

Addis Ababa University

College of Business and Economics

Department of Management

Critical Success Factors for Sustainable Kaizen Implementation in Case of Mugher Cement Factory

A Thesis submitted to school of Graduate Studies of Addis Ababa University in partial fulfillment of the requirement for the Degree of Masters of Science in Management

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DECLARATION

I, the undersigned, declare that this thesis is my original work and has not been presented for a degree in any other University, and that all sources of materials used for the thesis have been duly acknowledged and submitted for examination.

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This Thesis has been submitted for examination with my approval as a University advisor.

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College of Business and Economics

MSc. in Management Program

This is to certify that the thesis prepared by Meseret Debalkie Asfaw entitled: ""**Critical Success Factors for Sustainable Kaizen Implementation in Case of Mugher Cement Factory**" and submitted in partial fulfillment of the requirements for the degree of Master of Science in Management complies with the regulations of the university and meets the accepted standards with respect to originality and quality.

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Abstract

The purpose of this study focused on identifying critical success factors for sustainable first phase Kaizen implementation in Mugher Cement Factory. This study adopts a quantitative method as the research methodology. Accordingly, a questionnaire was distributed to 156 managers of which 140 were collected with a response rate of 89.7 %. The study employed confirmatory factor analyses. A factor analysis by principal components and Varimax rotation was applied for finding the critical success factors. Finding assign that 21 items are merged in to five critical success factors: process control & recognition and reward accounts for 19.769 % of the variance; employee's attitude and employee participation accounts for 14.538 % of the variance; education and training & effective communication accounts for 11.767% of the variance and ownership, continual evaluation and teamwork accounts for 9.845% of the variance. All the five factors together explain for 76% of the variance in successful kaizen implementation. Validity test result of KMO and Bartlett's result reveals that the postulated factors are valid since KMO values are greater than 0.4 and Sphericity values are significant less than 0.05. Finally, the research recommended that to implement Kaizen on a sustainable basis; the leadership of the factory should be knowledgeable and totally committed to the Kaizen philosophy and principles, the factory should be strength process controlling and establishing recognition and reward system, provide enough education and training for the staffs and the employees should strength there teamwork sprite in the factory.

Keywords: Kaizen, Critical Success Factor, Success Indicator, Factor analysis

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Acronym

EKI	Ethiopia Kaizen Institute
JICA	Japanese International and Cooperation Agency
SPSS	Statistical Package for the Social Sciences
CI	Continuous Improvement
TQM	Total Quality Management

CHAPTER ONE

INTRODUCTION

The purpose of this chapter is to provide readers with an overview of the study topic and its approach. Although many readers may be eager to directly go to the findings before reading the first parts, the researcher recommends to anyone who has interest in reading the research to spend some time on Chapter One since it serves as the foundation for the rest of the thesis. The chapter deals with background of the study, statement of the problem, basic questions of the study, objectives of the study, Delimitation of the study, limitation of the study, significance of the study, and organization of the study report.

1.1. Background of the Study

Kaizen is a problem-solving and people-oriented process. It has been defined as any process of continuous improvement in any area of life: personal, social, home or work, and when applied to the workplace kaizen means continuing improvement involving everyone – managers and workers Imai (1991). In terms of the time consumption, this activity is above the duration of the internal process improvement (Aoki, 2008). Kaizen is people-oriented and its application involves everyone in the organization from top management to workers at the shop floor (Berger, 1997). It can therefore, support any management activities including cost reduction and time management Bertodo (1993) safety management Krause & Finley (1993) product design, productivity improvements, zero defects, maintenance management or new product development. This multiplicity of methods and contexts means that kaizen is highly versatile both as a concept and a technique. This study shall adopt the definition of kaizen as that presented by Brunet and New (2003) which shall be that, "kaizen to consist of pervasive and continual activities, outside the contributor's explicit contractual roles, to identify and achieve outcomes he believes contribute to the organizational goals" (p.1428).

Maurer (2004) states that Japanese firms have long applied kaizen to achieve their business goals and maintain excellence. Imai (2001) suggests that kaizen has contributed greatly to Japan's competitive success. In Japan, kaizen is a pervasive concept linked to all Japanese manufacturing practices Young (1992). And Japanese manufacturing management technique stands out among several factors accounting for the success of Japanese manufacturing firms as quality producers of goods, reduction

in costs, increased throughput and increased flexibility Lee (1992). Kaizen which is supposed to be simple, low cost, low technology and people focused, which primarily aimed to continuously enhance the firm's capabilities, productivity and quality, can be considered as a major competitive resource.

Mugher Cement Factory is a leading public enterprise in the industry playing a significant role in national development by producing and supplying to the market mainly two types of cement products which are needed for construction industry in the country. Main factory of Mugher Cement Factory is located in Oromia National Regional State, North Shoa Zone Administration, 90 kilometer away from Addis Ababa Ada BergaWoreda, at particular location called Mekoda. The factory, which used to be previously known as Mugher Cement Factory, was integrated with Addis Ababa Cement Factory since June 1999, and became known as Mugher Cement Enterprise under Council of Ministers "Regulation No 53/91; and later incorporated under Chemical Industry Corporation under Council of Ministers" Regulation No 280/2012 since 8th of January 2013. Addis Ababa Mugher Cement Factory was established in 1965 to produce with the capacity of 70000 ton cement per year.

The main objective of this study is to identify the critical success factor for sustainable kaizen implementation.

1.2. Statement of the Problem

Kaizen has been regarded as a key element in Japanese management and has been presented as one of the sources of the competitiveness of Japanese manufacturers. Since late of the 1980s, a larger number of studies, which have focused on different Kaizen systems, approaches and practices such as Japanese manufacturing techniques (Brunet, & New, 2003), the Toyota production system (Liker, 2004) and lean production , have illustrated the effectiveness of Kaizen. Furthermore, studies of kaizen activities in the countries outside Japan, such as US, China, Australia, Sweden and the UK suggest that the concept, approaches, and practices of Kaizen have become routinely accepted throughout the world. The implementation of kaizen in Ethiopian production companies is a recent phenomenon.

There are only few studies on key success factors development for kaizen sustainability in Ethiopian manufacturing firms. One of the related title study "Critical success factors

for sustainable kaizen implementation" is done by Haftu Hailu (2015), on the case of Peacock shoes manufacturing industry. He identified eight Critical success factors for sustainability. They are Factor 1: Perception, Factor 2: Process Control, Factor 3: Planning, Factor 4: Implementation, Factor 6: Continually Evaluation, Factor 7: Recognition and Reward and Factor 8: Employee Attitude. The second identical study was done by Wubshet Mulatu (2015). He also studied on the title "Identification of Key Success Factors and Kaizen Implementation for Sustainable Development Case in Selected Manufacturing Industry in Addis Ababa" identified eight success factors. They are Factor 1 Commitment, Factor 2: Leadership, Factor 3: Communication, Factor 4: Education and training, Factor5 Organizational objective Factor 6: Globalization and Factor 7 Resources.

According to Bullen & Rockart (1981) there are five major sources of critical success factors: i.e. industry, competitive strategy & industry position, environmental factors, temporal factors, and managerial position. Each industry has a set of particular critical success factors in accordance with the nature of industry.

However, it was not found that there was no specific research which had been conducted on "Critical success factors for sustainable kaizen implementation in Cement industry". Therefore, the study attempts analyze the critical success factors for sustainable Kaizen implementation in Mugher Cement Factory which would lead them on sustaining the Kaizen activities, the company could be competitive globally and leading line of existing companies in the country.

The factory started to implement Kaizen since 2014, using the support offered from EKI, mainly to strengthen its market competitiveness which becomes intensified recently.

The company performed well, to certain extent, in introducing kaizen system to its work process, organizing kaizen team in shop floors, practicing 5S and the 7 muda elimination, improving efficiency in work process. By implementing the kaizen system the company gains much advantage; i.e. financial benefits by cost reduction, increases workers participation, increases job satisfaction, gaining additional work space, work place accident reduction, performing by using work standards. Above all kaizen system perceived as better and acceptable than previously implemented management systems.

The interest of this study is, therefore, to examine the critical success factor for sustainable kaizen implementation in the factory.

1.3. Research Questions

The research is proposed to seek answers for the following research question:

- What are the critical success factors for sustainable kaizen implementation?

1.4. Research Objective

1.4.1. General Objective

The General objective of this study is to determine the critical success factor for sustainable kaizen philosophy implementation in Mugher cement factory.

1.4.2. Specific Objectives

The specific objectives of this study is to:

- To examine the critical success factor or variables that influence and determine the successful implementation of Kaizen in Mugher Cement Industry.
- To develop a theoretical model for success factor for sustainable implementation of Kaizen in Mugher Cement Industry.

1.5. Delimitation of the Study

The results are not without limitations, because the study only taken Mugher cement factory. As a result, the findings may not be comprehensive to critical success factor on kaizen in other organizations. yet, this thesis could offer insights to develop framework for future research to look at the in Mugher cement factory critical success factor on kaizen project along with the documents ready by the process redesign team members in which this research not yet considered.

