector and sub sector.

2.10 Argument of the research

According to the above literature reviewed there were some agreements and arguments of the researcher. The researcher had been agreed that kaizen event helps to eliminate waste by empowering employees with the responsibility, time, and tools to support change (palmer, 2001). Kaizen event team members have been applied low-cost problem solving tools and techniques to rapidly plan and, often implement improvements in a target work area.

The Kaizen event needs to be implemented in an organized manner with well-defined roles for participants. Kaizen events focus on low-cost changes, rather than changes requiring significant capital investment. Also Kaizen events can apply for multiple tasks in a given work area to create cycles of improvement in the work area. Kaizen events often generate immediately perceivable performance improvements.

The study of (jennifer, 2008) states that kaizen event outcomes investigates the relationship between technical system outcomes (overall success, impact on area, and percentage of improvement sustained), work area factors (employee behavior, employee stewardship, and employee problem solving knowledge), and follow- up mechanisms (amount of resource invested, management review meetings, and training and so on). The researcher agreed to the idea of measurements of kaizen event encounter strengthens the kaizen teams. Also for strengthen the teams monitored and evaluated their activities would be helpful.

The study mainly focused on kaizen event team's success factors which affect the kaizen event. Those success factors appeared in most of manufacturing factories. Kaizen team formation have been done randomly not through systematic way which means it was selected without concerning the measurements of evaluation criterion. For example in EKI kaizen event evaluate according to three main categories. Those are organizational, kaizen department and individuals.

The evaluation has been done through interviewing, observation or by questionnaires for employee.

The kaizen team starts from proper formation of members to be functional for a long period of time. This paper tried to extract and prioritize those factors to successful implementation. The study has been stated that kaizen team plays a great role in aligning the company's strategic goals and identified the factors that affect the event. Effective kaizen team activity involves in directing the kaizen event toward the right direction. Those effective kaizen event team activities document the current process, identify waste, planning, problem counter measure, actions, verify change, measure the result, make it standard, and do it again. Based on these the researcher mainly focused on kaizen event team success factors which were affecting the kaizen events. By identified and analyzed those factors that are most strongly support the kaizen event.

There are a lot of articles based on kaizen events and the factors that affect the implementation program. Kaizen event teams face those factors during the program. The kaizen event team success is the productivity of once organization. Ethiopian author's kaizen event discussed with its importance and challenges to the companies in different sector. But there is a lack of researches regarding kaizen event team success and challenges. The main purpose to identified and analyzed success factor of kaizen event team is to assure that kaizen event is everybody's business. That involves every team member to actively participate for the sake of the team also for the organization.

CHAPTER THREE

3 RESEARCH METHODOLOGY AND APPROACH

This chapter explained about the overall design of the research and the methods used to collect relevant data for the accomplishment of the research. It consists of four parts. The first part is the literature review, the second part introduces the design of the research, the third part discusses about data collection (qualitative and quantitative) and the fourth part illustrates the general framework of the research.

3.1 Research Design

Research designs are core issues for studies to be realized. According to different authors research design is important to facilitate the smooth- sailing of the various research operations, thereby making research as efficient as possible yielding maximal information with minimal expenditure of effort, time and money.

Both qualitative and quantitative data were essentially motivated by the need to gain an insight into the factors that affect the kaizen event team in Ethiopian sugar factory. The methods to collect data would be shown below.

3.2 Research Framework

The figure below shown the procedures followed to carried out the study. Different concepts, tools and data were applied in designing the following research framework.

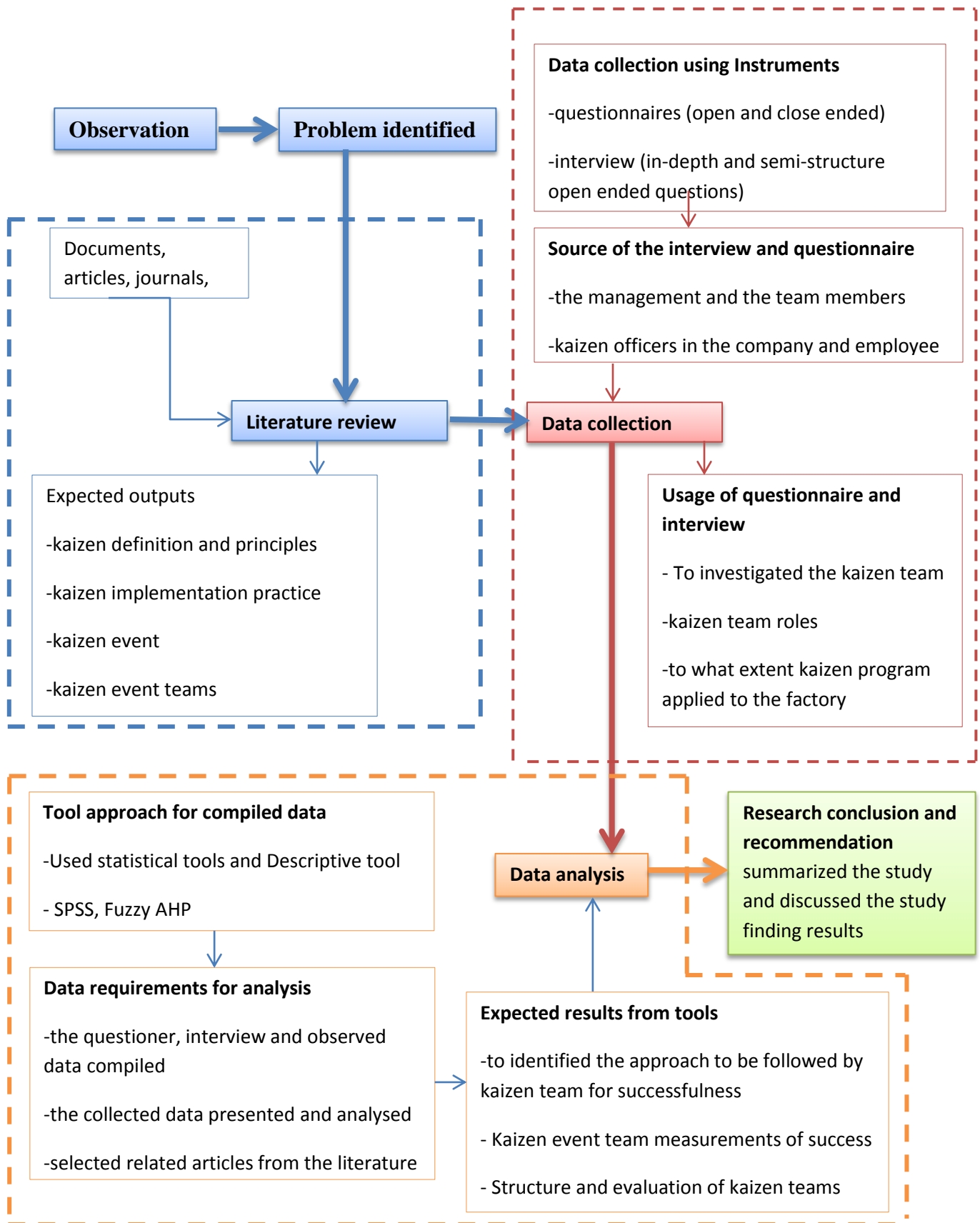


Figure 1: research framework of methodology

To meet the key objectives of the research, qualitative and quantitative methods and combination of primary and secondary sources of data have been used. The data gathering methods were discussed in following sections.

3.3 Data collection

The data collections were done through: observation, literature review interview, questionnaire and review of secondary data.

1. Literature review

In the literature review documents, related books, journals, previous reports, working papers, articles, and online references were used as source of data and information for the study.

90 articles were found from various references publications from 1964 to 2017 G.C. each selected articles which was related to the successful implementation of kaizen especially kaizen definition and principles, kaizen events, kaizen event teams, and effectiveness of kaizen event teams are found to be relevant to this study. Among those reviewed articles 42 articles were selected those are related to the concepts of the study. Finally the literature gaps have been listed out and concluded. Also the argument of the researcher that needs further investigation was identified.

2. Direct observation

The information was sought by way of investigator's own direct observation without asking from the respondent. Information's such as the managements approach to this practice, kaizen teams activities such as observe the evaluation for kaizen practices, the factory production store organization, and other related issues to implementation of kaizen practice. Documents observed such as best executer of the week announced in board. These was one way motivated the employee to succeed in their workplace. Some rework materials of kaizen event team in recent years were displayed in the workshop. Data's that was needed to stand all the day watched all factory (case company) plants according to kaizen team activities. The (kalibu) or kaizen event teams formation and their schedule of task.

3. Interview

In this study, key informants were selected from the case company kaizen department management officers. Those officers assigned for HR, plantation, irrigation and factory departments had Interview with the key kaizen management officers from case company were done.

In this study, the interview were conducted to collect information regarding the kaizen event teams aiming to; understood the existing working habit of kaizen event teams, identified the core factors for effectiveness and their causes also to analyzed the challenges. During the interview process the time mostly took was 20-40 minutes to completed. (Used in-depth and semi structured interviews) the questions were open-ended to allow for the widest range of answers and to allowed for flexibility, kaizen expert and from company officials, supervisors, kaizen officers. From the interview the researcher had been collected data from kaizen department which help the investigation were clear. Detailed information about the interview questions and key informants were given in the Appendix D.

4. Secondary data

Collection of secondary data were done through gathering data from documents (such as Ethiopian kaizen institute magazines, also the checklist of kaizen event evaluations (Appendix B) that have been used for concerning the main measuring metrics of the institute. There are three measurements for the evaluation process organizational, team, and team task. The researcher were used some of the metrics as a success factor for the kaizen teams. Kaizen department documents were used to see their checklists evaluation criterion; related books, journals, previous reports, or other published sources have been used as source of data and information for the study. Secondary data entailed the proactive seeking of existing data in both qualitative and quantitative research. It could also helped to interpret the primary data.

5. Questionnaire

In this research, questionnaires were used to assess the kaizen event team's effectiveness in the sector. Well-structured questions began with general and non-personal background questions have been made the respondent feel comfortable. The questionnaire included categorical and open-ended background questions, as well as Likert-scale questions asked respondents to agree

or disagree with statements related to Kaizen practices. Those questions were grouped according to the discussed objectives for this research. The questions concerning on

- Background characteristics of respondents
- Organizational
- Team (structure and task)

3.4 Target population

The factory currently had 1500 regular employee. In the factory there are four sector groups divided in to different departments. Factory operation, human resource, finance, and supply and facility management are the sectors implement kaizen in their work places. All of the team leaders and supervisors were taken as respondents. Due to the questionnaire designed concerning to the management groups. The other sectors factory operation human resource, finance, and supply and facility management employee responses were included according to their team member structure and out of the team members. From kaizen team members of the factory randomly included. Because, of their unstructured size of the members. The target populations of 447 employees are the respondents for questionnaires.

Table 4: -Target population

No	Category	Departments	No of employee
1	Team Leaders		4
	Boiler supervisors	operation, electrical and technic	11
	Mill house supervisors	operator, electrical and technic	9
	Evaporation and pan house supervisors	operator, electrical and technic	9
	Coordinators of the factory		9
2	Factory operation	Technique	13
		Production	12

		Operation	16
3	Human resource	Human resource fulfill administration	3
		Human recourse development and improvement	4
		Health service	6
		Gender office	5
4	Finance	Cost section	5
		Budget section	3
5	Supply and facility management	Material planning and inventory management	5
		Procurement	3
		Resource management	3
		Facility management	4
6	Kaizen team members		405
	Total		447

3.5 Sample size

To determine the sample size with given target population

$$n = \frac{NZ^2p(1-p)}{e^2(N-1) + Z^2p(1-p)}$$

Source: (Ketkesone, 2009)

Where n is the desired sample size,

N: target population

Z: the standard normal deviate usually set at 1.96 (which corresponds to the 95% confidence level)

P: the proportion in the target population to have a specific characteristic. If no estimate available set at 50% (or 0.50)

q: 1-p d: absolute precision or accuracy, normally set at 0.05. (Margin of error of ± 5%)

$$n = \frac{447(1.96)^2 0.5(1 - 0.5)}{(0.05)^2(447 - 1) + (1.96)^2 0.5(1 - 0.5)}$$

n= 207

Table 5: sample respondents

No	Category	No of employee	sample respondents
3	Team Leaders	4	4
	Boiler operation, electrical and technic supervisors	11	11
	Mill house operator, electrical and technic supervisors	9	9
	Evaporation and pan house operator, electrical and technic supervisors	9	9
	Coordinators of the factory	9	9
4	Kaizen team members	405	165
	Total	447	207

3.6 Sampling method and procedures of sampling

Both primary and secondary data were sourced and utilized for purposes of addressing the research objectives. Primary data collected on management bodies were used a five point Likert scale. The data collection instrument used for this research was well structured questionnaire that distributed to 207 employees included the managers, directors, section heads, team leaders and supervisors also workers.

A sample refers to a part of the target population that is procedurally selects to represent it (Oso and Onen 2005). The study had been used proportionate stratified random sampling technique. Because there were sub groups listed on table 4 in the above and based on the kaizen team member were randomly selected. These sampling technique identified set of subgroups. The design involves selecting the samples from a population that had been dividend in to tow sub-groups. Which had given more accurate information since each sub-group would have a certain opinion on the subject under study.

3.7 Data analysis

After the collection of primary and secondary data, the data analysis was followed. First, SPSS for correlate the variables and factor analysis have been used. Secondly, Fuzzy-AHP for prioritization of core factors followed. Then charts were used to analyze the output from the analysis. Finally suggestion has been given for the main factors of kaizen event team formations and evaluation system.

No	Item of data	Tools	Method of analyzing
1.	Close ended questionnaire	Exl, SPSS, and fuzzy AHP	Describe the factors, identify their correlation, using factor and fuzzy analysis based on quantitative results
2.	Open ended questionnaire	Description	These qualitative data were entertained qualitatively.
3.	Observation	Description	From the researcher observation of factory work floor and kaizen event activities
4.	Interview	Description	Qualitatively

Table 6: - data analysis

3.8 Fuzzy-AHP

The analytic hierarchy process (AHP) methodology was a systematic method that has been developed by (Satty, 1980). Except for the fuzzy representation of pairwise comparison, the steps in the proposed fuzzy-AHP model have same as those in the traditional AHP ones. It can be viewed as an advanced analytical method that has been developed from the traditional AHP. Despite the convenience of AHP in handling both qualitative and quantitative criteria of multi-criteria decision making problems based on decision makers judgments of decision makers in AHP approaches. A fuzzy analytical hierarchy process approach has been used, where the pairwise comparison of the factors and alternatives has being done and expressed with triangular fuzzy numbers.