1.6. Limitations of the Study

The research is limited the population of Mugher cement factory i.e. Addis Ababa and Tatek Plant; the outcome of the study is mainly dependent on the individual responses of the respondents who participate in the study. So the result may not be generalizable beyond the specific population. The study used only cross sectional data obtained using closed ended likert scale questionnaire distributed to employees of Mugher.

1.7. Significance of the Study

This study could benefits different classes of groups, including in Mugher cement factory, because it can draw attention where corrective actions are necessary to implement critical success factor on kaizen on all organization. It also adds value to those who would like to pursue their research on critical success factor, particularly kaizen implementation in context of Ethiopia, because the introduction of critical success factor on kaizen is a recent phenomenon. Thus, this study attempted to contribute to the body of literature.

1.8. Organization of the Study

Generally, this research paper will consist of five chapters. Chapter two is dedicated for review of related literature. The third chapter is research design and methodology, the sampling, data collection instrument and method of data analysis. The forth chapter designed for data presentation, analysis and interpretation. The final chapter consists of summary of findings, conclusions and recommendations.

CHAPTER TWO

LITERATURE REVIEW

The study on critical success factors for sustainable kaizen implementation calls for such pieces of information as overall description of the organization under study, definitions and concepts regarding kaizen, the overall aim and ultimate goals and its components. Accordingly, this chapter tries to review the related literature written on kaizen and its critical success factors. It specifically discusses, the definition of kaizen, objective of kaizen, critical success factor for kaizen implementation, kaizen sustainability, determinants of successful kaizen practices, challenges in implementing kaizen, kaizen in Ethiopia and conceptual framework.

2.1. The Definition of Kaizen

Several researchers regarded Kaizen as a principle, method or an effort. For example Lilrank & Kano (1989) defined continuous improvement as a serious of basic improvement principles. Nihon (1992) referred that continuous improvement is not only a method of improvement but also effort of everyone in an organization and it can be applied in any work that needs to be well improved. William (2001) paid his attention to the cost of production process, and he believed that CI is one of the most significant and valuable method than can reduce the production cost in the long term.

Meanwhile, a group of researchers defined kaizen as a process or an activity. Iman (1986) explained the kaizen in the workplace is the process of continuous improvement includes everyone in an organization so that the concept of kaizen is rooted in three levels with an organization; management level, group level and individual level. Fujimoto (1999) regarded kaizen activity as kind of activity that could change organizational routines in systematical ways. Paul Burnet & New (2003) explained kaizen as series of activities that have their specific functions for testing and ensuring continuous improvement so as to achieve organizational goals. In addition Farris et al. (2009) described Kaizen event as a "focused and structured continuous improvement project" (p. 42). In order to achieve specific goals, the project should be implemented across different areas and functional departments in accelerated framework.

Besides the definition above, other definitions of kaizen were put forward by scholars. For example Womack & Jones (1996) explained the kaizen is an important concept in research domain of lean manufacturing and gold of kaizen implementation is to help an

organization systematically reduce different wastes. Once more, Cheser (1998) explained the Kaizen refers to making serious in tiny changes for the better in workplace in order not only to reduce wastes but also to shorten lead time so as to improve the effectiveness of the production process. Bhuyan & Baghel (2005) defined continuous improvement from the perspective of organizational culture, and they believed that continuous improvement is organizational culture that targets the elimination of wastes in almost all parts and areas of an organization and all steps in production process by adopting the methods and technologies to sustain improvement continuously.

The definition of kaizen that as mentioned above include the meaning of kaizen in different ways stated by different people illustrating the difficulty of the general inexistence of a consensus in academic milieu on the definition of Kaizen. One of the reason is that many researchers defined kaizen based on their specific research fields which makes their perspectives different. Fortunately, most of them have reached a consensus that Kaizen meant "continuous improvement" and it could be implemented in any field that needs to be endlessly improved. From the authors' viewpoint, kaizen can be regarded as a management philosophy that means "change for the better". The concept of Kaizen could be extended and penetrated into methods and application of kaizen from theory to practice, therefore it is meaningful and valuable concept that can be applied into every field and place that need to be improved in long term.

2.2. The Objectives of Kaizen

The benefits of kaizen include increasing number of private enterprises and implement quality and productivity improvement. The success of the kaizen implementation also established to disseminate kaizen to private enterprise in sustainable manner (EKI & JICA, 2013). Kaizen aims for improvements in productivity, effectiveness, safety, and waste reduction. Those who follow the approach often find a whole lot more in return: less waste – inventory is used more efficiently as are employee skills; People are more satisfied – they have a direct impact on the way things are done; Improved commitment – team members have more of a stake (a share or interest in business) in their job and are more inclined to commit to doing a good job; Improved retention – satisfied and engaged people are more likely to stay; Improved competitiveness – increases in efficiency tend to contribute to lower costs and higher quality products; Improved consumer satisfaction – coming from higher quality products with fewer faults; Improved problem solving – looking at processes from a solutions perspective allows employees to solve problems

continuously; Improved teams – working together to solve problems helps build and strengthen existing teams (ibid).

2.3. Critical Success Factors

Bruno & Lei decker (1984) have defined Critical Success Factors as those characteristics, conditions or variables that, when properly sustained, maintained, or managed, can have a significant impact on the success of a firm competing in particular industry. Study of Critical Success Factors will permit companies to focus their efforts on some areas to meet the Critical Success Factors, or even allow companies to decide if they have the capability necessary to meet Critical Success Factors requirements. Boynton & Zmud (1984), regard Critical Success Factors as one of the few things that ensure success for an organization. Furthermore, the Critical Success Factors concept is the most important for overall organizational objectives, mission and strategies Freund (1988).

The researcher found in a literature review that there are adequate components that contribute to the successful implementation of Kaizen. 13 authors and 24 factors sorted according to their numbers of references.

NO	Factors	Source
1.	Commitment and motivation of staff	Tapias et al. (2010)
2.	Interdepartmental communication	
3.	Establish policies, objectives and structure	
4.	Support from senior management	Cooney R, (2004)
5.	Allocated resources (time, economic, spaces)	Bisgaard S (2007)
6.	Using an appropriate methodology	
7.	Interdepartmental cooperation	
8.	Follow the PDCA cycle	
9.	Leadership	Bateman N (2005);
10.	Set goals for improvement programs	Jorgensen F, (2004)
11.	Standardization and process measurement	Farris et al. (2003)
12.	Organization of support teams	Upton et al. (1996)
13.	Developing a culture of continuous improvement	Prajogo et al. (2004)
14.	Presence of a facilitator to support the program	
15.	Differences between the focus of improvement & the existing culture	Bessant J, (1997)

16.	Skills and experience	
17.	Clarify goals and common ideas	
18.	Employee attitude	Landa et al. (2009)
19.	Training and education	Jorge et al. (2013)
20.	Documentation and evaluation	
21.	Workers Recognition and award	
22.	Customer focus	
23.	Heterogeneity of improvement teams	Landa Am (2009)
24.	Assessment system	Readman J (2007)

Source: researcher own construction, 2019

2.4. Kaizen Sustainability

Because there is limited research on *Kaizen* event sustainability, this section reviews publications that discuss sustainability with respect to different process and continuous improvement methods. To address the sustainability of continuous improvement, Kaye & Anderson (1999) reviewed relevant literature and conducted semi-structured interviews. Their research resulted in a model that highlights the ten essential criteria of continuous improvement. Upton (1996) claimed that sustainability, continuous improvement over time, depends upon the underlying view of how improvement is achieved implicit in the actions of both managers and operators. Upton‘s continuous improvement initiatives model focuses on accelerating performance improvement, maintaining consistent long–term objectives, and choosing periodic projects based on organizational ability. These focus areas appear to provide direct improvement in the chosen direction and provide a platform for future gains. More recently, Readman & Bessant (2007) assessed the results of the United Kingdom‘s (UK) Continuous Improvement Survey that was administered to 1000 UK firms. A part of the survey inquired about enabling improvement activities that served to encourage or reinforce the continuous improvement behaviors and routines. The most frequently reported enabling activities that assisted in the facilitation of continuous improvement were identified. Anand et al. (2009) identified infrastructure decision areas that are important for continuous improvement initiatives through the creation of a framework of continuous improvement as a dynamic capability when it includes a comprehensive organizational context.

To address the sustainability of various process improvement activities, Dale et.al (1997) identified key TQM sustainability issues through qualitative research and reference to relevant theoretical literature. Keating (1999) worked with research partners to address general process improvement program sustainability. System dynamics modeling analysis explained both internal dynamics and external interactions that appear to influence the sustainability of process improvement activities. Oxtoby et al. (2002) also address general process improvement program sustainability and used qualitative research methods to identify 15 key factors that determine an enterprise‘s change capability. Pillet & Maire (2008) surveyed 40 organizations to examine their performance across different types of improvement activities (e.g., 5S, ISO9000, etc.) and to understand the factors that they viewed as most important for sustainability. Across multiple process improvement activities, organizations sustained, on average, 40 percent of improvements, which further illustrates the difficulty that organizations have in sustaining improvements. Based on the survey results, the authors created a model of process improvement sustainability that was based on three axes: organic state (the state towards which the organization will trend with no effort and absence of constraints), return on effort (reinforcing activities to encourage desired improvement activities), and facilitation (developing skills, group synergy, and simplified processes to support the desired improvement activities) (Pillet & Maire, 2008).

2.5. Determinants of Successful Kaizen Practices

Many literatures in operation management suggest eight factors which can be classified in to three types of input that influence the success of 5S practices:

A. Organizational Culture, Employee Behavior, Employee Participation and Leadership

Dixit & Bhati (2012) committed employees are more likely faithful to the organization they work and show well performance compared to uncommitted employees. Committed employees have a power in them to deliver their best in any obligations given and this could advantage the company via improved performance, less absenteeism and turnover as well as ensuing in sustained labor productivity.

B. Maintaining Equipment and Ergonomics

According to Heizer & Render (2011), modern work places are designed so they can be simply changes, products development, or even new design. In other words, when the

equipment is easily portable, the employees can easily do their work without changing their work area.

C. Work Procedures and Redesign Process

It is a set of rules and procedures which are used to control certain task of an employees. It describes how actions on the plant should be made if the organization goals is to be accomplished Antonsen et al. (2008). However, sometimes it is difficult to effectively implement the work as is designed in the procedure. Therefore re-designing process is needed to align work procedures to attain standards for practices for the determined objectives.

2.6. Challenges in Implementing Kaizen

Even though many organizations realize Kaizen is important at their workplace, not all companies are successful with its implementation. The reason is because managing Kaizen activities is difficult Pullin (2005). Garcia et al. (2011) has identified some of the challenges to Kaizen such as resistance to change especially among mature workers, and misperception on the concepts of continuous improvement. The findings from this study also support the earlier studies done by Bateman & Rich (2003), Bessant et al. (1994), Dale et al. (1997), Jorgensen et al. (2003) and Kaye & Anderson (1999).

A study that was conducted among the United States manufacturers indicated that only 11% of companies doing continuous improvements have considered their initiatives to be successful (Mendelbaum, 2006).Some organizations have failed to motivate their staffs to involve in the Kaizen activities due to the absence of benefit or reward, lack of training for the employees about the change and long delays in getting the recommendations handled (Robinson & Schroeder, 2004). The reward system should be developed by the top management that would recognize the effort done by their employees and managers to ensure Kaizen success (Imai, 1986). However, when companies needs to introduce Kaizen in their organization they must take extra care before starting their Kaizen. This is because companies have a tendency to develop a strategic path that lacks a good understanding between the higher management and the lower level employees (Hiam, 2003).

2.7. Kaizen in Ethiopia

The introduction of kaizen as a management tool in Ethiopia has been started with the assistance of JICA in response to the request of the government of Ethiopia to the government of Japan for kaizen technology transfer to Ethiopia. After the project design phase was completed, the former Ministry of Trade and Industry established kaizen unit with professionals drawn from the ministry and relevant sectoral institutes, and JICA deployed a consultant team to work with the Unit. The kaizen project was officially launched with the first National Kaizen Seminar in the presence of high level officials from both sides. With the project pilot companies, kaizen is selected as one of management tools to improve and enhance managerial capability to implement Growth and Transformation Plan (GRIPS, 2011).

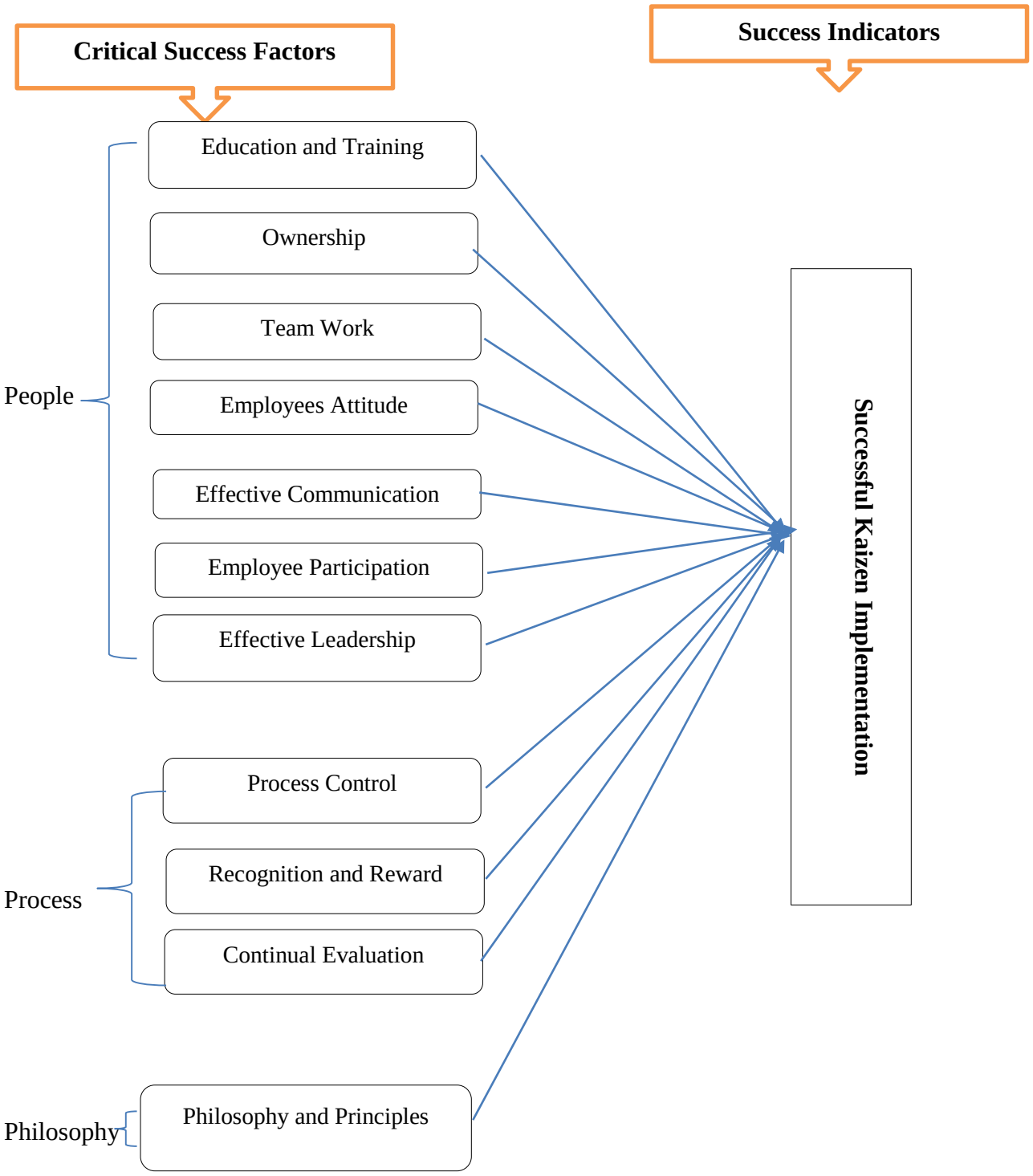
The philosophy of kaizen has kindled considerable interest among researchers because it increases productivity of the company and helps to produce high-quality products with minimum efforts. Several authors have discussed the concept of kaizen for instance Abhijit Chakraborty, et al. (2013), Deniels (1995), Alsmadi, S. (2009), Aoki, K. (2008), Chase, N. (1998), Cheser, R.N. (1998) and Imai M. (1986).

There is large evidence that kaizen implementation have positive impact on the performance of the industries (Williams, 2001). Different scholars in the area have been arguing that proper understanding of policy instruments, methods, culture, principles, and application techniques of the kaizen philosophy would be one essential step towards addressing and solving the currently existing problems and challenges. By so doing, the enterprises move towards incidentally achieving the desired developmental objectives Murata (2010) & Murata (2009).

Coming back to the case of the Ethiopian context so far, there have been limited and inconclusive studies conducted on the implementation of Kaizen in business organizations at different levels. NesraSeid (2012) conducted a quantitative study on the role of the Ethiopian Government in implementing kaizen as a modern management tool for quality and productivity at Kadisco Chemical Industry in Addis Ababa. The findings of this study indicated that the implementation of the Kaizen policy was found to increase labor productivity by reducing, on average of 50%, time wastage for searching tools; improved a defect ratio which ranged from 50% to 70%; and improved lead time in the range of 16%

to 90%. The study thus concludes that the implementation of Kaizen at Kadisco Industry has brought those benefits.

2.8. Conceptual Framework



Conceptual framework, Source: researcher own construction

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

This chapter outlines the methodology on how data and information relevant to the research is going to be gathered and analyzed in order to achieve the objectives of the study. It discusses the description of study procedures and the methods which will be employed in the study. Areas covered include the research design, study population, data gathering methods, methods of data analysis and presentation.

3.1. Research Approach

As described by Creswell (2009), there are three common approaches to conduct a research project in the area of business and social sciences research namely; quantitative, qualitative, and mixed research approaches.

Quantitative method is an objective and systematic process in which pieces of numerical data are used to obtain information about the world and which are analyzed by using mathematical methods. Quantitative research is used to test a theory by identifying the variables based on the previous studies, examining the research relationships and obtaining the findings. Quantitative method can generalize research findings when the study collects data from a random sample which represents its population and it has sufficient sample size. Quantitative method can achieve greater objectivity and more accurate results. It depends on a few variables and it follows many tools in order to test the validity and reliability of the data (Kothari, 2004).