In this study, twelve alternatives used to pairwise comparison, five for the organizational factors, four for the team structure and three for team task. In order to incorporated expert opinions through questionnaires, a fuzzy AHP had been applied to obtain more decisive judgments by prioritized the success factors and weighted them in the presence of vagueness, characteristics of subject, and fuzziness (Buckley, 1985). The fuzzy AHP approach were used the concept of fuzzy set theory and hierarchical structure analysis to evaluate success factors of in the pairs, and to quantified the relative importance of each factor to the successful implementation.

According to (chang, 1996) introduces a new approach for handling fuzzy AHP, with the use of triangular fuzzy numbers for pair-wise comparisons. In this paper Chang, (1996) analysis used for the prioritization of various success factors of kaizen event teams.

In many practical cases, the linguistic assessment of human feelings and perceptions are vague and it was not reasonable to represent it in terms of precise numbers. It is feels more confident to give interval judgments than fixed value judgments.

3.9 Pre testing and Pilot study

Once the questionnaire was constructed the research instrument must be tested to see whether or not it obtained the results the researcher required.

First of all, the researcher selects six employees from team members, managements and kaizen officers and asked those people who had not been involved in its construction to read it through and to see if there are any ambiguities which remained unnoticed. Once this has been done, alter

the questions accordingly, then sent out a number of questionnaires to the types of people who would be taking part in the main survey. Now, the researcher had to make sure they knew it was a pilot test and ask them to forward any comments they may have about the length, structure and wording of the questionnaire.

Based on the feedbacks generated from the pre-test and pilot study, the researcher went through each response very carefully, noted comments and looked at the answers to the questions.

In order to detect unclear statements, a draft questionnaire was first administered by selecting a total of ten respondents (i. e. five members, four supervisors, and one kaizen management officer for pre-testing the questionnaire and undertook the initial pilot study at the case company. The purpose of conducting pre-testing was to check the relevance, clarity and chance of ambiguity of each item in the instrument on the part of the respondents. Some vague and ambiguous statements have been identified through their feedbacks and then corrected based on the results obtained. While conducting the pilot study and distributing the questionnaires, a time convenient for the respondents was arranged so as to maximize the rate of return.

3.10 Reliability analysis

The reliability of instruments measures the consistency of instruments (Creswell, 2009). Considers the reliability of the instruments as the degree of consistency that the instruments or procedure demonstrates. In this study each statement rated on a 5 point likert response scale which includes Strongly Disagree, Disagree, Undecided, Agree, Strongly Agree. Based on these an internal consistency reliability was tested by SPSS 20. and the Cronbach's alpha coefficient for the instrument was found as shown in the table 7 below which were reliable. Typically an alpha value of 0.70 or higher is taken as a good indication of reliability.

Table 7: Reliability statistics

Success of kaizen teams	Reliability statistics	
	Cronbach's alpha	Questionnaire items
Organizational	0.733	12
Team structure (team task) and success	0.71	43
Challenges that affect kaizen event team	0.726	10

Table 8: Reliability statistics

CHAPTER FOUR

4 DATA ANALYSIS AND DISCUSSIONS

Introduction

The quantitative and qualitative data has been collected and analyzed using descriptive statistics and inferential statistics. There are three sections in the chapter. The first section was on background characteristics of the respondents. Section two examined correlation and factor analysis on kaizen event team and extracts success factors of kaizen event teams. Also fuzzy-AHP had been used for prioritization of kaizen event team success factors. The last chapter was proposed an improvement framework for kaizen event teams from the analysis. The chapter highlights those major results of the quantitative data analysis, and the findings of the qualitative data analysis in the research.

4.1 QUESTIONNAIRE RESULT

4.2 Background characteristics of the respondents

The first analysis of data includes profiling the background characteristics of the respondents of the case company. Table 9 below indicates the demographic characteristics of the respondents. A total of 195 (94.2%) of the respondents were males and 12 (5.8%) were females. The majority of the respondents were males because of the social/cultural influence and restriction, the prevailed low level of technology by manufacturing related to sectors, which involved much more physical work contributed to the less number of female workers in the study. Also the females were not participated in the kaizen event teams. But a few of them had been engaged in work shop teams in welding activities with great potential

As it is a new sugar factory most of the employees, 153 (73.9%) have been 1-5 years of service time. 36 of 17.4 have 5-10 working experience. The others 8.7% of 18 respondents have above 20 years of service time. Those respondents brought from other sugar factory for their experience. More than half of the respondents were in low range of service time. It indicates they have been less experienced also less experienced the kaizen event. The educational background of respondents, 115 (55.6%) were below certificate. 39 (18.8%) have certificate. 11 (5.3%) have diploma. 40 (19.3%) of respondent hold their degree. 1% of 2 respondents have their MSc.

Above half of the respondents show below certificate educational background. That implies education have its own impact on kaizen event programs.

Table 9: background characteristics of the respondents

No	Item	Respondents		
		F	%	
1	Gender	Male	195	94.2
		Female	12	5.8
		Total	207	100
2	Service time	1-5	153	73.9
		5-10	36	17.4
		Above 10	18	8.7
		Total	207	100
3	Level of education	Below certificate	45	55.6
		Certificate	39	18.8
		Diploma	14	5.3
		B.Sc. degree	37	19.3
		M.Sc.	2	1
		Total	207	100

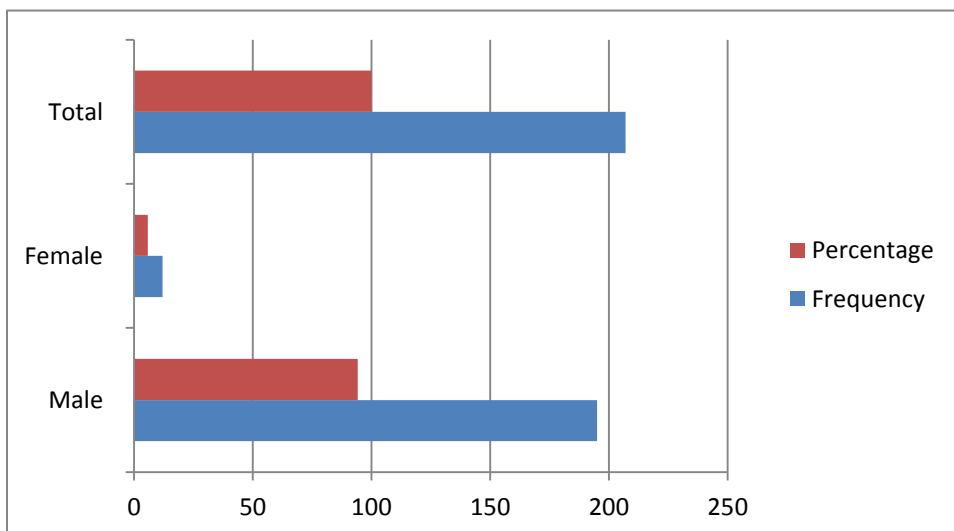


Figure 2: gender respondents

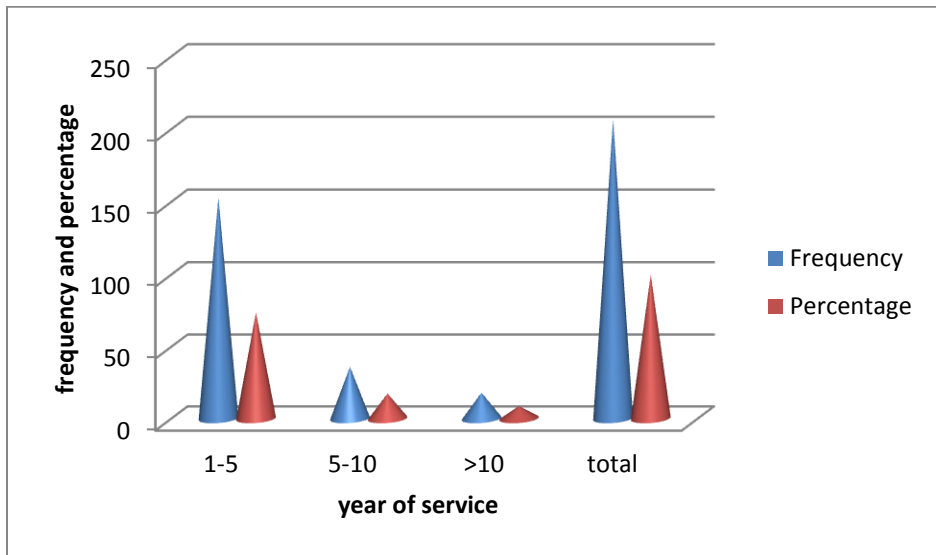


Figure 3: year of service of respondents

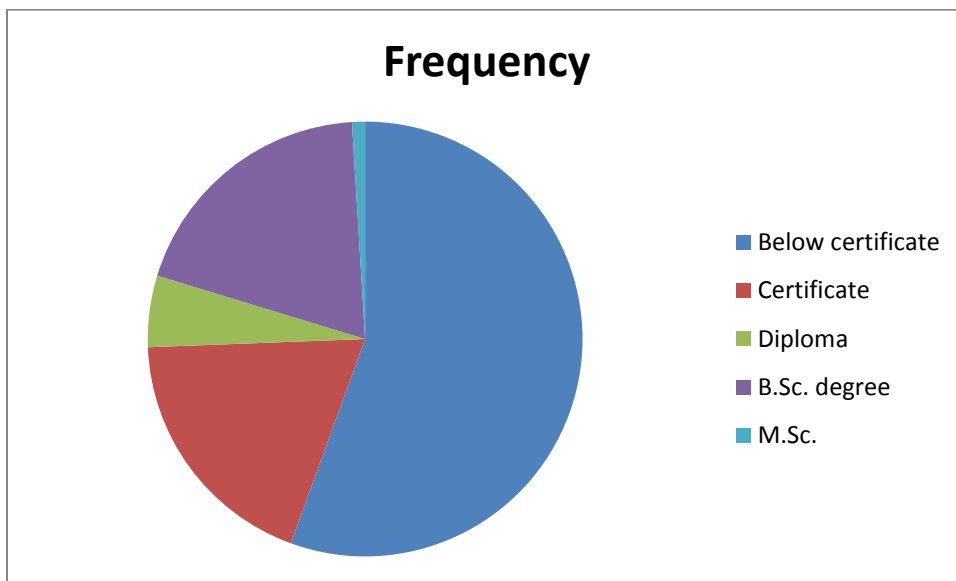


Figure 4: level of education

There are a lot of factors that affect the kaizen event team success. In this study the questionnaire designed by the metric systems of EKI (Ethiopian kaizen institute) as it described in the previous chapter. There are four category of questions distributed to the respondents. The questionnaire

includes the codes and category of the questions. Every factor has one or more questions to elaborate the idea. The respondents average response from each question taken. For example for goal clarity there are two questions the average response taken because it has common factor.

As it shows in APPENDIX C factors that affect the kaizen event listed according to their followed questions. It reviewed from different literatures. Also it used as a metric system for EKI (Ethiopian kaizen institute). In the institute organizational and individual metric systems were prepared to measure the companies’ effectiveness in kaizen event teams Appendix B.

4.3 Factors Descriptive statistics

There were 17 factors used for the descriptive results. It includes the organization, team, and team task are included. As can be seen the mean values for kaizen event team success vary from 4.48 to 1.76. The maximum rating was for team attitude for the kaizen event team success. The minimum ratings were for ‘involvement’, ‘thinking capability’, ‘group compositions’, ‘solve problems’, ‘problem scope’, and ‘monitor and follow up’ with their descending order. Based on the result that the team attitude had the value of 4.48 which is strongly agree that implies the team attitude for the improvement change is more important.

The standard deviation “Std Dev” provides an indication of how far the individual responses to a question vary or “deviate” from the mean. Also tells that the respondents concentrated around the mean, or scatter far and wide.

Table 10: descriptive statistics

	N	Mean	Std. Deviation
O1	17	3.17	1.413
O2	17	2.69	1.220
O3	17	2.45	1.435
O4	17	2.24	1.340
O5	17	2.24	1.078

O6	17	2.40	1.231
O7	17	2.50	1.366
TS1	17	3.23	1.331
TS2	17	2.88	1.548
TS3	17	3.43	1.272
TS4	17	2.96	1.183
TS5	17	1.78	.781
TS6	17	2.06	1.300
TT1	17	4.48	.766
TT2	17	3.24	1.381
TT3	17	2.96	1.183
TT4	17	1.96	.911
Valid N (list wise)	17		

4.4 Selection of the existing factors influencing kaizen event team success

The organizations had their own metric system to align to their strategy and policy. The measurements are different from organization to organization. In Ethiopia organizations especially sugar companies mostly used kaizen events for successful productivity. EKI in Ethiopian industries measures the employee and the management using three measurements showed in Appendix B. Those metrics are organizational, kaizen departments and individuals. Therefore in this study a small number of metrics was considered using EKI metrics and analysis based on different literatures.

The data that has been received from questionnaire was analyzed and filter out based on the descriptive data result.

- Success factors for KET in the industries
- The factors causing time wastage of the industries

These factors were selected through literature review and also the respondent's results to the questionnaire were used.

Table 11: Selection of the existing factors influencing kaizen event team success

Metrics	Factors	Code
Organizational	Goal clarity	O1
	Management support	O2
	Monitor and follow up	O3
	Problem solve	O4
	Proper training	O5
	Problem scope	O6
	Reward and recognition	O7
Team	Team attitude	TS1
	Team formation	TS2
	Decision making	TS3
	Team knowledge	TS4
	Thinking capability	TS5
	Group composition	TS6
Task	Task design	TT1
	Problem scope	TT2
	Team authority	TT3
	Involvement	TT4

4.5 Correlations and Factor analysis

Correlation is a statistical method which enables the researcher to find whether two variables are related and to what extent they are related. Correlations measure the association or relationship between two variables and quantify the strength of their relationship. For this analysis the study had been used bivariate correlations procedure because the available information is expresses

with weight. From -1 (two variables are perfectly related in a negative manner) to +1 (two variables are perfectly related in a positive manner).

Correlation needed for this study used to determine and analyze the association between the seven factors raised by the respondent results

The end result of correlation analysis is a correlation coefficient whose values range Using SPSS data entry module the analysis shows as Pearson Correlation (r) and significance (p) value of the two variables. The effect size has measure varies between 0 (no relationship) and 1 (perfect positive relationship). Therefore, the closer to 1 is the stronger the relationship. As a general rule of thumb, the following cut-off points have been sometimes proposed: (r < 0.1 weak, r < 0.3 modest, r < 0.5 moderate, r < 0.8 strong, r ≥ 0.8 very strong).

4.6 Analysis of organizational measurements

Based on descriptive statistics organizational measurements those highly affects factors are selected from the respondents. From the response the study creates correlation between organizational variables (O1, O2, O3, O4, O5, O6, and, O7)

The result shows that O1 (Goal clarity) moderately positive correlation with O4 (solve problems). It's significant at the level of 0.01. If the kaizen event team clearly define and align the goals with strategies and policy of the organization that will improve the problems. The management support O2 has weak positive correlation with O4, O5, and O7 also significant at 0.05 levels. Proper training O5 has strong positive correlation with reward and recognition significant at 0.01 point. Proper training and reward and recognition can bring the kaizen event team for success. Problem scope O6 has moderate positive correlation to solve problems and significant at 0.01 level.