In order to achieve the objectives of this study and thereby to give answer for its problems, quantitative research approach was used by the researcher due to appropriateness Creswell (2009).

3.2. Research Design

Explanatory research seeks to test a theory which is a set of logically organized and interconnected principles, rules, assumptions, statements and propositions which are employed to explain, describe & predict the phenomenon Ahmed (2014). Explanatory research attempts to go beyond the findings of exploratory research and descriptive research to understand the real reasons behind the phenomenon Kothari, (2004) & Saunders et al. (2009).

The main purpose of this research is to explore and identify the critical success factors for sustainable kaizen implementation explanatory research design is applicable.

3.3. Study Population

The population used for this study was employees of Mugher Cement Factory Addis Ababa and Tatek Plant. The target populations are employees which have involved in kaizen implementation in the production unit. Therefore, the population for this study was 26 team leaders and under each leader there are 5 group members, thus making the size of the total population 156 employees.

3.4. Data Gathering method

According to Lancaster (2005) A questionnaire is considered to be a key tool in collecting data and it is the most widely used tool in social research. It contains standardized questions whereby all respondents may understand these questions in the same way. The main item found in literature review were used to build an initial questionnaire with 36 items, in issues management and employee related to factors affecting kaizen implementation. The questionnaire should be answered on the level of importance in five – point Likert scale (5 extremely important, 4 Very important, 3 Important, 2 Low important and 1 Not at all important) as shown in Appendix I.

Therefore, it is more suitable for descriptive or explanatory research and is inappropriate to exploratory research which requires many open-ended questions Saunders et al. (2009). Hence, this study collected data using a questionnaire because the present study is an explanatory research.

3.5. Methods of data analysis and presentation

In this research both descriptive and inferential statistics were employed. Descriptive statistics are simply about describing what data is or what data show. The description of the given sample data were calculated such as mean, standard deviation, skewenes and kurtosis. Meanwhile, inferential statistics are about reaching conclusions that extend beyond the immediate data. From inferential statistics factor analysis and correlation analysis were employed. For both descriptive as well as inferential analysis, the statistical software SPSS was applied.

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

This chapter deals with the presentation, analysis and interpretation of the data collected through questionnaire from Mugher Cement Factory employees and from kaizen officer in order to get the relevant information about critical success factor for sustainable kaizen implementation.

4.1. Response Rate

In this study a total of 156 questionnaires were distributed. From this distributed questionnaires, only 140 questionnaires were returned. Therefore, a response rate of these collected questionnaires was 89.7% and reveals that it was good enough and appropriate to precede the next steps.

4.2. Reliability Test

Bordens & Abbott (2014) showed that reliability related to the extent to which a test measured consistently regardless of what it measured or whether or not a test produced the same results on different occasions. The measure was reliable when respondents gave the same answer in different situations. A question might be unreliable because it contained words which could be misunderstood and, consequently, which might cause confusion. Researchers use multiple-item indicators to create reliable indicators.

The values of Cronbach's alpha range from 0 (observed items are not consistent) to 1 (they completely correlate). This means that internal consistency will be acceptable if Cronbach's alpha is high George & Mallery (2003). Hair et al. (2010) reported that Cronbach's alpha ought to be equal to or above 0.70 or 0.60.

The internal reliability or consistency was assessed for 38 items by means of the Cronbach Alpha. Table 4.1 provides the Cronbach Alpha scores for each items. The Cronbach's Alpha recorded scores above 0.60, resulting that all questionnaire items could be considered as reliable.

Table 4.1: Reliability Statistics

Cronbach's Alpha	N of Items
.934	21

Source: Survey Result 2019

Table 4.2. Provides the reliability estimates of each of the variables; they are all above 0.6, which satisfies the recommended threshold in the literature.

Table 4.2: Reliability Statistics

	Cronbach's Alpha	N of Items
Process Control	.740	4
Recognition and Reward	.965	3
Continual Evaluation	.683	3
Education and Training	.637	4
Ownership	.641	2
Teamwork	.776	2
Employees Attitude	.733	4
Effective Communication	.732	3
Employee Participation	.749	2
Effective Leadership	.846	5
Philosophy	.612	6

Source: Survey Result 2019

4.3. Descriptive Analysis

Descriptive data analysis aims to describe basic features of the data. Descriptive analysis is done first to help the researcher gain an initial impression of the data that were collected Terre et al. (2006). Accordingly, in this study the most popular descriptive statistics measures such as mean, standard deviation, skewenes and kurtosis were applied. Table 4.2 below provides the descriptive statistics of the data for all the questionnaire items.

All the items recorded very high scores on the 5-point Likert scale, resulting in the data being negatively skewed. Skewenes indicates the degree to which the shape of the frequency distribution deviates from the symmetry. The data is thus not symmetric which may cause problems in later statistical procedures. (Appendix II)

4.4. Assessing Common Method Bias

Common method bias assumes that a single factor explains the majority of variance. Researchers rely on the same respondent who provides information about all the variables Podsakoff et al. (2012). Common method bias is a problem because it is

considered to be a main source of measurement error which has a negative effect on the validity of the measure Podsakoff et al. (2003). Due to the method bias, correlations are inflated Meade et al. (2007). This study investigated this method because of using one questionnaire to measure all constructs. The total variance explained in Table 4.3 Showed that the first factor accounted for 45.2% of the total variance.

Therefore, the results suggested that there were no common variable since its value was not above 50% Podsakoff et al. (2012) to threaten the data to be analyzed further.

Table 4.3. Total Variance Explained

Component / Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	111Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.494	45.208	45.208	9.494	45.208	45.208	4.196	19.981	19.981
2	2.127	10.127	55.335	2.127	10.127	55.335	4.151	19.769	39.749
3	1.661	7.909	63.244	1.661	7.909	63.244	3.053	14.538	54.287
4	1.610	7.667	70.911	1.610	7.667	70.911	2.471	11.767	66.055
5	1.048	4.988	**75.899**	1.048	4.988	**75.899**	2.067	9.845	**75.899**
6	.905	4.309	80.208						
7	.764	3.638	83.846						
8	.661	3.147	86.994						
9	.644	3.067	90.061						
10	.433	2.060	92.120						
11	.393	1.872	93.992						
12	.315	1.501	95.493						
13	.268	1.276	96.769						
14	.188	.897	97.667						
15	.142	.675	98.342						
16	.128	.609	98.950						
17	.075	.357	99.307						
18	.051	.244	99.550						
19	.042	.198	99.748						
20	.028	.133	99.881						
21	.025	.119	100.000						
Extraction Method: Principal Component Analysis.									

Source: Survey Result 2019

4.5. Data Analysis: Factor Analysis

Factor analysis is the best-known statistical technique for explaining the relationship between a set of observed variables Tinsley & Brown (2000) & Byrne (2010). Factor analysis can be used for various purposes. Factor analysis can be

- Employed for evaluating the validity of measurements through calculating the factor loading.
- Used to confirm or develop a theory through investigating the observed variables which belong to latent ones (unobserved variables).
- Used to produce a smaller group of latent variables which consist of a larger set of observed variables Thompson (2004), Albright &Park (2009) and Field (2009).

4.5.1. Exploratory Factor Analysis (EFA)

EFA aims to obtain a set of factors which explain the structure of the correlations between items which are related to each other for the purpose of producing an appropriate structure model Hair et al. (2010). The primary objectives EFA's are to identify the factors, which consist of a set of measures; to find out the relationship between each factor and each observed measure; and to reduce a data set to a more manageable size whilst retaining as much of the original information as possible Field (2009). Using SPSS version 20.00, this study performed EFA and reliability analysis.

Factor analysis involves three steps; computing inter-correlations between variables (correlation matrix), extracting initial factors and rotating the factors to obtain a clearer picture of the factor content. In this study, the Principle Component Analysis method was applied

SPSS generated two statistical measures to evaluate the factorability of the data i.e Kaiser-Meyer-Olkin (KMO); and Bartlett's test of Sphericity Pallant (2003). The KMO measure of overall sampling adequacy assesses the degree to which indicators are valid or appropriate for factor analysis. A KMO value is between 0 (Factor analysis is likely to be inappropriate) and 1 (Factor analysis yield reliable factors).

In order to determine the sampling adequacy and Sphericity, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (MAS) and Bartlett's Test of Sphericity were respectively carried out on the inter-correlation of the 38 items of the measuring instrument 17 items were dropped due to recording low MAS, that is scores of less than 0.5 (6 from the philosophy, 2 from process control, 2 from education and training, 2 from employee attitude, one each from ownership, teamwork, effective communication, employee participation and effective leadership). As the result, only 21 items were remained after the MAS were inter-correlated. With this feasibility indexes, factor analysis could be applied.

Kaiser (1974) recommended that the KMO value for excellent 0.9 and above, for great between 0.8 and 0.9, for good between 0.7 and 0.8, for middling between 0.5 and 0.7 and for unacceptable less 0.5. Table 4.4 shows that KMO was 0.825 (great) indicating that this data was appropriate for conducting factor analysis. Furthermore, Bartlett's test of Sphericity tests a null hypothesis; this test depended on the assumption of normality which was proved above. Table 4.4 shows that Chi-Square was 3033.257 with (df = 210, $p<0.001$) which means that variables were related to each another. Therefore, the study is able to continue to complete the remaining steps of the factor analysis.