Table 12: Correlations of organizational factors

Correlations

		O1	O2	O3	O4	O5	O6	O7
O1	Pearson Correlation	1	.101	-.182	.481**	.230	.227	.133
	Sig. (2-tailed)		.523	.247	.001	.144	.149	.402

O2	Pearson Correlation	.101	1	.054	.345*	.317*	.232	.344*
	Sig. (2-tailed)	.523		.734	.025	.041	.140	.026
O3	Pearson Correlation	-.182	.054	1	-.057	.102	-.023	.317*
	Sig. (2-tailed)	.247	.734		.718	.520	.883	.041
O4	Pearson Correlation	.481**	.345*	-	1	.247	.502**	.200
	Sig. (2-tailed)	.001	.025	.057	.718	.115	.001	.204
O5	Pearson Correlation	.230	.317*	.102	.247	1	.073	.613**
	Sig. (2-tailed)	.144	.041	.520	.115	.647	.000	
O6	Pearson Correlation	.227	.232	-	.502**	.073	1	.022
	Sig. (2-tailed)	.149	.140	.023	.883	.001	.647	.891
O7	Pearson Correlation	.133	.344*	.317*	.200	.613*	.022	1
	Sig. (2-tailed)	.402	.026	.041	.204	.000	.891	

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

* . Correlation is significant at the 0.05 level (2-tailed).

4.7 Analysis of team structure measurements

In kaizen event implementation program the kaizen team plays a great role to accomplish the organizations goal. Team formation is the first process to implement the kaizen activities. The

most known small groups are the cross-functional teams which formed to conduct kaizen events. The team assembled for a kaizen event is responsible for attaining the results targeted by the team itself. A kaizen team typically consists of between five and ten members and is guided by a facilitator. These individuals perform the process analysis necessary to create an implementation plan for change.

Table 13: Correlations of team structural factors

Correlations		TS1	TS2	TS3	TS4	TS5	TS6
TS1	Pearson Correlation	1	-.035	.786**	.081	.075	-.089
	Sig. (2-tailed)		.681	.000	.347	.381	.300
TS2	Pearson Correlation	-.035	1	-.080	.179*	.003	.894**
	Sig. (2-tailed)	.681		.350	.036	.977	.000
TS3	Pearson Correlation	.786**	-.080	1	.012	.048	-.120
	Sig. (2-tailed)	.000	.350		.885	.578	.163
TS4	Pearson Correlation	.081	.179*	.012	1	-.080	.257**
	Sig. (2-tailed)	.347	.036	.885		.351	.002
TS5	Pearson Correlation	.075	.003	.048	-.080	1	-.060
	Sig. (2-tailed)	.381	.977	.578	.351		.484
TS6	Pearson Correlation	-.089	.894**	-.120	.257**	-.060	1
	Sig. (2-tailed)	.300	.000	.163	.002	.484	

When we see the above table of each variables in team structure perspective they have strong relation with significance level of 0.01 and the causal Pearson Correlation of variable of team attitude (TS1) VS Team formation (TS3) has strong positive relationship of 0.78 and it's significant with significance level of 0.01.the team attitude towards kaizen event lead to effective

formation of kaizen event team. Team formation (TS2) VS group composition (TS6) has very strong positive correlation. It's also significant at 0.01 levels. This implies that team formation needs to have different perspective of team members. Every member has their own quality and profession. So for effective team formation group composition is a requirement.

4.8 Team task measurements

Kaizen event teams have their own tasks during the implementation program. The team mostly occupied by Task design, Problem scope, Team authority and, Involvement in team tasks.

Table 14: Correlations of team task factors

Correlations		TT1	TT2	TT3	TT4
TT1	Pearson Correlation	1	.105	.120	.218*
	Sig. (2-tailed)		.220	.162	.010
TT2	Pearson Correlation	.105	1	-.056	.026
	Sig. (2-tailed)	.220		.513	.764
TT3	Pearson Correlation	.120	-.056	1	.005
	Sig. (2-tailed)	.162	.513		.954
TT4	Pearson Correlation	.218*	.026	.005	1
	Sig. (2-tailed)	.010	.764	.954	
*. Correlation is significant at the 0.05 level (2-tailed).					

According the table results in the above that TT1 (task design) VR TT4 (Involvement) have weak positive relationship it means that task design my not came due to involvement significant with 0.01 level. TT2 VR TT3 has moderate negative correlation and indicates that the coefficient is not significant at 0.05. That means team formation may not come due to the decision making.

4.9 Challenges that affect the kaizen team success

In this section the challenges to sustainability of kaizen event team's response analysis of nine questions analyzed.

The first statement response shows that strongly agree to (30.9%) of respondents. The mean of this question is 3.23 which approach to 3 that are undecided in "Teams commitment and innovativeness is not surely one of the challenges facing Kaizen event success". The standard deviation is 1.609 less inconsistency. The second statement received different responses, 43.2% strongly disagree these responses gave a mean of 2.4 which is the average response is disagree. The standard deviation of 1.471 shows less inconsistency. This shows that Lack of participation of members affects the success of Kaizen event is not approve. Kaizen team structure affects success of Kaizen event is undecided with 31.7% of the respondent undecided also 26.6% strongly disagree.with1.397 standard deviation of less inconsistency and mean of 2.94 undecided. Kaizen event success is faced by lack of management support is strongly with 36% of strongly agree that the management support has high impact to the program. Resource constraints is a major challenge facing Kaizen event sustainability results that 51.1% of the respondent strongly agree to shortage of resources with mean 3.56 approaches to 4 means agree. The standard deviation is 1.667 less inconsistency. Ineffective training affects Kaizen event success has 32.4% strongly agree but 21.1% of the respondents strongly disagree with 1.55 standard deviation and 2.69 mean of undecided result. Also lack of budget allocation 60.4% of the respondent strongly agree with 3.62 mean approach to 4 is agree for that management support to budget allocation is the challenge of kaizen event team.

No	Challenges on kaizen event team	Availability				
		5	4	3	2	1
1.	Teams commitment and innovativeness is one of the challenges facing Kaizen event team success	32.4	19.4	11.5	10.8	25.2
2.	Lack of participation of members affects the success of Kaizen event	23		8.6	42.4	25.2
3.	Kaizen team formation affects success of Kaizen event	15.1	21.6	31.7	4.3	26.6
4.	Kaizen event success is faced by lack of management support or leadership	36	15.8	9.4	20.9	17.3

5.	Resource constraints is a major challenge facing Kaizen event sustainability	51.1	2.9	9.4	17.3	18.7
6.	Attitudes and misconceptions about Kaizen is one of challenges facing Kaizen event success	23.7		15.8	27.3	32.4
7.	Ineffective training affects Kaizen event success	32.4	10.8	14.4	20.1	21.1
8.	Lack of budget allocation	60.4	12.2	8.6	5	12.9
9.	This kaizen event increased our team members' knowledge of how continuous improvement can be applied	15.8	9.4	12.2	40.3	21.6
10.	Lack of proper communication systems is one of challenges faced by kaizen event teams	40.3	10.8	19.4	7.9	20.9

From the interview results that some of the challenges were explained. The kaizen department officer also reflects that the management didn't respect the activities of the kaizen department. That reduce the productivity also motivation of the members. The top managements are taken this kaizen event like a fault finder. The kaizen department officer agreed that they have to find faults and address them but how to solve problems will be every bodies business. The kaizen event needs guide line for example current status analysis frame work. The effective team expects recognition otherwise it reduce the initiation energy of the employee.so the managers have to being kaizen person and influential. Challenges that affect the kaizen event teams were concluded based on the above questionnaire and interview results

- Lack of established system for training and education.
- Lack of adequate training and information about kaizen.
- Lack of knowledge about team formation or structure also the teams doesn't have authority to make decisions.
- Unprepared facilitator & team leader
- Lack of team composition
- Misunderstanding by management in forming and evaluating Kaizen event teams.
- Difficulty in comprehending Kaizen implementation practices and reporting results.
- Lack of necessary resources.
- Lack of skilled man power
- Employee resistance to change

- Shortage of proper safety and health materials and equipment's

Finally kaizen event program is a success of the implementation program. The researcher observed that those kaizen events have been grouped unstructured which is the challenges of the program. The team's poor team formations were not computed with other teams. Most of the team member complained that their team members are not capable of the improvement program. The team's process facilitator should be well prepared to manage time, Overview participant responsibilities, and facilitate the team and mediate conflicts Coach and educate team members/others. But most of the team facilitators are not well prepared and making a difference. So the above challenges during the implementation program were needs serious attentions.

4.9.1 Existing system of kaizen event team in the company

According to results from interview and observation revealed that there are 405 kaizen event team members included in the different teams. Those kaizen event teams have been formed at different sectors of the factory. The team had structured informally by themselves. Some of the team had a supervisor that leads them as a team leader. During observation the researcher were observed that ranks of best executer of the month displayed on the board. Most of the team members were from the same plant the same workplace and the same shift. The roles of the kaizen event teams were participated when there is problem. Last year boiler plant teams were actively participated on walking ways, dangerous area indicators, and green the environment during non-production days.

To the question that the management supports to kaizen event teams most of the respondent in the interview result was

- Attend the meetings with kaizen event team to discuss freely with every member
- Attend meetings with teams
- Freedom for decision makings
- Also solve problems that are above the teams
- Continues follow up

From workshop supervisor interview that the team members should be composed from different plant that will help all of them to engage to work. If they have the same profession one of them would be idle. At workshop there are nine team members out of nine members four of them are effectively engaged at some activities.

According to kaizen management officer at fabrication reflects that the management support at KSF, there are trainings sessions with supervisors in the kaizen department schedules. The management problem solving ability is helpful. Problems beyond the KET go to the management bodies. There are also monitoring and follow up within 15 days interval. The absence of reward and recognition reduce the initiation of the members.

4.10 Factor analysis

Factor analysis is a statistical tool that measures the impact of a few un-observed variables called factors on a large number of observed variables. It is used as a data reduction method. It does this by seeking underlying unobserved (latent) variables that are reflects in the observed variables. Factor analysis is a technique that requires a large sample size. In this study the sample size is 207 employee of the case company. Factor analysis allows researchers to investigate concepts that have not easily measured directly by collapsing a large number of variables in to a few interpretable underlying factors.

Large datasets that consists of several variables has been reduced by observing ‘groups’ of variables (i.e. factors) that assembles common variables in to descriptive categories. Factor analysis is useful for studies that involves a few or hundreds of variables, items from questionnaires, or a battery of tests which can be reduced to a smaller set, to get at an underlying concept, and to facilitate interpretations.

It attempts to discover the unexplained factors that influence the co-variation among multiple observations. These factors represent underlying concepts that cannot be adequately measured by a single variable. For example, various measures of employee attitudes may be influenced by one or more underlying factors.

In order to identify complexity factors of success factor of the company, this study investigated the perceptions of workers and managers. The factors that were selected based on their mean

value are seventy factors which are concerned on organizational, team members, and team task. All of seventy factors are retained. Those factors are

Organizational

- Goal clarity
- Management support
- Monitor and follow up
- Solve problems
- Proper training
- Problem scope
- Reward and recognition

Team (individual)

- Team attitude
- Team formation
- Group composition
- Decision making
- Team knowledge
- Thinking capabilities

Task

- Task design
- Problem scope
- Team authority
- Involvement

A. Initial eigenvalues: eigenvalues are the variances of those selected eighty factors. Because the researcher conducted the factor analysis on the correlation matrix, the variables are standardized which means that each variables have a variance of 1, and the total variance is 18 according to the table 12.

- B. Total: as it shows in the table this column contains the eigenvalues. The first factor (management support) accounts for the most variance which has the highest eigenvalues of 6.568.
- C. % of variance and cumulative %: contains the total variance accounted by each factor and variance accounted by the current and all preceding factors respectively. From the table 12 the forth row shows 66.169 this means that the first three factors together account for 66.169% of the total variance.
- D. Extraction sum of square loadings: the values in this column are the same as the values before extraction, except that the values for the discarded factors are ignored (hence, the table is blank after the fifth factor).
- E. Rotated sums of squared loadings: in this values represent the distribution of the variance after the varimax rotation. Varimax rotation tries to maximize the variance of each factor. The total amount of variance accounted for is redistributed over the five extracted factors.

SPSS output has been listed the eigenvalues associated with each linear component (factor) before extraction, after extraction and after rotation. Before extraction, SPSS identifies 16 linear components within the dataset. The eigenvalues has been associate with each factor represent the variance explained by that particular linear component and SPSS also displays the eigenvalue in terms of the percentage of variance explained (so, factor 1 has 22.72% of total variance). It should be clear that the first few factors explain relatively large amount of variance (especially factor one) whereas subsequent factors explain only small amount of variance. SPSS extracts all factors with eigenvalues greater than 1. In this study 6 factors extracted. Rotation has the effect of optimizing the factor structure and one consequence for these data is that the relative importance of the six factors has been equalized. Before rotation, factor 1 accounted for considerably more variance than the remaining (20.392, 11.923, 10.035, 7.638, 6.485and so on). After extraction it accounts for only 18.394% of variance (compared 14.875, 14.183, 12.775, 11.263, and 7.702respectively).

Table 15: factor analysis of total variance explained

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.862	22.720	22.720	3.862	22.720	22.720	3.127	18.394	18.394
2	3.467	20.392	43.112	3.467	20.392	43.112	2.529	14.875	33.269
3	2.027	11.923	55.035	2.027	11.923	55.035	2.411	14.183	47.453
4	1.706	10.035	65.070	1.706	10.035	65.070	2.172	12.775	60.227
5	1.298	7.638	72.708	1.298	7.638	72.708	1.915	11.263	71.490
6	1.102	6.485	79.193	1.102	6.485	79.193	1.309	7.702	79.193
7	.930	5.473	84.665						
8	.855	5.027	89.692						
9	.628	3.696	93.389						
10	.483	2.842	96.231						
11	.355	2.088	98.318						
12	.175	1.031	99.350						
13	.111	.650	100.000						
14	1.951E-016	1.148E-015	100.000						
15	8.682E-017	5.107E-016	100.000						

16	- 6.743 E-018	-3.966E- 017	100.000						
17	- 1.968 E-016	-1.157E- 015	100.000						
Extraction Method: Principal Component Analysis.									

As shown in (Table 12) the total variance explained to determine the number of significant factors that are lists on their descending orders. The factors are not only extracted also rotated values are meaningful for better interpretation since unrotated factors are ambiguous.

The above table shows the actual factors that were extracted. As it display in section labeled “Rotation Sums of Squared Loadings” only those factors that met the cut-off criterion (extraction method). There are 5 alternatives with eigenvalues greater than 1. SPSS always extracts as many factors initially as there are variables in the dataset, but the rest of these didn’t make the grade.

F. Communalities: shows before and after extraction. Principal component analysis works on the initial assumption that all variance is common therefore, before extraction the communalities are all 1. The communalities in the column labeled extraction reflect the common variance in the structure. So for the first factor 78.5 % of the variance associated with factor 1 is common or shared variance. Also it shows the amount of variance in each variable that can be explained by the retained factors has been represented by the communalities after extraction.

Table 16: communalities

Communalities		
	Initial	Extractio n
Goal clarity	1.000	.785
Management support	1.000	.449
Monitor and follow up	1.000	.770

Solve the problems	1.000	.770
proper training	1.000	.613
Problem scope	1.000	.691
Reward and recognitions	1.000	.700
Team attitude	1.000	.991
Team formation	1.000	.940
decision making	1.000	.991
team knowledge	1.000	.962
Thinking capability	1.000	.481
group composition	1.000	.940
task design	1.000	.612
Problem scope	1.000	.991
team authority	1.000	.962
Involvement	1.000	.816
Extraction Method: Principal Component Analysis.		

G. Factor rotated matrix: table is key for understanding the results of the analysis factors are rotated so that they are easier to interpret. Rotation makes it so that, as much as possible, different items are explained or predicted by different underlying factors, and each factor explains more than one item.

In this analysis 17 factors has sorted, as shown in the table the items are sorted so that the items that have the highest loading from goal clarity loaded on factor 5. Management

support and monitor and follow up are substantially loaded on factor 4. ‘Solve the problems’ then loaded on factor 5.

Table 17: rotated component matrix

Rotated Component Matrix						
	Component					
	1	2	3	4	5	6
Goal clarity			.380		.746	
Management support				.544		
Monitor and follow up		-.636	-.397	.342		
Solve the problems					.799	
proper training				.721		
Problem scope			-.350		.734	
Reward and recognitions				.763		
Team attitude	.983					
Team formation			.942			
decision making	.983					
team knowledge		.965				
Thinking capability				.674		
group composition			.942			
task design			-.331			.640
Problem scope	.983					

team authority		.965				
Involvement						.858
Extraction Method: Principal Component Analysis.						
Rotation Method: Varimax with Kaiser Normalization.						

From the factor analysis factor that are mainly affect the kaizen event team were Goal clarity, Management support, Monitor and follow up, Solve the problems, Team structure, and Decision making that have been extracted factors from respondents. Most of the factors are from the organizational measurements. The organizations have full authority to control every activity in the company. Clearly defined goal led to achieve goals of the program. Also the organization goal will align to the kaizen events to manage time. The power that keeps the kaizen event for success is management support. So the management must stand beside the changing program. The teams also must well-structured for better results. Poor team selection lead to failure. The team also has the power to make their decisions. If they are free to make decisions they are accountable for their actions.

4.11 Prioritization of success factors of kaizen event teams using Fuzzy-AHP approach

This section discussed the Fuzzy- AHP approach to prioritize kaizen event team success in the study area. First the concept of Fuzzy- AHP introduced then examined used previously to assess the success factors while the third one is method of prioritization prior to Fuzzy- AHP. The last one deals with success factors in relation to Fuzzy- AHP.

Kaizen event teams have play a great role for successful kaizen implementation by solving problems with in a specific period of time. This is important to reduce cost of maintenance, manage time, and to achieve once goal. Kaizen event team has different factors that face in the implementation process.

The factors that affect the kaizen event teams are identified in the previous chapter. The factors that are mainly face the company are management support for the achievement of the team. Employees have different interpretation regarding management support. Also their attitudes towards any change or kaizen event team are so different one another. Decision making authority should be given to the team members to participate freely. Teams must be formed and organize systematically not randomly that will affect the kaizen event team success. Each member ability

and performance should be considered. The kaizen event team must consider the size of each group, their efficiency, Functional Heterogeneity, Team Member Problem-Solving Abilities, and Team Member Attitudes. The good team structure will lead to success of kaizen implementation. Also they can well design tasks will improve their problem solving abilities. Clearly define and align the goals of kaizen event team with the company strategy and policy. Continue follow up and monitoring the kaizen event team activities. Proper training needs to give to change the attitude towards improvement tools. Reward and recognition are the real motivators for the employee. This all factors need to filter out and clearly extract and prioritize accordingly their importance.

Employee and management attitude to kaizen event team are different. They may have reward and recognition issue, support from the management, structural formation problems, and so on. Because of those reasons prioritizing the success of kaizen event teams is difficult to rank with different scales.

The likert scale has limited options of quantifying the needs of kaizen event team. But the Fuzzy-AHP scale gives a range value from equal importance to extremely more importance with value of (1,1, 2) for the least and (8,9,10) for the highest. This implies that the Fuzzy-AHP is a better measurement of alternative values than other tools.

There are limited studies on success of kaizen event teams which contributed to the implementation program, but also it has some hindrance. For using Likert scale in gathering data, it does not give the value in-between. Because of this a significant amount of information is lost and/or distorted due to the built-in limitations of the Likert method.

In the study used a fuzzy-AHP to prioritize the need of the kaizen event team for success and solved the pitfalls with the existing methods. However, up to now, no research has been conducted by using fuzzy-AHP to prioritize the kaizen event team success factors in sugar factory.

4.11.1 Fuzzy AHP

A Fuzzy AHP has been applied to obtain more decisive judgments by prioritizing the critical success factors and weighting them in the presence of vagueness. The Fuzzy AHP approach has been used the concepts of Fuzzy set theory and hierarchical structure analysis to evaluate success

measurements in pairs, and quantify the relative importance of each factor to the successful implementation. The knowledge on the prioritization of success of kaizen event teams lead to better understanding of team's composition. Also focus on some of the most important success measurements.

In this section, the Fuzzy-AHP has been found to be a better approach to work on the identified gap of prioritizing the success factor of kaizen event team. Because, fuzzy logic is primarily concerned with quantifying and reasoning using linguistic expression in which words can have ambiguous meaning. The AHP helps to give a reasonable weightage in the study to prioritize the factors. Factors that affect the implementation can be from different corners. The employee may have different understanding for the program. Management support has its own different interpretation under the employee. The employees have different level of understanding to any change. Those vague human feelings and perceptions are not reasonable to represent it in to precise number. It's better to give interval value judgments than fixed value judgments (Dag, 2013).

The fuzzy set theory has been design to deal with the extraction of the possible outcome from a variety of information expressed in vague and imprecise terms. Fuzzy set theory treats to express vague data as a certain distribution which can be effectively implemented for logical reasoning, in terms of membership functions (Zadeh, 1965) (Chen, 2008). In this paper each linguistic variable has been defined by a triangular fuzzy number (TFN) because of its simplicity and computational efficiency. A triangular fuzzy number (TFN), M is shown in the figure. A TFN is denoted simply as $(l, m, \text{ and } u)$. The parameters $l, m, \text{ and } u$ denote the smallest possible value, the most promising value and the largest possible value that describe a fuzzy event (Dag, 2013).

$$\mu_A(x) = \begin{cases} (x-l) / (m-l), & l \leq x \leq m, \\ (u-x) / (u-m), & m \leq x \leq u, \\ 0, & \text{otherwise} \end{cases} \quad (1)$$

Let $\tilde{M} = (l, m, u)$ be the triangular fuzzy number where $l \leq m \leq u$, then

$$\tilde{M} = [M^l, M^r] = (l + (m-l) \alpha, u + (m-u) \alpha, \alpha \in [0, 1] \quad (2)$$

Where M^l and M^r denote the left side representation and the right side representation of a fuzzy number respectively. (Zadeh, 1965)

Chang (1992) stated the extent analysis has been used to consider the extent of an object to be satisfied for the goal, that is, a satisfied extent. In the method, the “‘extent” quantified by using a fuzzy number. On the basis of the fuzzy values for the extent analysis of each object, a fuzzy synthetic degree value can be obtained.

4.11.2 Prioritizing kaizen event team success factors need in sugar industry

Kaizen event teams in sugar industry have so many factors that affect the implementation program. To control these factors different activities in the existing system has been done. From those activities BSC (balanced score card) form prepared to control and measure each team tasks which is used for recognition and approval of employee. The Ethiopian kaizen institute measures the kaizen event team using a questionnaire, interview and observation. But the result will not as expected. The activities were not successful for better achievements. Because there lack of prioritized the factors that affect the program in the sector. So kaizen event team in kaizen implementation event should get more focus than other departments. The employee is the power who can fix problems by themselves which is need more focus on them.

Kessem sugar factory is the new factory which has less productivity. Kaizen event team to all departments has their own role. The teams formed according to their need. That results some of the team achieved their goal and the others not. Employees and management attitude for kaizen event were affecting the team members. This indicates that the priority to these factors is needed.

Triangular fuzzy numbers is use to represent subjective pairwise comparisons of expert' judgments. In this paper, the triangular fuzzy conversion scale is used to convert such linguistic scales in to fuzzy scales to the evaluation of success of kaizen event teams.

Literatures have identified that the major and common success factors are, organizational, team formation, team task. These three factors have been identified as per their expressive content of success factors.

After identified the success factors, different priority weights of each success factors were calculated using the fuzzy-AHP approach. The comparison on the importance of one service

quality dimension over another is done by using the questionnaire as explained in detail in Appendix. The questionnaire facilitated the answers of pair-wise comparison questions. The preference of one measure over another was decided by the experience of experts in the area.

Experts has been used the linguistic variables to compare the criteria with respect to the main goal. Then the linguistic variables were converted to fuzzy numbers. Table below shows the linguistic variables and their corresponding fuzzy numbers. The pair-wise comparison matrices were formed, the consistency of the pair-wise judgment of each comparison matrix has been checked, using the calculation method of consistency index and consistency ratios in crisp AHP.

The procedure of fuzzy AHP is described as follows

Define the problem and objective: The objective of the study on prioritization of success factors of kaizen event teams in the implementation. The objective can be achieved by analyze their effect on success of kaizen event teams.

Develop a hierarchy model

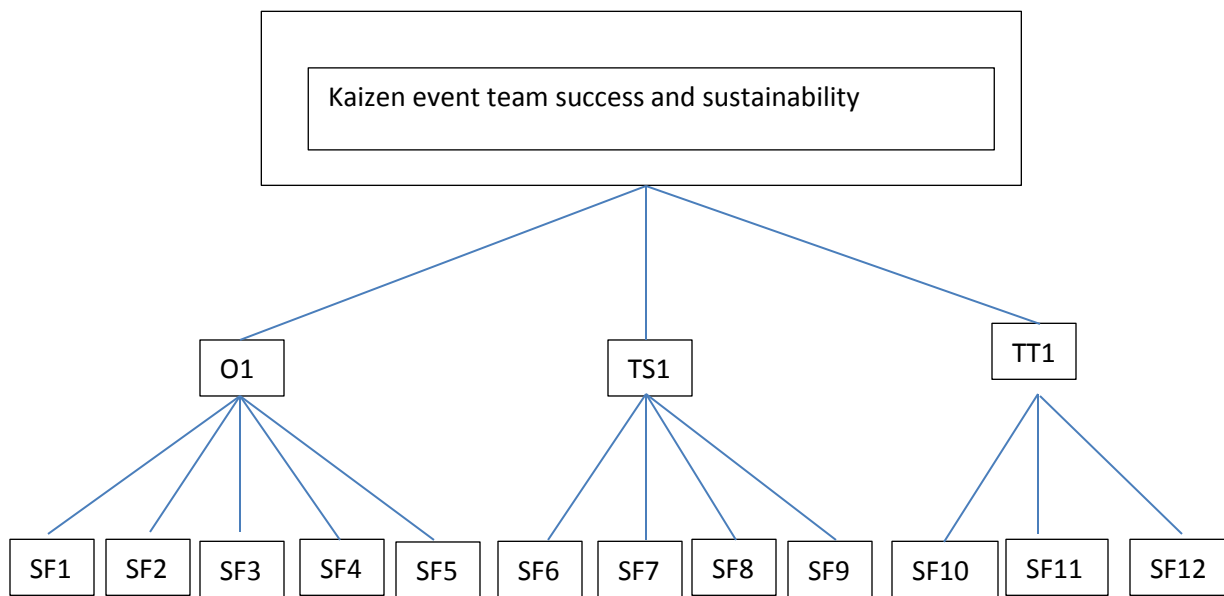


Figure 5: hierarchical structure for prioritization of success factor of kaizen event teams

Where,

- | | |
|------------------------------|-----------------------|
| O1 = organizational | SF6 = team attitude |
| TS1 =team formation | SF7 = team structure |
| TT1 =team task | SF8 = team knowledge |
| SF1 = goal clarity | SF9 = decision making |
| SF2 =management support | SF10 = task design |
| SF3 = problem solve | SF11 = problem scope |
| SF4 =proper training | SF12 = team authority |
| SF5 = reward and recognition | |

$$M = (l, m, u)$$

$$M\text{-crisp} = (4 * m + l + u) / 6$$

The comparison matrix then converted to a crisp number. After the fuzzy comparison matrices were converted into crisp matrices; the consistency of each matrix has checked by the method in crisp AHP.

$$M_{g1}^1, M_{g2}^2, \dots, M_{gi}^m, \quad i = 1, 2, \dots, n \quad (3)$$

Where all the $M_{gi}^m (j = 1, 2 \dots m)$ are triangular fuzzy numbers.

The procedure of fuzzy AHP can be given as following steps: (Mikhailov, 2003) (Chang, 1996)

Step 1: compute the value of fuzzy synthetic extent with respect to the i^{th} object, S_i .

The triangular fuzzy comparison matrix is

$$= \left[\begin{array}{cccc} M_{g1}^1 & M_{g2}^2 & \dots & M_{g1}^m \\ M_{g2}^1 & M_{g2}^2 & \dots & M_{g2}^m \\ \dots & \dots & \dots & \dots \\ M_{gn}^1 & M_{gn}^2 & \dots & M_{gn}^m \end{array} \right]$$

For $i = 1, 2, \dots, n$, $j = 1, 2, \dots, m$, if $i = j$ $M_{gi}^j = (1, 1, 1)$

$$S_i = \sum_{j=1}^m M_{gi}^m * \left[\sum_{i=1}^n \sum_{j=1}^m M_{gi}^m \right] \quad (4)$$

Step 2: compute degree of possibility of $S_i \geq S_j$ by

$$V(S_i \geq S_j) = \text{height}(S_i \cap S_j) = \left\{ \begin{array}{l} 1, \text{ if } m_i \geq m_j \\ 0, \text{ if } l_j \geq u_i \\ \frac{l_j - u_i}{(m_i - u_i) - (m_j - l_j)}, \text{ otherwise} \end{array} \right\} \quad (5)$$

Where $S_i = (l_i, m_i, u_i)$ and $S_j = (l_j, m_j, u_j)$.