Table 4.4: KMO ant Bartlett's test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.825
Bartlett's Test of Sphericity	Approx. Chi-Square	3033.257
	Df	210
	Sig.	.000

Furthermore, an anti-image matrix of covariance's and correlations were calculated. All elements on the diagonal of this matrix were greater than 0.5 this also indicates the sample was adequate. And also the determinate of the correlation matrix was greater than 0.00001, resulting there was no multi-collinearity problem (Appendix II).

4.5.2. Factor Extraction

Factor extraction is concerned with finding "the smallest numbers of factors that can be used to best represent the inter-relations among the set of variables" (Pallant, 2003). The two methods for this issue are as follows.

4.5.2.1. Communality

For any variables, the variances can be divided into two components. These are called common variances which are shared with other variables and the unique variance which is specific to that measure. The communality was interested in common variances Field (2009). Therefore, the communality related to how much of the variance in the variables had been explained or was accounted for by the extracted factors. Through the common source with others, the communality estimates a part of the variance in a variable. Low communality (below .5) may lead to its variable being omitted Thompson (2004). Principal component analysis starts with 21 variables and common factors. Initially, it

assumes that all variances are common. Hence, the communalities equal 1 before extraction. This means that there are common factors which, after extraction, represent the common variance in the data structure. The communalities after extraction represented the amount of variance in each variable which could be explained by the retained factors. All the variables of in the data were above 0.5 indicating high communality (see in the appendix III).

4.5.2.2. Total Variance Explained

In order to determine the number of factors to be retained, some rules of thumb have been suggested by different scholars. One criterion that can be used to determine the number of factors to retain is Kaiser's criterion which is a rule of thumb. This criterion suggests retaining all factors that are above the eigenvalue of one Kaiser (1960). Another criterion is based on Jolliffe's criterion which recommends retaining factors above .70 Jolliffe (1986). It has been argued that both criteria may result in overestimation in the number of factors extracted (Costello & Osborne, 2005; Field, 2009). Therefore, it is suggested to use the screen test in conjunction with the eigenvalues to determine the number of factors to retain.

Total Variance Explained result (Table 4.3) used to determine the number of significant factors. From this result only extracted and rotated values are meaningful for interpretation. The factors are arranged in the descending order based on the most explained variance. The Extraction Sums of Squared Loadings is identical to the Initial Eigenvalues except factors that have eigenvalues less than 1 are not shown. These columns show the eigenvalues and variance prior to rotation. The Rotation Sums of Squared Loadings show the eigenvalues and variance after rotation. Moreover, the researcher tried to use the scree-plot for showing the relationship between eigenvalues and factors**.**

Table 4.3 illustrates that the first five factors/components that have eigenvalues greater than one meet the requirement. As can be seen from the result, after rotation, Factor 1 accounts for 19.981 % of the variance; Factor 2 accounts for 19.769 % of the variance; Factor 3 accounts for 14.538 % of the variance; Factor 4 accounts for 11.767% of the variance and Factor 5 accounts for 9.845 % of the variance. All the five factors together explain for 76 % of the variance in successful Kaizen implementation.

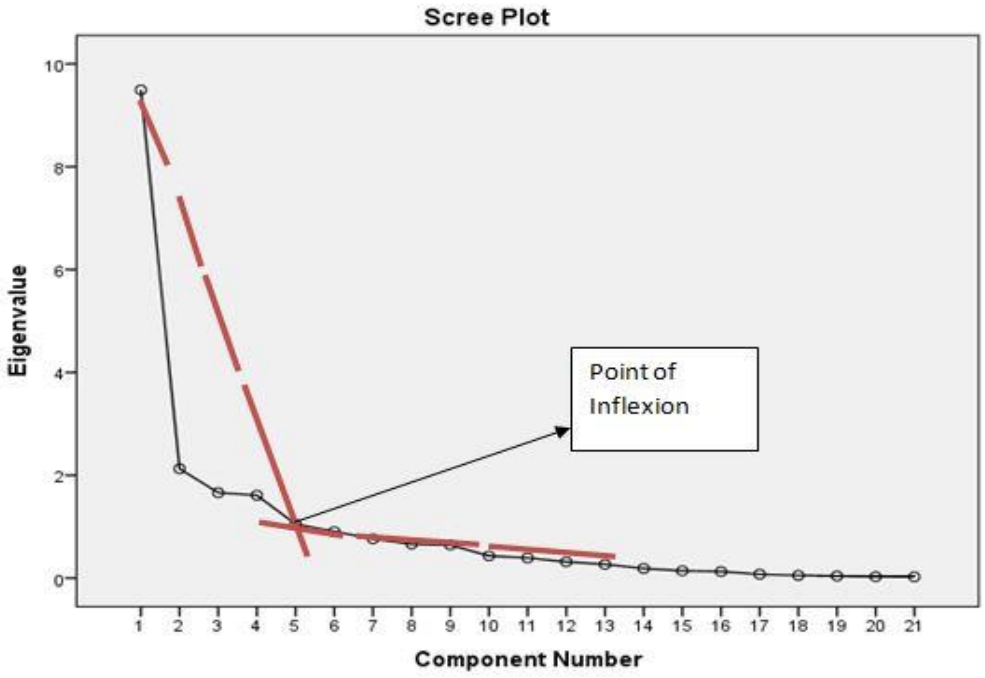


Figure 4.1: Scree plot

Figure 4.1 illustrates the scree-plot graphs the eigenvalues against each factor. The number of factors to be retained is the data points that are above the break (i.e., point of inflexion). To determine the 'break', the researcher tried to draw a horizontal line and a vertical line starting from each end of the curve. As can be seen from figure, after factor/component of five there is a sharp change in the curvature of the scree-plot. This shows that after factor five the total variance accounts for smaller and smaller amounts.

Furthermore, the researcher tried to check if the model was a good fit by looking at the summary of the percentage of the non-redundant residuals at the Reproduced Correlation Matrix. A model that is a good fit will have less than 50% of the non-redundant residuals are greater than 0.05. In this study, the non-redundant residuals have a value 30% which reveals that the model is good fit (see Annex VI).

4.5.3. Factor Rotation

Table 4.5 contains the rotated factor loadings which related to the correlations between each item and its construct. The loadings reflect the strength of the relationship between a scale item and a particular construct or factor. The higher the loading, the better the representation that particular item has on the factor. Hair et al.(2006) recommended that

factor loadings greater than 0.30 are the minimum requirement; loadings of 0.40 are considered more important; and loadings of 0.50 or greater are considered significant.

To obtain a clearer picture of the factor content, the factor matrix was rotated by means of Varimax with Kaiser Normalization method. The rotated component matrix Table 4.5 illustrates the rotated factor matrix correlation of the variables with each of the extracted factors. Usually, each of the variables is highly loaded in one factor and less loaded towards to the other factors. To identify the variables, included in each factor, the variable with the value maximum in each row is selected to be part of the respective factor. Loading values greater than and equal to 0.5 were considered significant to group the 21 variables in to five critical factors.

Thus, four items loaded on Factor 1, five items on Factor 2, four items on Factor 3, four items on Factor 4 and four items on Factor 5. All factors thus consist of at least three items, which is in line with Thurstone's recommendation of at least three variables per factor for explanatory analysis Kim & Mueller (1978).

Table 4.5: Rotated Factor Loadings

Code[1]	Item	Component/Factor				
		1	2	3	4	5
EL3	Aligning of short & long term plans with a company's vision	.914				
EL1	Focusing on bench marking activities for best practicing	.909				
EL4	Testing the organization's mission and vision statements against the principles implicit in Kaizen	.908				
EL2	Top management's pledging to the development of the entire workforce and encourage participation, learning, innovation, and creativity throughout the organization to get shop floor commitment and employee trust	.874				
PC1	Standardization and designing full proof implementation processes to minimize errors		.852			
PC4	Discussion with all employees Kaizen - related issues in meetings		.847			
RR1	A salary promotion system to encourage employee participation in Kaizen		.780			
RR3	Value employees as long term resources at all levels of the organization		.757			

RR2	Financially rewarding for excellent suggestions to get shop floor commitment and employee trust		.755			
EA2	Having positive attitude to actively involved employees in problem solving, quality & productivity improvement			.834		
CE3	Continually providing feedback to employees concerning the implementation			.726		
EA1	The company employees openness for accepting feedbacks			.717		
EP2	The company implements various inspections effectively (incoming, process, and final products).			.698		
ET3	Providing training and education for all personnel in Kaizen - related concepts and skills				.832	
EC1	Establish policy for Kaizen and cross functional goals realize through policy deployment and audits				.690	
EC3	Clarifying the organization's goals and objectives formulated				.686	
ET2	Change in organizational culture by build systems, procedures, and structures conducive to Kaizen				.616	
O2	Maximizing ownership with management and employees commitment					.735
CE1	Regularly top management and relatives auditing the implementation					.671
T2	All employees recording Kaizen related data during implementation					.523
CE2	Establishing evaluation systems to measure the performance of all employees					.511
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.						