To compare S_i and S_j we need both the value of

$V(S_j \geq S_i)$ and $(S_i \geq S_j)$

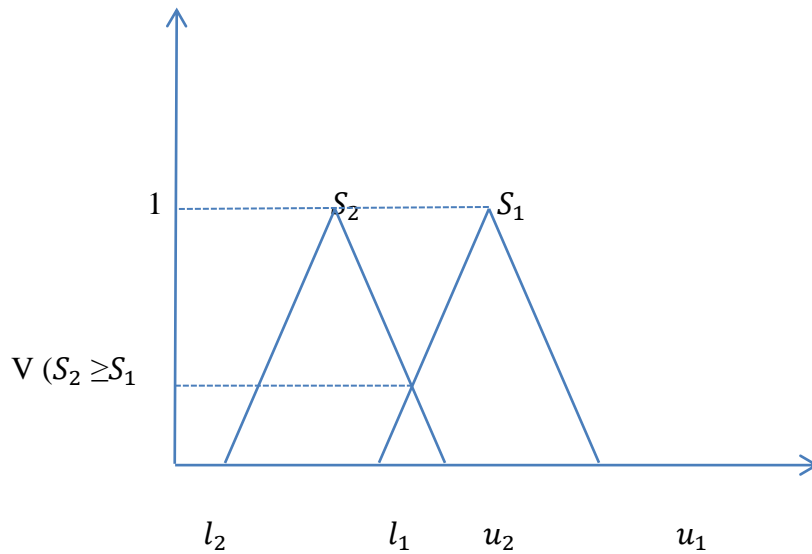


Figure 6: intersection between S_1 and S_2 (Remica, 2013)

Step 3: degree possibility for a convex fuzzy number to be greater than k convex fuzzy numbers S_i ($i = 1, 2, 3, 4, 5 \dots k$) can be defined by

$$V(S \geq S_1, S_2, \dots, S_k)$$

$$= V[(S \geq S_1) \text{ and } (S \geq S_2) \text{ and } \dots \text{ and } (S \geq S_k)] = \min V(S \geq S_i), i=1, 2, 3, 4, \dots, k. \quad (6)$$

$$d(A_i) = \min V(S_i \geq S_k) \quad (7)$$

For $k=1, 2, 3, 4, \dots, n; k \neq i$. then the weight vector is given by

$$W = (d(A_1), d(A_2), d(A_3), d(A_4), \dots, d(A_n))^T \quad (8)$$

Step 4: normalize the weight vectors

$W = (w_1, w_2, \dots, w_n)^T$ are computed as follows: (wang, 2009)

$$w_i = \frac{w'_i}{\sum_{j=1}^n w'_i} \quad (9)$$

Table 18: Satty's scale express in fuzzy numbers (Satty, 1989)

Linguistic scales	Membership function	Fuzzy number
Equal importance	(1,1,2)	1
Between equally and moderately important	(1,2,3)	2
Moderate important	(2,3,4)	3
Between moderately and strongly important	(3,4,5)	4
Strong important	(4,5,6)	5
Between strongly and very strongly important	(5,6,7)	6
Very strong important	(6,7,8)	7
Between very strongly and extremely important	(7,8,9)	8
Extremely more importance	(8,9,10)	9

Each success factor should weighted success factors of kaizen event teams using Satty's fuzzy scale. Those are organization, team and team task. A linguistic evaluation with respect to each dimension is taken. The base for giving this weightage was a discussion with experts having more work experience in kaizen office and middle managements. Respondents from the experts were the supervisors, kaizen officers and planning department.

4.11.3 Sample size determination

$$n = \frac{N}{1+N(e)^2} \text{ according to Yamane (1967)}$$

It uses a 95% confidence level and $p=0.05$ are assumed

$$n = \frac{N}{1+N(e)^2} = \frac{8}{1+8(0.05)^2} = 7 \text{ experts}$$

Step 1: The triangular fuzzy comparison matrix is

	O	Ts	TT
O	(1,1,1)	(0.1,0.11,0.125)	(0.125,0.143,0.167)
T	(8,9,10)	(1,1,1)	(7, 8, 9)
TT	(6,7,8)	(0.11,0.125,0.14)	(1,1,1)

Table 19: fuzzy evaluation with respect to matrix three success criteria

	Row sums	Column sums
O	(1.225,1.253,1.292)	(15,17,19)
Ts	(16,18,20)	(1.21,1.235,1.265)
TT	(7.11,8.125,9.14)	(8.125,9.143,10.167)
Column sum	(24.335,27.378,30.432)	

Table 20: row and column sum

$$S_1 = (1.225, 1.253, 1.292) * \left(\frac{1}{30.432}, \frac{1}{27.378}, \frac{1}{24.335} \right) = (0.04, 0.046, 0.053)$$

$$S_2 = (16, 18, 20) * \left(\frac{1}{30.432}, \frac{1}{27.378}, \frac{1}{24.335} \right) = (0.53, 0.66, 0.82)$$

$$S_3 = (7.11, 8.125, 9.14) * \left(\frac{1}{30.432}, \frac{1}{27.378}, \frac{1}{24.335} \right) = (0.23, 0.3, 0.38)$$

Step 2: compute degree of possibility of $S_i \geq S_j$ according to equation (5)

$$V(S_1 \geq S_2) = \frac{0.53 - 0.053}{(0.046 - 0.053) - (0.66 - 0.53)} = -3.48 = 0$$

$$V(S_1 \geq S_3) = \frac{0.23 - 0.053}{(0.046 - 0.053) - (0.3 - 0.23)} = -2.29 = 0$$

$$V(S_2 \geq S_1) = 1$$

$$V(S_2 \geq S_3) = 1$$

$$V(S_3 \geq S_1) = 1$$

$$V(S_3 \geq S_2) = 0$$

Step 3: degree possibility for a convex fuzzy number to be greater than k convex fuzzy numbers S_i ($i = 1, 2, 3, 4, 5, \dots, k$) can be defined by equation (7)

$$\text{Min } V(S \geq S_i), i = 1, 2, 3, 4, \dots, k.$$

$$\text{Min } V(S_1 \geq S_2, S_3) = \text{Min}(0, 0) = 0$$

$$\text{Min } V(S_2 \geq S_1, S_3) = \text{Min}(1, 1) = 1$$

$$\text{Min } V(S_3 \geq S_1, S_2) = \text{Min}(1, 0) = 0$$

Then the weight vector obtained is as follows:

Step 4: the weight vectors obtained by normalizing with respect to

$$W = (0, 1, 0)^T$$

It can be concluded that the most important factors to give priority in the case company was team structure the others will follow next.

Table 21: pairwise comparison matrix for alternatives with respect to O1

O1	SF1	SF2	SF3	SF4	SF5
SF1	(1,1,1)	(0.33,0.125,0.14)	(0.5,1,1)	(0.25,0.33,0.5)	(0.14,0.167,0.2)
SF2	(7,8,9)	(1,1,1)	(2,3,4)	(1,1,2)	(1,2,3)
SF3	(1,1,2)	(0.25,0.33,0.5)	(1,1,1)	(0.33,0.5,1)	(0.167,0.2,0.25)
SF4	(2,3,4)	(0.5,1,1)	(1,2,3)	(1,1,1)	(2,3,4)
SF5	(5,6,7)	(0.33,0.5,1)	(4,5,6)	(0.25,0.33,0.5)	(1,1,1)

Table 22: row and column sum

	Row sums	Column sums
SF1	(2.22,2.622,2.84)	
SF2	(12,15,19)	
SF3	(2.747,3.03,4.75)	
SF4	(6.5,10,13)	
SF5	(10.58,12.83,15.5)	
Column sum	(34.047,44.482,55.09)	

The normalized weight vector for alternatives are calculated as

$$W_1 = (0, 1, 0, 0, 0)$$

Table 23: pairwise comparison matrix for alternatives with respect to TS

TS	SF6	SF7	SF8	SF9n
SF6	(1,1,1)	(0.1, 0.11, 0.125)	(0.11,0.125,0.14)	(0.25, 0.33,0.5)
SF7	(8,9,10)	(1,1,1)	(4,5,6)	(2,3,4)
SF8	(7, 8, 9)	(0.167,0.2,0.25)	(1,1,1)	(0.1, 0.11, 0.125)
SF9	(2,3,4)	(0.25,0.33,0.5)	(8,9,10)	(1,1,1)

The normalized weight vector for alternatives are calculated as

$$W_2 = (0, 1, 0.24, 0.35)$$

Table 24: pairwise comparison matrix for alternatives with respect to TT

TT	SF10	SF11	SF12
SF10	(1,1,1)	(1,1,2)	(2,3,4)
SF11	(0.5,1,1)	(1,1,1)	(0.25,0.33,0.5)
SF12	(0.25,0.33,0.5)	(2,3,4)	(1,1,1)

The normalized weight vector for alternatives are calculated as

$$W_3 = (0.28, 0.89, 0.032)$$

4.11.4 Determination weights of criteria using FAHP

In FAHP methodology for a very large number of alternatives, making pairwise comparisons of alternatives, with respect to each other can be time consuming and confusing. Therefore, MCDM multiple criteria decision making carried out which includes pairwise comparisons of criteria. AHP is one of the most commonly used techniques when problem contain social, economic, technical and politic factors that need to be evaluated by linguistic variables. But for the uncertain or fuzzy environment, fuzzy numbers have to use for the evaluation due to the deviation of decision makers. The FAHP approach has been proved to be a convenient method in tackling practical multi-criteria decision making problems.

Table 25: weighted factors and their alternative of factors influencing the kaizen event team

Factors	Weight of factors	Weight	Overall weight (ranking)
Organizational O1	0		
SF1		0.38	0.16 (9)
SF2		1	0.42 (1)
SF3		0	0
SF4		0.68	0.28 (7)
SF5		0.312	0.13 (10)
Team formation TS2	1		
SF6		0	0
SF7		1	0.39 (2)
SF8		0.675	0.26 (8)
SF9		0.86	0.34 (3)
Team task TT3	0		
SF10		1	0.33 (4)
SF11		0.89	0.30 (6)
SF12		0.91	0.31 (5)

Weighted factors and their alternative of factors are used to know the highest score is the most important factor that needs more attention.

The table shows the overall weights of success factors of kaizen event teams. The most critical factor prior to the case company was team structure of the kaizen event Followed by organizational factor and team tasks.

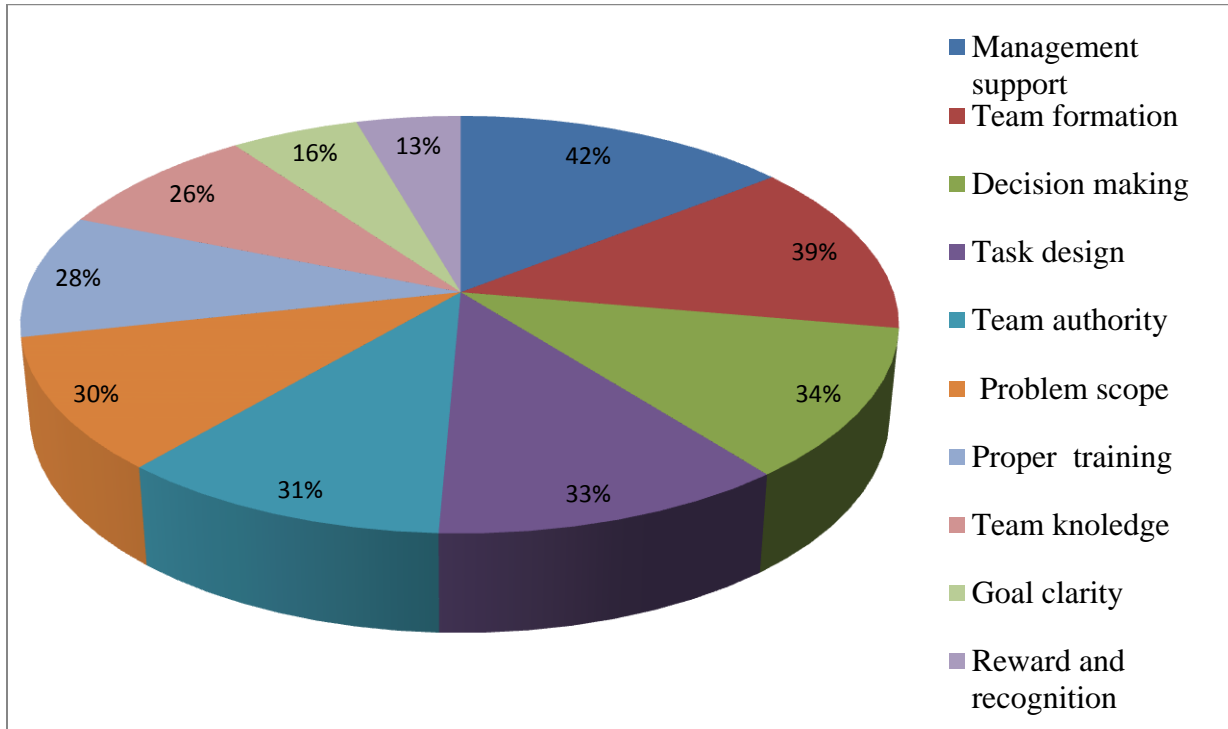


Figure 7: represents the final ranking and selection of the three alternatives

According to fuzzy AHP analysis that from experts judgmental that management support, team formation and decision making have been taken as a priorities. According to their priority order

- Management support
- Team formation
- Decision making
- Task design
- Team authority
- Problem scope
- Training ...

4.11.5 Result and discussion

The final weights for the three factors that affect success of kaizen event teams were shown in the above table 17, which are ‘management support’ (1) show the highest importance with respect to each factor. It is the most important factor that affecting the kaizen event team in the case company Followed by ‘team formation’ and ‘decision making’ success factors. The relatively slight difference in weights occurred between the three success factors. The result show that ‘management support’ is outweighs all other success factors by. The alternatives team attitude, team formation, team knowledge and decision making have their own value for the success of the team. Therefore, in order to implement the kaizen event successfully in kessem sugar factory

- The management must support the program it can be in finance, moral, initiation, being an example, recognize and rewards, and monitor their activities.
- Kaizen team formation must be structured based on dedicated cross functional team to improve a target activity. The team may have different size and different roles. The team member problem solving ability must be considered. Each member must have specific knowledge of the process.
- Decision making ability should be free from the management. The team can reflect their idea through meetings freely.

The second rank comes after the ‘management support’ were ‘team formation’ and then ‘decision making’. That implies support from the organization will promote to employee initiate to participate. Thus paying attention to team task and organizational factor are also another success factors. For the alternatives shown in figure 8 ‘team formation’, ‘decision making authority’ and ‘team authority’ are all prior from all other success factors. The study prioritized the factors that affect the kaizen teams in kessem sugar factory. The main factors which face the company were lack of well ‘team structure’ followed by ‘management support’ and ‘team task’.

4.11.6 Analysis result

According to the above results that kaizen event team had different factors that are mainly affecting the implementation program. Depending on the results from correlation analysis kaizen event team factors at organizational measurement described below.

The management support had strong positive correlation with problem solve. It means that the management support for the kaizen event team in financial, moral, and resource allocation and so on will solve the problems that face during the implementation program. Also team formation had the very strong positive correlation with group composition. That reviles group composition is more important for effective team formation.

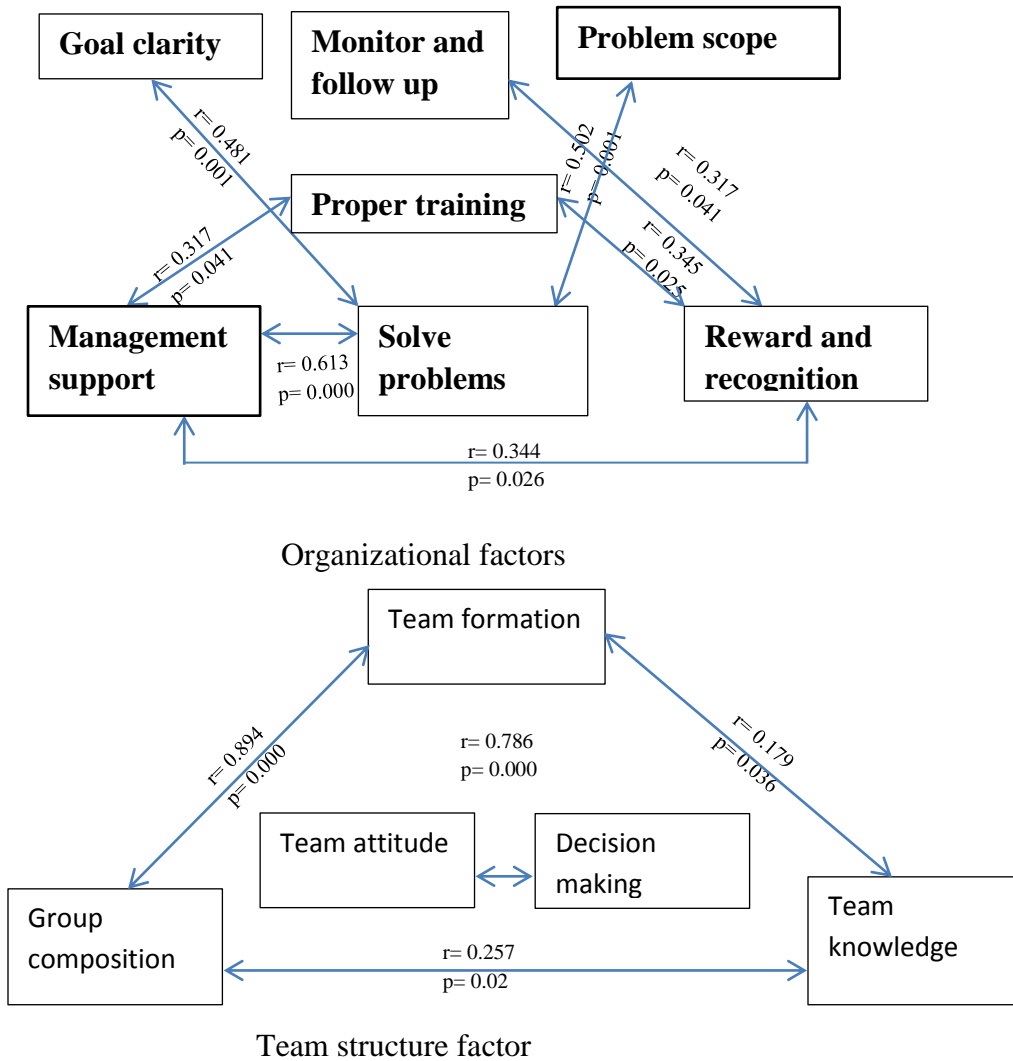


Figure 8: correlation between each perspective

From the factor analysis and fuzzy AHP analysis the factors that extracted based on questionnaire and expert judgmental of prioritization come up to one solution. The common factors were management support and problem solve. They have been also strong positive

correlation. Next to that team formation, decision making, task design, team authority, goal clarity, monitor and follow-up, solve problem, and proper training were included to each circle of analysis.

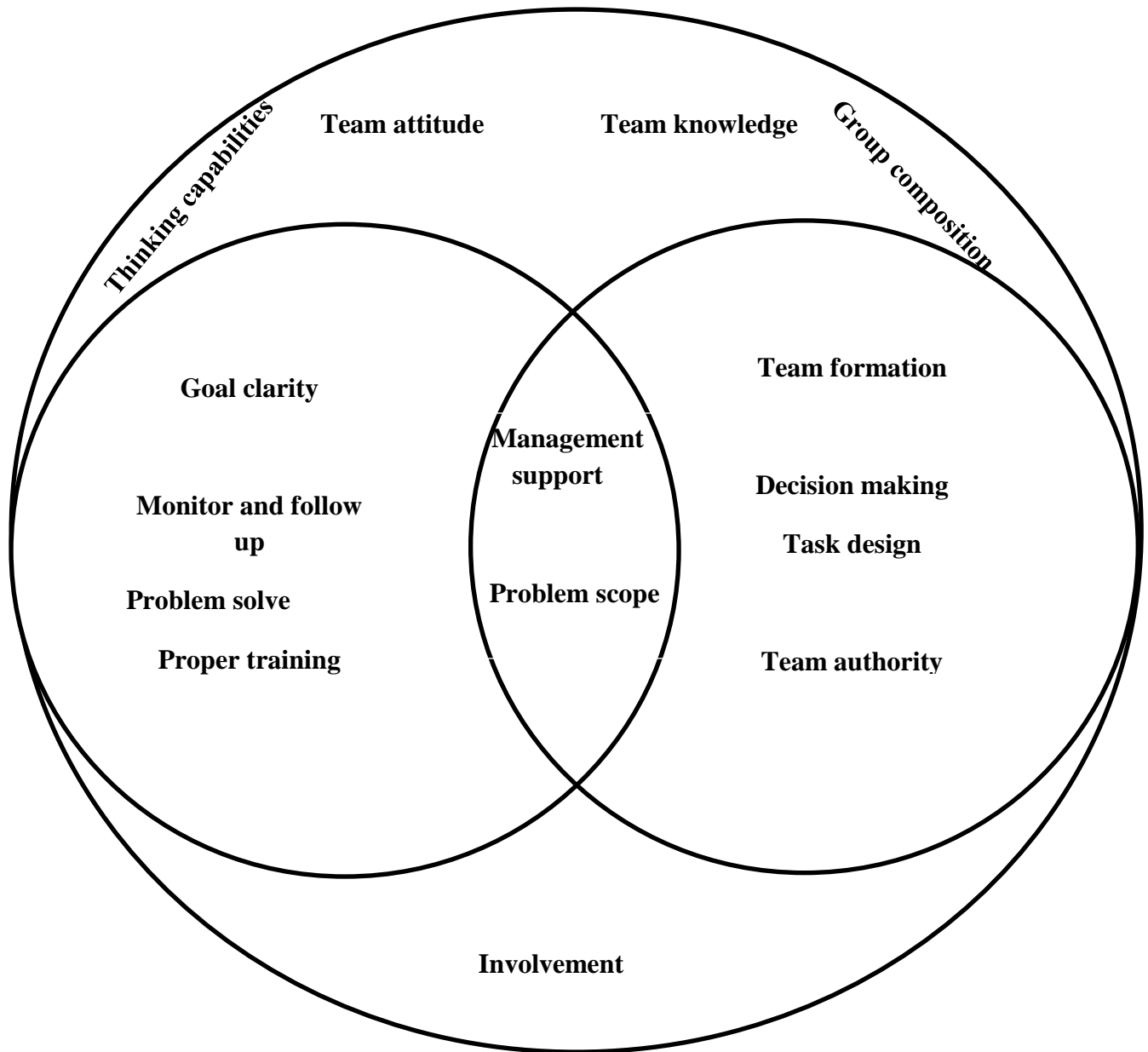


Figure 9: result analysis of factor and fuzzy AHP

CHAPTER FIVE

5 Improved kaizen event teams

This part of the paper was intended to answer research objective. As discussed and argued in the previous chapter, it is needed to have a solution for kaizen event teams to improve their contribution on kaizen event program. The factors that affected the kaizen event process identified and analyzed in chapter four analysis sections. The factors that mainly had an impact on the program were management support, problem scope, team formation, and decision making and so on. As it shown below in figure 11 those factors identify in detail.

5.1 Kaizen success factors

The fish bone diagram, which is a quality control tool let an industry analyses the root cause of the problem through the process problem solving method. Fish bone diagram has been used for the brainstorming issue where root cause is analyzed. In this study the questionnaire developed include main three factors (they were selected according to different literatures and Ethiopian kaizen institute evaluation measurements) that affect the kaizen teams those factors has been divided in to ten main sub- factors. As a data analysis these factor are the most significant effects on success of the kaizen event teams. The analysis of the sub factors were described below in the fishbone diagram

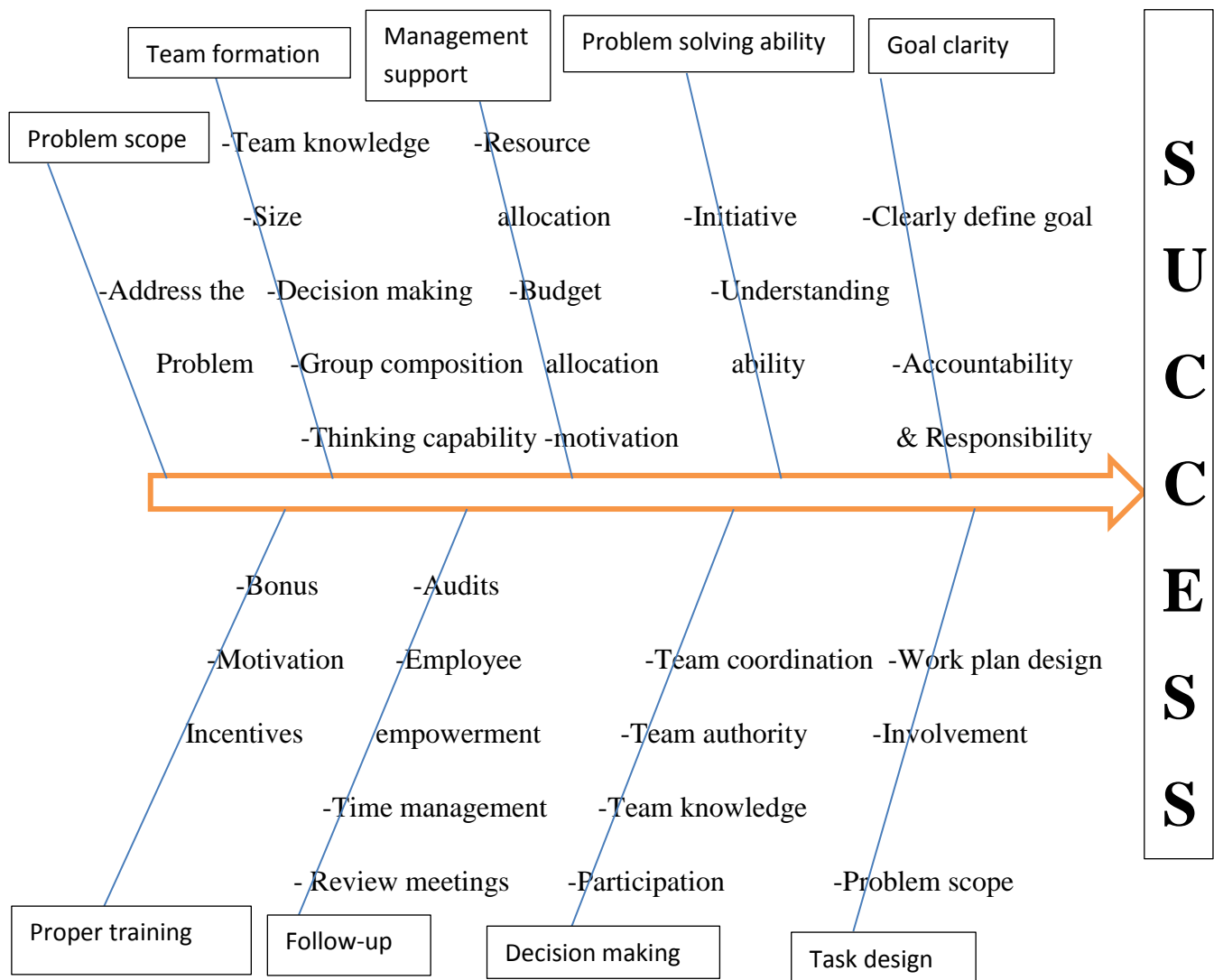


Figure 10: Fish bone diagram for success factors of kaizen event teams

5.2 Improved kaizen event team implementation framework

Improved kaizen event team implementation framework described the success of the kaizen event team during implementation program. The factors those affect the success of kaizen event teams also described in the framework. The success of kaizen event has three stages planning, kaizen event, and recognition stages. First at the planning stage the kaizen department plan to identify the case, set goals, selects team, and document the current process. Factors such as management support, goal clarity, team formation, and follow up are mainly affect the planning stage. Secondly kaizen event stage includes identify the problem, countermeasure the plan, proper direction; make change, result achieved, and measure the result. At this stage kaizen

implemented using the kaizen event teams for the successful implementation on the workplace. Kaizen event faces factors such as problem scope, task design, decision making authority, follow up, team attitude, team knowledge and so on. Those factors are mainly affecting the event. Finally at the recognition stage the management recognizes the employees to initiate and improve their success. The management support specially needed at all stage of kaizen event team success framework.