Source: Survey Result 2019

EL= Effective leadership, PC= Process Control, RR= Recognition & Reward, EA= Employee attitude, EP= Employee participation, ET= Education and Training, EC= Effective communication, O= Ownership, CE= Continual evaluation and T= Teamwork

At this point (after factor loading), the researcher is faced with the task of deciding whether the factor analytical procedure produced any meaningful results, and whether conceptually sound interpretation can be attached to the results. Each factor has to be identified and appropriately labeled or named. The five factors that emerged could be named as depicted in Table 4.6.

Table 4.6: Naming of Emerged Factors

Factor	Name of the factor	Item	Factor Loading % of Variance
1	Management Commitment and Leadership	Aligning of short & long term plans with a company's vision	19.981
		Focusing on bench marking activities for best practicing	
		Testing the organization's mission and vision statements against the principles implicit in Kaizen	
		Top management's pledging to the development of the entire workforce and encourage participation, learning, innovation, and creativity throughout the organization to get shop floor commitment and employee trust	
2	Process Control & Recognition and Reward	Standardization and designing full proof implementation processes to minimize errors	19.769
		Kaizen related process control issues are open for discussion with of all employees.	
		A salary promotion system to encourage employee participation in Kaizen	
		Value employees as long term resources at all levels of the organization	
		Financially rewarding for excellent suggestions to get shop floor commitment and employee trust	
3	Employees Attitude and Employee Participation	Having positive attitude to actively involved employees in problem solving, quality & productivity improvement	14.538
		Continually providing feedback to employees concerning the implementation	
		The company employees openness for accepting feedbacks	
		The company implements various inspections effectively (incoming, process, and final products).	
4	Education and Training & Effective Communication	Providing training and education for all personnel in Kaizen - related concepts and skills	11.767
		Providing training and education for all personnel in Kaizen - related concepts and skills	
		Establish policy for Kaizen and cross functional goals realize through policy deployment and audits	
		Clarifying the organization's goals and objectives formulated	
5	Ownership, Continual Evaluation and Teamwork	Maximizing ownership with management and employees commitment	9.845
		Regularly top management and relatives auditing the implementation	
		All employees recording Kaizen related data during implementation	
		Establishing evaluation systems to measure the performance of all employees	

Source: Survey Result 2019

The factors that emerged differ from the factors in the theoretical model that was to be subjected to an empirical assessment. In other words a number of the items did not load

as expected. The factors that remained intact are Effective Leadership, Process Control, Recognition and Reward, Employees Attitude, Education & Training and Effective Communication, whilst the theoretical factor of philosophy was rejected.

Therefore, the study identified five critical success factors for sustainable kaizen implementation in Mugher cement factory which are: Management Commitment and Leadership accounts for 19.981% of the variance; process control & recognition and reward accounts for 19.769 % of the variance; employees attitude and employee participation accounts for 14.538 % of the variance; education and training & effective communication accounts for 11.767% of the variance and ownership, continual evaluation and teamwork accounts for 9.845% of the variance. All the five factors together explain for 76% of the variance in successful kaizen implementation.

4.5.4. Reliability Test of Postulated Factors

Reliability assesses how consistent the items measuring a construct are and as such ensures trustworthiness of the measurement instrument. A common statistic for evaluating reliability is the coefficient of internal consistency (Cronbach's Alpha). This statistic should be computed for each of the factors that passed all tests of validity. The recommended and widely accepted threshold in the literature is 0.7 Hair et al. (2010). Table 4.7 provides the reliability estimates of each of the variables; they are all above 0.7, which satisfies the recommended threshold in the literature. Thus, the measurement instrument is reliable.

Table 4.7: Cronbach Alpha Values for Factors

Factor	Name of Factors	Cronbach Alpha
1	Management Commitment and Leadership	.972
2	Process Control & Recognition and Reward	.952
3	Employees Attitude and Participation	.809
4	Education and Training & Effective Communication	.808
5	Ownership, Continual Evaluation and Teamwork	.724

Source: Survey Result 2019

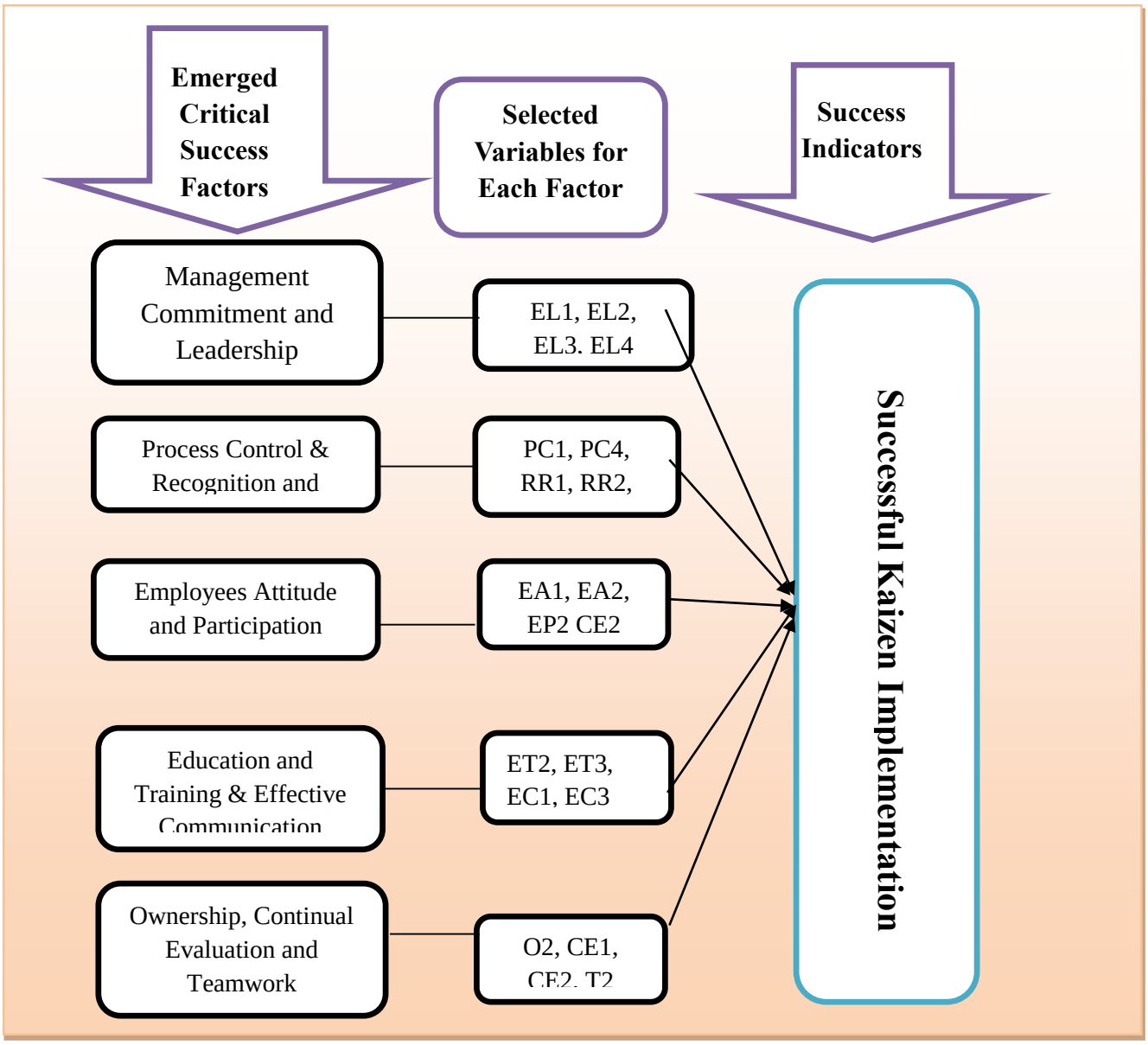
The Reliability or consistency was assessed for 21 items Table **4.8** Provides Cronbach Alpha score for the items. The Cronbach's Alpha recorded scores of 0.934, resulting all items could be considered as reliable.

Table 4.8: Cronbach Alpha Values for Factors

Cronbach's Alpha	N of Items
.934	21

Source: Survey Result 2019

Based on the above factor analysis, it was decided to revised or change the first theoretical model. Accordingly the revised theoretical model for critical success factors and success indicators are depicted as follow:



Source: Survey Result 2019

Figure 4.2: Critical Success Factors Theoretical Model for Mugher Cement Factory

EL= Effective leadership, PC= Process Control, RR= Recognition & Reward, EA= Employee attitude, EP= Employee participation, ET= Education and Training, EC= Effective communication, O= Ownership, CE= Continual evaluation and T= Teamwork.

4.5.5. Validity Test for Postulated Factors

Table 4.9: KMO and Bartlett's Test for Management Commitment & Leadership

	KMO and Bartlett's Test		
Management Commitment and Leadership	Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.810
	Bartlett's Test of Sphericity	Approx. Chi-Square	868.206
		df	6
		Sig.	.000

Validity test result of KMO and Bartlett's result also reveals that the postulated factor i.e. Management Commitment and Leadership is valid since KMO value is greater than 0.4 and Bartlett's Test of Sphericity value is significant less than 0.05. Table 4.9 reported that Chi-Square was 868.20 with ($df = 6$, $p<0.001$) which means that variables were related to one another.