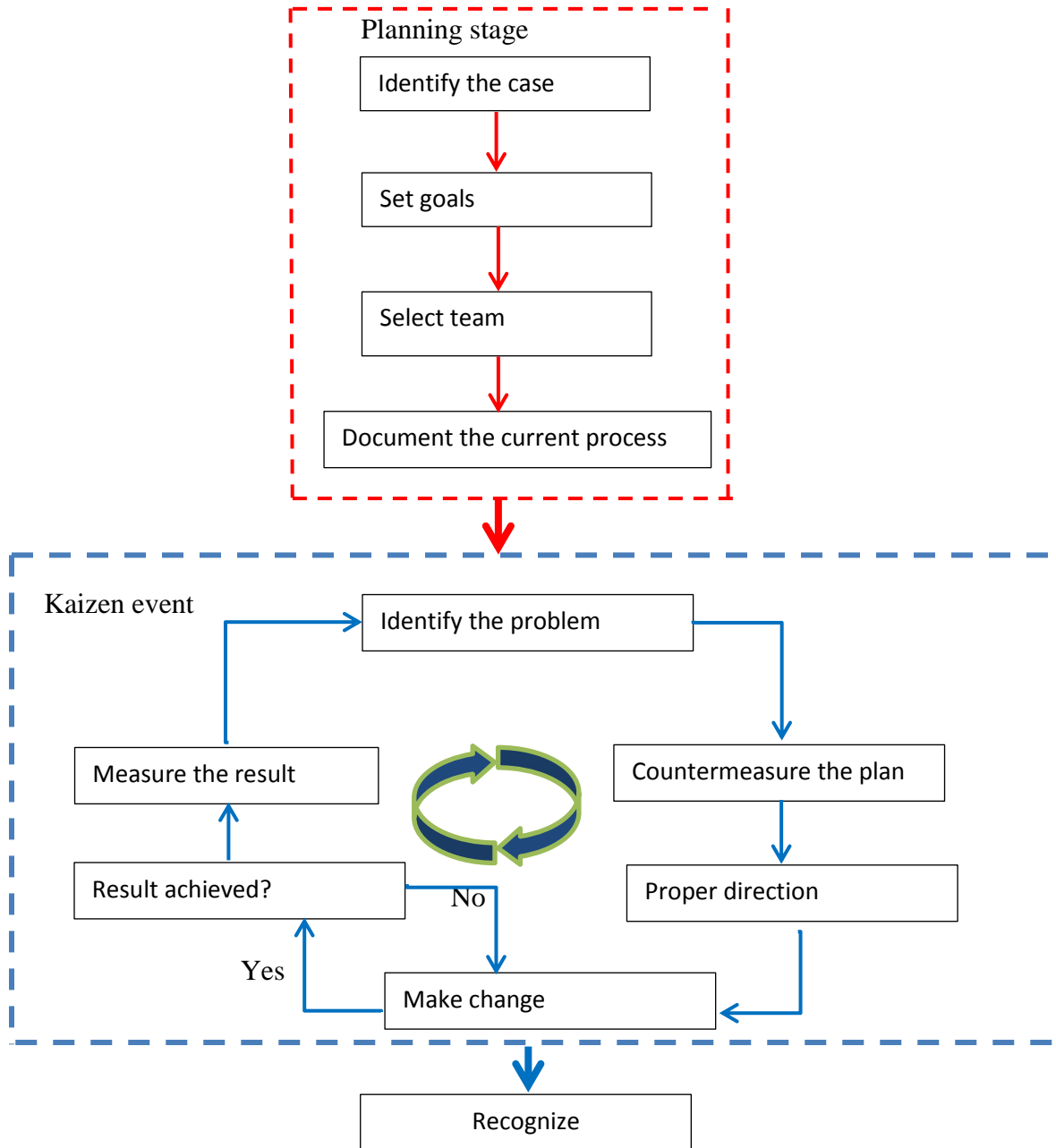


Figure 11: Improved kaizen event team implementation framework

1. Identify the case

At the planning stage of kaizen event is identifying the case. It is a launching pad for kaizen event. It defined as a difference between expectation and the current process. To exceed the expectations the kaizen event should eliminate the scrap, bottlenecks, and increase delivery performance.

2. Set goals

The goals set by the kaizen department and with the support of management. It must be measurable e.g.: time, money, defects, rework, and improved workplaces. Also align with the company's strategic goals and identified by safety, quality, delivery, and cost. The problem scope should be stretch but realistic target on improvements.

3. Select the team

The team selection should be done with the kaizen officers and the management bodies. During the team formation, Team Structure, Team Member Problem-Solving Abilities, team knowledge, team attitude, thinking capabilities and group composition should be consider. Team size should be based on the area being kaizen and weight of the task. The team selection includes team sponsor, facilitator, team leader, and members.

Every team member should be chosen for a specific reason and in different perspective. After the kaizen event team formed the kaizen event process followed up. After selecting the team's continuous training given to the members to initiate them participate continuously.

4. Document the current process

The current process of should be documented to understand how processes are performed in the present time. The document can be includes observation sheet, layout, and 5S that helps to understand what is happening in the area.

5. Identify the problem

The kaizen event team members and the officer's task is to identify the problems or wastes of their workplace. They can identify the problems that attack the event.

6. Countermeasure the plan

In this stage focusing on the things that can be done within the kaizen are come first. Low cost solutions (creativity), right-sized resources, and maximum waste elimination are more the boundaries of the kaizen event team process.

7. Proper direction or reality check

The facilitator and the team leader review the countermeasures and the to-do lists to ensure the event in proper direction also this are proper lean solutions. The facilitator then approves the plan if it goes in proper planned direction.

8. Make changes

Make changes biases to actions, just Do it!! The kaizen event team engaged in makes change stages also the kaizen officers and management support them with their necessities. The team leader helps lead and guide the process. The team should build coalition, involvement, authority, knowledge, thinking capability, and cooperation. The kaizen event team facilitator manages and organizes meetings to report on each task progress every day. The management encourages team members to work collaboratively and find creative solutions.

9. Result achieved?

The kaizen department officers Observe the results that achieved by the kaizen event teams. If it achieved proceed to measure the results and evaluate. But if not, again go back and check to make additional changes.

10. Measure the result

The result that achieved make changes then measured by the kaizen officers and the team leaders. Measuring result includes waste elimination, sustainability of improvements, improvement aligns with company strategy and plan, and the objectives of the kaizen event achievement should be concerned.

11. Recognize

The teams that performed great achievement announced and recognized by the management. For repeatable achievement reward and recognition initiate the team members.

Management support included at all over the process to support at planning stage and the event process also. After the kaizen, the focus must be placed on ensuring that the improvements continue. This is done by aggressive follow-up on the activities by the managers and the kaizen department officers. According to the process below the kaizen event team can perused their activity successfully.

CHAPTER SIX

6 CONCLUSIONS AND RECOMMENDATIONS

. The conclusion and recommendations drawn were focused on addressing the purpose of this study which was the success of kaizen event teams in kessem sugar factory. From the analysis and data collected, the following conclusions and recommendations were made.

6.1 Conclusion

There is no better way than Kaizen event to reflect organization culture geared towards improvement realizes by minor steps, step by step, every day, within the framework of all processes. Every employee is obliged to improve his/her individual skills in order to be able to achieve high quality, low costs and delivery on time.

The assessment done on kessem Sugar Factory regarding kaizen event team success factors has come up with major factors that affect the implementation program. Based on these findings the following conclusion can be drawn. The result from the data analysis shows that kaizen event team factors that mostly affect the success of the program are the management support, problem scope are mainly affect the event besides team formation, decision making, task design, and team authority according to judgmental decision of the experts prioritized. On the other hand goal clarity, problems solve ability, and proper training was extracted among the other factors. According to the interview results kaizen team formation needs serious attention to control every kaizen event team structure will be a failure to the kaizen events.

The priority of success factors enables policy makers to understand the relative importance among the factors and develop an improvement strategy for the management support. the management support in the kaizen event programs needed in all stages of the program for successfulness of the event. Due to lack of initiation, well-formed team, motivation, support in financial, resource, trainings, attitude towards the kaizen activities affects the factory kaizen event team success.

From the challenge that affects the kaizen event team analysis team commitment, involvement, management support, team attitude, and allocation budget. These challenges can be resolved through willingness of the management to give value for the kaizen events. Also the resistance of

the employee for this improvement program needs to be strong. The employee and management attitude can change by adequate trainings and by experience sharing's from other company.

The result suggests the kaizen event team size depends on their heavy tasks. The team member had their own role that they perform according to the program. The kaizen event team should be formed with a team leader at the top. Below the team leader is a sub-leader. Their role is to control activities also they are the member of the team. The team member can differentiate the tasks to different small groups. The size of teams in the group can change as conditions of the problem.

On the basis of the data analysis and interpretation regarding implementation of Kaizen event teams, it helps the factory. Accordingly, it contributes to the continuous improvement of the Factory's productivity by strong kaizen team. Other important contributions of kaizen teams, as the collected data witness, are to change the team attitude and develop support from the management, development of trust and confidence between team members as well as improved strong relationship between them. This are directly helped the factory to develop its productivity. Kaizen event team brought changes through avoiding considerable wastes in production and this has helped the factory to increase production quality and quantity.

6.2 Recommendations

The kaizen event team success determined by the following supportive actions: The management gets profits from the rework materials or modifications of the kaizen event teams. That money should invest for the kaizen team's necessity. That shows the managements support without the request of kaizen event team. The management should have to change their attitude of kaizen as a fault finder or as a second task which increase the initiations of the members for improvement. At a current situation EKI has responsibilities to measure the implementation program but it should be organizational measurement. The management should prepare its on evaluation checklist for the performance of every team as well as the members. The respond for what action should the management done to resolve problems. Also strict follow up needed to employees to control every detailed activity. The success of the organization has been through its qualified and skilled human resources, because human resources are the driver of the Kaizen event teams. Hence, the factory must revise the different human resource policies (such as, recruitment, retention mechanism, pay scale) so as to recruit and retain skilled human resources.

According to the fuzzy analysis team formation has its own effect on success of kaizen event team the effective team formation requires structurally formed and the size of the team should be depend on the types of task. More is not always better. More team members on a kaizen team slow progress considerably. Also it's essential for rapid decision making. Cross- functional composition: team members should be chosen with care, considering both the need for varying perspectives. The kaizen team must understand all of the relevant inputs and outputs in the process. The facilitator who has the greatest chance of producing aggressive results, while creating a positive environment for rapid change spreads throughout the organization. The facilitator should have Technical skills: able to apply the full range of lean principles and tools, strong project, time management, and organization skill needed, Effective team building strong listening skills, and understand human psychology and the change process. Authority: should be confident and trustworthy. Also has to be strong influential leader. Personality: the facilitator should be challenging yet supportive, creative, problem solver. Effective team needs a charter, a mission, and a set of expectations for its work as a team. Individuals of the team members, collaborative teams may need to substantially, the skills that has been obtained include meeting management, problem solving, collaboration, influencing, and change management.

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APPENDIX A

Addis Ababa Institute of Technology

School Of Graduate Studies

School Of Mechanical and Industrial Engineering

Dear participants;

I am Selamawit Birara, a master's graduate student at the School of mechanical and industrial engineering. This questionnaire is designed to gather information on kaizen event team success and sustainability in kessem sugar factory.

The main purpose of this questionnaire is to obtain information about your company's overall experience with Kaizen concerning kaizen event teams also kaizen team challenges and achievements of Kaizen Implementation in your Organization.

Any information you give would be kept confidential as the data are needed for academic purpose only.

Your kind cooperation is very much appreciated.

With best regards!

Selamawit Birara

Interview guiding questions for

Key Factory Officials'

1. What did you perceive your role in the implementation?
2. What improvement tools implemented in the company?
3. How do you describe improvement activities in your office?
4. What's your understanding in kaizen event team?
5. What do you think the benefit of kaizen event teams?
6. What are the factors faced in your kaizen team?
7. Do you feel the kaizen team was successful? Why?
8. Do you have schedules to meet the kaizen teams?
9. Is there any reward for employee contribution?
10. If there is a culture of recognition, was that really helpful?
11. What are the supports from top organization?
12. Did the management support by allocation of training material?
13. What do you expect from the organization for strengthen the teams?

Thank you very much for your time and help.

**Interview Guiding Questions For
Kaizen management Officers**

1. How effective was the department in implementing Kaizen event?
2. How effective was the department in kaizen team formation?
3. How effectively select the kaizen team leaders concerning their members?
4. Does the kaizen team leaders and members trained according to the schedule?
5. How does the department to control meetings?
6. How effective was the institute evaluation of Kaizen event team?
7. How effective was the kaizen event team reporting and record problems at it occur?
8. Does the kaizen event team effectively use the schedule?
9. Is there any evaluation method for the kaizen event team?
10. How do you evaluate and monitor the outcome of Kaizen event team on the general work culture?
11. What are the major achievements and challenges of the Kaizen teams particularly in the manufacturing sector?
12. Does the organization accept the questions raised by the teams?
13. What are the supportive actions of the organization for the kaizen event teams?
14. How do you find the willingness and capability of the team to continue working together in future?

Thank you!!!

8.	O5	Lack of proper training (for members less than 5 days)					
9.	O5	Implemented documents are well prepared, analyzed and organized					
10.	O6	Proper Understanding of problem identification in all kaizen teams					
11.	O6	All of the workers organize in team					
12.	O7	Lack of reward and recognitions					

Kaizen Team and individuals for kaizen teams (kelibu)

No	Code	Kaizen Team and individuals	Availability				
			5	4	3	2	1
1.	TS1	Our entire team understands our goals					
2.	TS1	Most of our team members think that this Kaizen event is a good strategy for this work area.					
3.	TS1	In general, members of our team think that it is a mistake to hold this Kaizen event					
4.	TS1	This Kaizen event has improved the performance of this work area.					
5.	TS1	Most of our team members liked being part of this Kaizen event.					
6.	TS1	In general, this Kaizen event motivated the members of our team to perform better.					
7.	TS1	This Kaizen event had a positive effect on this work area.					
8.	TS1	Overall, this Kaizen event increased our team members' interest in our work.					
9.	TS2	Our team had enough help from our facilitator to get our work done.					
10.	TS2	Our team formed according to cross functional structure					
11.	TS2	The kaizen event team formation is accordingly the structure					
12.	TS3	Our team was free to make changes to the work area as soon as we thought of them.					

13.	TS3	Our team had enough contact with management to get our work done.					
14.	TS4	It will take a lot of skill to achieve our team's improvement goals.					
15.	TS4	Most of our team members gained new skills as a result of our participation in this Kaizen event.					
16.	TS4	Our team had enough help from others in our organization to get our work done.					
17.	TS4	Our goals clearly define what is expected from the team					
18.	TS5	In general, members of our team believe that this Kaizen event is needed.					
19.	TS5	Overall, this Kaizen event increased our team members' knowledge of the need for continuous improvement.					
20.	TS6	This Kaizen event made most of our team members more comfortable working with others to identify improvements.					
21.	TS6	Well group composition					
22.	TS6	Our team members are a composition of fly kite					
23.	TT1	This work area improved measurably as a result of this Kaizen event.					
24.	TT1	Our team had enough materials and supplies to get our work done					
25.	TT1	In general, this Kaizen event increased our team members' knowledge of how continuous improvement can be applied.					
26.	TT1	This Kaizen event increased most of our team members' ability to measure the impact of changes made to this work area.					
27.	TT1	The kaizen event team defines the goals and strategies.					
28.	TT1	Meeting our team's improvement goals will be tough					
29.	TT2	Our team had enough equipment to get our work done					
30.	TT2	Lack of problem solving ability					
31.	TT3	Our team had a lot of freedom in determining how to improve this work area.					

32.	TT3	Our team had a lot of freedom in determining what changes to make to this work area.					
33.	TT4	Our team spent as much time as possible in the work area					
34.	TT4	Our team spent a lot of time discussing ideas before trying them out in the work area					

Challenges to Sustainability of kaizen event teams

No	Challenges to Success of kaizen event teams	Availability				
		5	4	3	2	1
1.	Teams commitment and innovativeness is one of the challenges facing Kaizen event sustainability					
2.	Lack of participation of members affects the sustainability of Kaizen event					
3.	Organization structure affects sustainability of Kaizen event					
4.	Kaizen event sustainability is faced by lack of management support or leadership					
5.	Resource constraints is a major challenge facing Kaizen event sustainability					
6.	Attitudes and misconceptions about Kaizen is one of challenges facing Kaizen Sustainability					
7.	Ineffective training affects Kaizen event sustainability					
8.	improper kaizen event team formation is a factor affecting Kaizen event success					
9.	Lack of proper communication systems is one of challenges faced by kaizen event teams					

APPENDIX B

Evaluation of kaizen teams

ተ.ቁ	የመጠይቁ መግለጫ	4ነጥብ (በጣም ጥሩ)	3ነጥብ (ጥሩ)	2ነጥብ (ዝቅተኛ)	1ነጥብ (በጣም ዝቅተኛ)	ውጤት	አመላካች
1	የልማት ቡድን አደረጃጀት						
1.1	በክልቡ አደረጃጀት መመሪያ መሰረት በአመራር ከይዘን እና በቡድን ካይዘን መደራጀታቸውና ስራቸው ተመሳሳይ የሆኑ ከ3-10 አባላትን የያዘ የቡድን አደረጃጀት መደራጀታቸው						
1.2	ሁሉም ቡድኖች መሪና ፀሃፊ በቡድን አባላት ተመርጦ በቃለ ጉባኤ ሲያዘና ለቡድናቸው ስም መሰየማቸው ሲረጋገጥ						
1.3	ሁሉም የቡድን አባላትና መሪዎች የክልቡ ስልጠና የወሰዱና መሪዎቻቸው የመሪዎች ስልጠና የወሰዱ መሆናቸው ሲረጋገጥ						
1.4	በአደረጃጀታቸው መሰረት የቡድን አባላቱ የመሪው የስራ ድርሻና ኃላፊነት በግልፅ የተቀመጠና ሁሉም አባላት የሚያውቁት ሲሆን						
1.5	የሰብሰባ ዓይነት ፣ ቦታ ፣ ሰዓትና የሚፈጀው ጊዜ ተወስኖ መረጃው በፋይላቸው ወይም በቦርድ ላይ ሲለጠፍ						
2	የካይዘን ልማት ቡድን (ክልቡ) አሰራር						
2.1	በስራ ቦታቸውና በስራቸው ላይ የሚያጋጥሟቸውን ማንኛውንም ችግር መመዘገብና ችግሩን ለቡድን መሪው ማሳወቅ መቻላቸው						
2.2	ከስራተኞች የሚነሱ ችግሮችን መሰረት በማድረግ ለቀጣይ አጀንዳ በቃለ ጉባኤ ላይ መካተቱ ሲረጋገጥ						
2.3	የተመረጠው አጀንዳ ሁሉንም አባል የሚያሳትፍና የሁሉም አባል የስራ ቦታ ችግር መሆኑ በጭብጥ ማስረጃ ከተረጋገጠ ማለትም ከነባራዊ ሁኔታ ቀጥተኛ ግንኙነት ያለው መሆኑ ሲረጋገጥ						
2.4	የችግሩን ስፋትና ጥልቀትን መረዳት የሚያስችልና የደረሰውን ጉዳት የሚያሳይ አሃዛዊ መረጃ ሲያዘና ሁሉም አባላት ለችግሩ ዕውቅና መስጠታቸው ሲረጋገጥ						
2.5	የአጀንዳውን አስፈላጊነት በግልፅ ተቀምጦ በሰብሰባው ላይ ሁሉም አባላት ተገኝተው የነቃ ተሳትፎ ማድረጋቸውና የጋራ ውሳኔና መፍትሄ መስጠታቸው በመረጃ ተደግፎ ሲያዘ						
2.6	ከተጠናው ነባራዊ ሁኔታ በመነሳት ግልፅ የሆነ ኢላማ ሲቀመጥ						
2.7	ከቡድኑ አቅም በላይ የሆኑ ችግሮችን መለየትና ለሚመለከተው አካል ማሳወቅ፣ ለአዳድስ ሃሳቦችና ፈጠራዎች ማስፈፀሚያ ግብዓቶችን እንዲሟሉ						

	በመሪው በኩል መጠየቅ / ተጠይቆ ሲወሰን/						
2.8	የተቀመጠው ኢላማ ለመድረስ የሚሰሩ ዝርዝር ተግባራት መርሃ ግብር ወጥቶለት ሁሉም አባላት የቤት ስራ ተሰጥቷቸው በተቀመጠው መርሃ ግብር መሰረት ሲፈጸምና ውጤት ሲያስመዘግቡ						
3	የክልቡ መረጃ አያያዝ						
3.1	ክልቡዎች የቃለ ባኤ፣ የሪፖርት፣ የእቅድ፣ የተሳትፎና ሌሎች መረጃዎችን በቅጾቹ መሰረት በክልቡ መረጃ ቋት መያዛቸው						
3.2	ሁሉም አባላት የሚያመነጩትን ሃሳብና በቡድኑ ተሳትፎ የሚያደርጉት አስተዋፅኦ ተለክቶ በመረጃ ቋታቸው ሲገኝ						
3.3	በአጠቃላይ ቡድኑ ያስመዘገበውን ውጤትና ያመጣውን ለውጥ የሚያሳይ አሃዛዊና አሃዛዊ ያልሆኑ ውጤቶች ተመዝኑና ተለክተው የተያዘበት መረጃ ከመረጃ ቋታቸው ሲገኝ						
4	ግምገማ ስርዓት						
4.1	ቡድኑ አፈፃፀሙን በየወሩ እየገመገመ የቡድኑን፣ የመሪውንና የአባላቱን የአፈፃፀም ደረጃ ሲያወጣና ከአስተባባሪው ኮሚቴና በአብይ ኮሚቴ ግምገማና ግብረ መልስ መቀበሉ ሲረጋገጥ						
4.2	በቡድኑ አባላት ውስጥ ዝቅተኛ ተሳትፎና አፈፃፀም ያላቸውን የቡድኑ አባላት ለይቶና የሚያስፈልጋቸውን ድጋፍ ለአስተባባሪው ሲያሳውቅ						
4.3	የተሻለ ለውጥ የተገኘባቸው ተሞክሮዎችና አዲስ ሃሳቦችን የፈጠረን አባል ያመጣውን ውጤት ገልፀው ለሚመለከተው አካል ሲያሳውቁ						
4.4	በትግበራ ሂደት ላይ ገዢ የሆኑ ጉዳዮች ካሉ ተለይተው ለበላይ አመራር አሳውቀው ውሳኔና የመፍትሄ አቅጣጫ እንዲሰጥባቸው ያላሰለሰ ጥረት ማድረጋቸው ሲረጋገጥ						
5	ሪፖርት ዝግጅትና አቀራረብ						
5.1	የቡድኑ ሪፖርት በወጣለት መርሃ ግብር መሰረት ለሚመለከተው አካል ማቅረብ						
5.2	ቡድኖችን ያላቸውን የልምድ ልውውጥ የሚያሳይ ሪፖርት ማዘጋጀታቸው						
5.3	በሪፖርት ውስጥ መካተት ያለባቸውን መረጃዎች በሙሉ ማካተት						
	ጠቅላላ ውጤት						
	አማካይ ውጤት						

APPENDIX C

Questionnaire design

No	Code	Factor	Categories
1	O1	Goal clarity	Organizational
2	O1		
3	O2	Management support	
4	O2		
5	O3	Monitor and follow up	
6	O3		
7	O4	Solve problems	
8	O5	Proper training	
9	O5		
10	O6	Problem scope	
11	O6		
12	O7	Reward and recognition	
13	TS1	Team attitude	Team structure and team task
14	TS1		
15	TS1		
16	TS1		
17	TS1		
18	TS1		
19	TS1		
20	TS1		
21	TS2	Team formation	
22	TS2		
23	TS2		
24	TS3	Decision making	
25	TS3		
26	TS4	Team knowledge	
27	TS4		
28	TS4		
29	TS4		
30	TS5	Thinking capability	
31	TS5		
32	TS6	Group composition	
33	TS6		
34	TS6		
35	TT1	Task design	

36	TT1		
37	TT1		
38	TT1		
39	TT1		
40	TT1		
41	TT2	Problem scope	
42	TT2		
43	TT3	Team authority	
44	TT3		
45	TT4	Involvement	
46	TT4		

APPENDIX D

Interview results in short

Questions	Gender office Respondents
1. What did you perceive your role in the implementation?	Gender staff curator
2. What improvement tools implemented in the company?	There are three types of improvement tools such as BSC, kaizen, and Qcc
3. How do you describe improvement activities in your office?	Good, because the activities are completed as we scheduled also there is a meeting in a week to discuss.
4. What's your understanding in kaizen event team?	The kaizen event teams grouped in 5 and they have the same activity. The team meets in a week to solve the problems by discussing.
5. What do you think the benefit of kaizen event teams?	First the person will know about his work and understand his activity Second there are different problem solving ideas raised
6. What are the factors faced in your kaizen team?	The kaizen team formed randomly not structural. Also there is shortage of teams compared to the heavy activities
7. Do you feel the kaizen team was successful? Why?	No because there is lack of training, recognition, and support from the management
8. Do you have schedules to meet the kaizen teams?	Yes every weekend
9. Is there any reward for employee contribution?	No
10. If there is a culture of recognition, was that really helpful?	There is a board to announce who perform great that's all
11. What are the supports from top organization?	Attend the meetings with kaizen event team to discuss freely with every members
12. Did the management support by allocation of training material?	Yes
13. What do you expect from the organization for strengthen the teams?	The organization should support the team by encouraging it

Questions	Finance office Respondents
1. What did you perceive your role in the implementation?	Finance sector vice manager
2. What improvement tools implemented in the company?	BSC and kaizen
3. How do you describe improvement activities in your office?	Good, the improvement tool lead us work in our schedule, increase productivity, and cost reduction
4. What's your understanding in kaizen event team?	
5. What do you think the benefit of kaizen event teams?	Working in a team will separate the problems that occurred in the event, to encourage inventiveness, and together to solve problems
6. What are the factors faced in your kaizen team?	Lack of recognition and reward
7. Do you feel the kaizen team was successful? Why?	Yes the problems are solve at a time through weekly meetings
8. Do you have schedules to meet the kaizen teams?	Yes one day with a week
9. Is there any reward for employee contribution?	No
10. If there is a culture of recognition, was that really helpful?	There is announcement of the best employee of the event
11. What are the supports from organization?	The organization solves the problems above our team
12. Did the organization support by allocation of training material?	Yes
13. What do you expect from the organization for strengthen the teams?	The organization should stand for the team to support at any problem

Questions	Agriculture office Respondents
1. What did you perceive your role in the implementation?	Agriculture manager
2. What improvement tools implemented in the company?	BSC and kaizen
3. How do you describe improvement activities in your office?	Medium, 5s activities are not properly improved for example lack of space to kip the materials which occurs mixing with different tools.
4. What's your understanding in kaizen event team?	
5. What do you think the benefit of kaizen event teams?	All of the employees have different ability and knowledge which helps to fill the gaps between each other by helping the kaizen event teams
6. What are the factors faced in your kaizen team?	There is shortage of training
7. Do you feel the kaizen team was successful? Why?	Yes, knowledge shared
8. Do you have schedules to meet the kaizen teams?	Yes
9. Is there any reward for employee contribution?	No
10. If there is a culture of recognition, was that really helpful?	
11. What are the supports from organization?	Problem solving idea in meetings
12. Did the management support by allocation of training material?	Yes
13. What do you expect from the organization for strengthen the teams?	Continuous follow up, recognition and allocation of resource

Questions	Civil and construction office Respondents
1. What did you perceive your role in the implementation?	Civil and construction vice manager
2. What improvement tools implemented in the company?	Kaizen team
3. How do you describe improvement activities in your office?	Good, but weekly best implementer should be continuous
4. What's your understanding in kaizen event team?	The team formed in 5 to 1 and has the same activity. The team meets in a week to solve the problems by discussing.
5. What do you think the benefit of kaizen event teams?	Cost reduction, waste reduction, time management, and problem will be easy to solve
6. What are the factors faced in your kaizen team?	Continuous training should be important
7. Do you feel the kaizen team was successful? Why?	Yes but continuous follow up should be important
8. Do you have schedules to meet the kaizen teams?	Weekly and once in a months
9. Is there any reward for employee contribution?	No
10. If there is a culture of recognition, was that really helpful?	
11. What are the supports from organization?	First the organization bring this improvement tool and solves problems that are beyond the teams
12. Did the organization support by allocation of training material?	Yes
13. What do you expect from the organization for strengthen the teams?	The last time we attained meetings are one years ago so the management should think of it

Questions	Safety office Respondents
1. What did you perceive your role in the implementation?	Safety officer
2. What improvement tools implemented in the company?	Kaizen team, BSC
3. How do you describe improvement activities in your office?	Medium, uncooperative
4. What's your understanding in kaizen event team?	Organizing in a team to implement and to solve problems
5. What do you think the benefit of kaizen event teams?	By sharing different ideas and raising new ideas working together
6. What are the factors faced in your kaizen team?	Team cooperation, management focus, and support
7. Do you feel the kaizen team was successful? Why?	Yes
8. Do you have schedules to meet the kaizen teams?	Yes every weekend
9. Is there any reward for employee contribution?	No
10. If there is a culture of recognition, was that really helpful?	
11. What are the supports from organization?	The organization should support the kaizen team with resource, budget and motivate.
12. Did the organization support by allocation of training material?	Yes
13. What do you expect from the organization for strengthen the teams?	

Questions	Civics and good governance office Respondents
1. What did you perceive your role in the implementation?	Manager of Civics and good governance office
2. What improvement tools implemented in the company?	Kaizen team, ISO 9000 and so on
3. How do you describe improvement activities in your office?	Medium, it is not that much change as it started
4. What's your understanding in kaizen event team?	Yes, but now kaizen event teams at the factory are not productive
5. What do you think the benefit of kaizen event teams?	There are a lot of benefits from the kaizen event teams such as: work stress and overlap in one body will solve, for sharing idea at last but not least unity is power.
6. What are the factors faced in your kaizen team?	Lack of focus, continuously work
7. Do you feel the kaizen team was successful? Why?	Yes but not now
8. Do you have schedules to meet the kaizen teams?	Yes every weekend
9. Is there any reward for employee contribution?	No
10. If there is a culture of recognition, was that really helpful?	
11. What are the supports from organization?	Continuous follow up
12. Did the organization support by allocation of training material?	Yes
13. What do you expect from the organization t for strengthen the teams?	Continuous improvement needed