Direct involvement of top management allows all decisions to be made quickly and facilitate Kaizen journey. Top management support is necessary to prove the availability of concrete actions. The action can be taken to establish the Kaizen policy, establish structure, attract a whole staff, disseminate information on Kaizen, managing the change process and organize the day of continuous improvement activities. Management is committed to be always aware of demand for change. Among the commitments that need to be highlighted is to renew and update key elements of the organization, make structural changes in the organization, prepare for a new job specification, resolving conflicts to be faced, to ensure the involvement of members and create an effective plan to improve the administration of an organization. The skills of the management can make a significant boost to staff. Management style highlighted by the management is able to provide a boost to staff. Management is committed to promoting cooperation rather than competition within the organization Norhayati et al. (2012). This factor is combined by four main items and explains the 19.981 % of all the items variance.

Table 4.10: KMO and Bartlett's Test Process Control & Recognition and Reward

	KMO and Bartlett's Test		
Process Control & Recognition and Reward	Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.758
	Bartlett's Test of Sphericity	Approx. Chi-Square	1002.456
		df	10
		Sig.	.000

Validity test result of KMO and Bartlett's result also reveals that the postulated factor Process Control and Recognition & Rewards is valid since KMO value is greater than 0.4 and Bartlett's Test of Sphericity value is significant less than 0.05. Table 4.10 reported that Chi-Square was 1002.456 with ($df = 10$, $p<0.001$) which means that variables were related to one another.

This factor is related to the integration that must exist by workers in decision making process of the company, since rarely they know the problems of production systems and may have a better assessment of technical aspects so that their opinions should be heard. However, this process of integration to work in a company requires the recognition of his/her work when the activities entrusted to them have full compliance and when they have an ongoing involvement in solving problems. Employees shall be given due recognition for their contributions and their ideas. It is a psychological process to develop confidence between the members of the organization and encourage them to make decisions and solve problems with each other Jorge et al. (2013).

This factor is part of implementation and associated with processes in which workplaces and operations including maintenance activities are standardized or designed to minimize both human and machine errors, kept neat and clean at all times, implements various inspections effectively. Different authors also agree on this factor Bhuiyan N, (2007). This factor is combined by four main items and explains the 19.769 % of all the items variance.

Table 4.11: KMO & Bartlett's Test Employees Attitude & Employee Participation

	KMO and Bartlett's Test		
Employees Attitude and Participation	Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.608
	Bartlett's Test of Sphericity	Approx. Chi-Square	142.983
		df	3
		Sig.	.000

Validity test result of KMO and Bartlett's result also reveals that the postulated factor Employees Attitude and Employee Participation is valid since KMO value is greater than 0.4 and Bartlett's Test of Sphericity value is significant less than 0.05. Table 4.11 reported that Chi-Square was 142.983 with ($df = 3$, $p<0.001$) which means that variables were related to one another.

This factor is related with company employee's attitude and participation towards change. Employees developing culture of continuous improvement with openness and willingness to accept feedback and the philosophy are necessity for any initiatives to implement successfully. Employees with positive attitude to accept and implement the philosophy. This condition demands developed culture to continuous improvement. Without having positive attitude, it is not expecting to implement the philosophy. Different authors also agree on this Landa et al. (2009) describe successful Kaizen implementation requires positive employees attitude and participation. It is associated with problem solving activities and the heart of Kaizen implementation because there is all employees (front line workers to main development team) involvement: During 5S (Sorting, Set in order, Shine, Standardize and Sustain) implementation methodology, discussing Kaizen issues in meeting, parallel problem solving, working in team, in generating new ideas for success continuous improvement. Different authors also agree on this factor Bateman N, et al. (2005). This factor is combined by four main items and explains the 14.538 % of all the items variance.

Table 4.12: KMO & Bartlett's Test Education & Training & Effective Communication

	KMO and Bartlett's Test		
Education and Training & Effective Communication	Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.778
	Bartlett's Test of Sphericity	Approx. Chi-Square	189.584
		df	6
		Sig.	.000

Validity test result of KMO and Bartlett's result also reveals that the postulated factor Education and Training & Effective Communication is valid since KMO value is greater than 0.4 and Bartlett's Test of Sphericity value is significant less than 0.05. Table 4.12 reported that Chi-Square was 189.584 with (df =6, $p<0.001$) which means that variables were related to one another. Education and Training is related with the training given to workers and management commitment with continuous improvement projects to be successful; thus, this factor is associated with people, managers, and operators Jorge L. G, et al. (2013). Increased involvement means more responsibility, which in turn requires a greater level of skill. This must be achieved through training. Training is an important factor that helps in making efforts toward continuous improvement. Kaizen training includes educating and training all employees, help employees to increase knowledge, provide information about the mission, vision, direction and organization structure to enable them to gain skills in an effort to improve the work quality and thus solve the problem. An organization that demands staff development, policy formulation and planning will determine the allocation sampler for the training and strategic planning is not only focused on training needs now, but also training in the future.

Communication could be vertical or horizontal. Vertical communication between the different structural levels of the organization and horizontal communication, between leaders of various projects, where there should be a collaborative and supportive relationship for successful Kaizen implementation Jorge et al. (2013). Communication inextricably linked in the Kaizen process, yet some executives find it difficult to tell others about the plan in a way that will be understood. An additional difficulty is filtering. As top management's vision of Kaizen filters down through the ranks, the vision and the plan can lose both clarity and momentum. Thus, top management as well as managers and supervisors at all level serve as translators and executors of top

management's directive. The ability to communicate is valuable skill at all levels from front-line supervisor to senior managements. The factor of communication helps to allow confidence to others as well as provide encouragement and share the risks.

Table 4.13: KMO and Bartlett's Test Ownership, Continual Evaluation & Teamwork

	KMO and Bartlett's Test		
Ownership, Continual Evaluation and Teamwork	Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.745
	Bartlett's Test of Sphericity	Approx. Chi-Square	109.002
		df	6
		Sig.	.000

Validity test result of KMO and Bartlett's result also reveals that the postulated factor Ownership, Continual Evaluation and Teamwork is valid since KMO value is greater than 0.4 and Bartlett's Test of Sphericity value is significant less than 0.05. Table 4.13 reported that Chi-Square was 109.002 with ($df = 6$, $p<0.001$) which means that variables were related to one another.

Continual evaluation associates with the habits of record of activities and commitments acquired by each team member for continuous improvement, targets, and achievements using the adequate formats, preferably standardized among all improvement groups that exist in the company, which would facilitate communication and reports or informs the factor number two in importance. It also refers to the establishment of standards and guidelines that indicate how to measure the performance indices for the groups established. Besides, in this factor, the need to establish systems and regular periodic evaluation for the group is noted, all as a monitoring process Jorge et al. (2013).

Teamwork can unite the entire staff of the organization in the success of continuous improvement. In this spirit practiced through cooperation, commitment and participation of staff in the overall continuous improvement program initiated by the organization. Therefore, it involves the concerted action of employees, through their role in providing skills, assessment and experience to a particular task Norhayati et al. (2012).

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1. Conclusion

The aim of this research was to identify critical success factors for sustainable Kaizen implementation in Mugher Cement Factory. The study applied factory analysis to identify critical factors. The factor analysis involves three steps; computing inter-correlations between variables (correlation matrix), extracting initial factors and rotating the factors to obtain a clearer picture of the factor content. The Principle Component Analysis method was applied.

The study identified five critical success factors for sustainable Kaizen implementation in Mugher Cement Factory. Those factors are:

- ✓ Effective leadership accounts for 19.981% of the variance; process control & recognition and reward accounts for 19.769 % of the variance; Effective leadership is key for sustainable Kaizen implementation.
- ✓ Employees' attitude and employee participation accounts for 14.538 % of the variance; Employee attitude is key for sustainable Kaizen implementation.
- ✓ Education and training & effective communication accounts for 11.767% of the variance. Education and training and effective communications are key for sustainable Kaizen implementation.
- ✓ Ownership, continual evaluation and teamwork accounts for 9.845% of the variance. Ownership, continual evaluation and teamwork are key for sustainable Kaizen implementation.

All the five factors together explain for 76% of the variance in successful kaizen implementation. Validity test result of KMO and Bartlett's result also reveals that the postulated factors are valid since KMO value are greater than 0.4 and Bartlett's Test of Sphericity values are significant less than 0.05

The study shows that the company performed well, to certain extent, in introducing kaizen system to its work process, organizing kaizen team in shop floors, practicing 5S and the 7 muda elimination, improving efficiency in work process.

By implementing the kaizen system the company gains much advantage; i.e. financial benefits by cost reduction, increases workers participation, increases job satisfaction, gaining additional work space, work place accident reduction, performing by using work standards. Above all kaizen system perceived as better and acceptable than previously implemented management systems.

5.2. Recommendations

Based on the findings the following recommendations were forwarded:

- The factor analysis finding reveals that effective leadership was the main factor for the implementation of successful Kaizen in Mugher Cement Factory. Leadership plays a pivotal role in driving the change management required for a successful shift to a Kaizen culture and a rewarding continuous improvement program. Therefore, to implement Kaizen on a sustainable basis, the leadership of the factory should be knowledgeable and totally committed to the Kaizen philosophy and principles.
- Effective implementation of Kaizen also requires quality planning and control strategies. In this study, a combination of process control and reward and recognition were identified as a key factor for sustainable Kaizen implementation in Mugher Cement Factory. This factor is linked to process and related with staff performance and manufacturing cost. Using process control and establishing recognition and reward system will result in increased staff performance, customer satisfaction and decreasing manufacturing cost. Therefore, the factory should strength process controlling and establishing recognition and reward system.
- Education and training is the one of the most important contributors to the success implementation of Kaizen. By applying the knowledge in daily life one can improve its performance. Therefore, the factory should provide enough education and training for their staffs in order to assure a sustainable Kaizen implementation.
- Kaizen is not a task for individuals, but a holistic approach to be used at all levels. Teamwork is very important in sustainable Kaizen implementation. Since Kaizen is a quality improvement tool driven by teamwork they can solves problems together, they develop a bond and build team spirit. Thus, employees should strength there teamwork sprite in the factory.

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APPENDICES

Appendix I: Structured questionnaire

Addis Ababa University
College of Business and Economics
Department of Management
MSc in Management Program

This questionnaire is designed to gather information on "Critical Success factor for Kaizen implementation". The purpose of the study is to fulfill a thesis requirement for the Masters of Science in Management at Addis Ababa University. Your highly esteemed responses for the questions are extremely important for successful completion of my thesis. The information that you provide will be used only for the purpose of the study and will be kept strictly confidential. You do not need to write your name. Finally, I would like to thank you very much for your cooperation and sparing your valuable time for my request.

Instruction

Please read each statement carefully and put a tick mark (✓) under the number that most describes each respondent's opinion. The typical scale that is used in this section of questionnaire is a five - point level of importance Likert scale: 1 = Not at all important (NI); 2 = low important (LI); 3 = Important (I); 4 = Very important (VI); 5 = extremely important (EI).

PART I. CRITICAL SUCCESS FACTORS FOR KAIZEN IMPLEMENTATION

No	Items	Likert Scale				
		1	2	3	4	5
I.	**Process**					
A.	**Process Control**					
1.	Standardization and designing full proof implementation processes to minimize errors					
2.	Using idea generation soft techniques by following PDCA cycle extensively for process control and improvement					
3.	Well maintaining production equipment's according to the maintenance plan.					
4.	Kaizen related process control issues are open for discussion with of all employees.					

B.	**Recognition and Reward**					
5.	A salary promotion system to encourage employee participation in Kaizen					
6.	Financially rewarding for excellent suggestions to get shop floor commitment and employee trust					
7.	Value employees as long term resources at all levels of the organization					
C.	**Continual Evaluation**					
8.	Regularly top management and relatives auditing the implementation					
9.	Establishing evaluation systems to measure the performance of all employees					
10.	Continually providing feedback to employees concerning the implementation					
II.	**People**					
A.	**Education and Training**					
11.	Views and understand Kaizen as a philosophy and a corporate strategy rather than another strategy					
12.	Change in organizational culture by build systems, procedures, and structures conducive to Kaizen					
13.	Providing training and education for all personnel in Kaizen - related concepts and skills					
14.	Providing specific work-skills training to all employees					
B.	**Ownership**					
15.	Provide support and direction for Kaizen by allocating resources					
16.	Maximizing ownership with management and employees commitment					
C.	**Teamwork**					
17.	Working in team for fixing problems and scale up employee's capability					
18.	All employees recording Kaizen related data during implementation					
D.	**Employees Attitude**					
19.	The company employees openness for accepting feedbacks					
20.	Having positive attitude to actively involved employees in problem solving, quality & productivity improvement					
21.	All employees of the willingness to accept the philosophy					
22.	Organizing KPT from members of same disciplines					
E.	**Effective Communication**					
23.	Establish policy for Kaizen and cross functional goals realize through policy deployment and audits					
24.	Providing frame work of strategic improvement plan for achieving the objectives broadly defined by managements					
25.	Clarifying the organization's goals and objectives formulated					

F.	**Employee Participation**					
26.	Applying generated new ideas from employees for process modifications and change layouts					
27.	The company implements various inspections effectively (incoming, process, and final products).					
G.	**Effective Leadership**					
28.	Focusing on bench marking activities for best practicing					
29.	Top management's pledging to the development of the entire workforce and encourage participation, learning, innovation, and creativity throughout the organization to get shop floor commitment and employee trust					
30.	Aligning of short & long term plans with a company's vision					
31.	Testing the organization's mission and vision statements against the principles implicit in Kaizen					
32.	Top managements participation in formation of realistic time scale for change and Kaizen organizational structure					
III.	**Philosophy**					
33.	Increases productivity of the company and helps to produce high-quality products with minimum efforts.					
34.	Involved everyone, managers and workers alike.					
35.	Teamwork and commitment from direct contact and communication between the individual and his boss.					
36.	Liberate the thinking of both management and employees at all levels and provide the climate in which creativity and value addition can flourish.					
37.	Indicates small improvements as a result of ongoing efforts.					
38.	Making small changes on a regular basis—reducing waste and continuously improving productivity, safety, and effectiveness.					

Appendix II : Descriptive Statistics

No.	Code	Item	Mean	Std. Deviation	Skewness	Kurtosis
1	PC1	Standardization and designing full proof implementation processes to minimize errors	3.99	0.85	-0.55	0.40
2	PC2	Using idea generation soft techniques by following PDCA cycle extensively for process control and improvement	4.00	0.65	0.00	-0.56
3	PC3	Well maintaining production equipment's according to the maintenance plan.	4.06	0.64	-0.05	-0.51
4	PC4	Kaizen related process control issues are open for discussion with of all employees.	3.94	0.85	-0.45	0.24
5	RR1	A salary promotion system to encourage employee participation in Kaizen	3.83	0.86	-0.20	-0.09
6	RR2	Financially rewarding for excellent suggestions to get shop floor commitment and employee trust	3.79	0.85	-0.22	0.08
7	RR3	Value employees as long term resources at all levels of the organization	3.83	0.83	-0.28	0.28
8	CE1	Regularly top management and relatives auditing the implementation	3.76	1.03	-0.64	0.09
9	CE2	Establishing evaluation systems to measure the performance of all employees	4.01	0.90	-0.37	-0.95
10	CE3	Continually providing feedback to employees concerning the implementation	3.79	0.82	-0.24	-0.45
11	ET1	Views and understand Kaizen as a philosophy and a corporate strategy rather than another strategy	3.49	0.80	-1.64	2.59
12	ET2	Change in organizational culture by build systems, procedures, and structures conducive to Kaizen	3.92	0.61	0.04	-0.32
13	ET3	Providing training and education for all personnel in Kaizen - related concepts and skills	3.86	0.77	-0.15	-0.01
14	ET4	Providing specific work-skills training to all employees	3.81	0.63	0.16	-0.56
15	O1	Provide support and direction for Kaizen by allocating resources	3.84	0.62	-1.18	2.43
16	O2	Maximizing ownership with management and employees commitment	3.91	0.98	-0.76	0.67

17	T1	Working in team for fixing problems and scale up employee's capability	3.54	0.60	-0.76	-0.13
18	T2	All employees recording Kaizen related data during implementation	3.68	0.71	0.56	-0.87
19	EA1	The company employees openness for accepting feedbacks	3.82	0.81	-0.08	-0.28
20	EA2	Having positive attitude to actively involved employees in problem solving, quality & productivity improvement	3.91	0.82	-0.24	-0.25
21	EA3	All employees of the willingness to accept the philosophy	3.36	0.86	-1.25	0.80
22	EA4	Organizing KPT from members of same disciplines	3.47	0.93	-0.37	0.53
23	EC1	Establish policy for Kaizen & cross functional goals realize through policy deployment & audits	3.59	0.49	-0.35	-1.90
24	EC2	Providing frame work of strategic improvement plan for achieving the objectives broadly defined by managements	3.64	0.51	-0.24	-1.20
25	EC3	Clarifying the organization's goals and objectives formulated	3.76	0.79	0.46	-1.23
26	EP1	Applying generated new ideas from employees for process modifications and change layouts	3.63	0.66	-0.64	0.31
27	EP2	The company implements various inspections effectively (incoming, process, and final products).	3.60	0.73	-0.70	0.12
28	EL1	Focusing on bench marking activities for best practicing	3.96	0.83	0.07	-1.53
29	EL2	Top management's pledging to the development of the entire workforce and encourage participation, learning, innovation, and creativity throughout the organization to get shop floor commitment and employee trust	3.99	0.88	0.01	-1.71
30	EL3	Aligning of short & long term plans with a company's vision	4.02	0.83	-0.04	-1.54
31	EL4	Testing the organization's mission and vision statements against the principles implicit in Kaizen	3.89	0.87	0.09	-1.39
32	EL5	Top managements participation in formation of realistic time scale for change and Kaizen organizational structure	3.62	0.84	-0.24	-0.45
33	PH1	Increases productivity of the company and helps to produce high-quality products with minimum efforts.	4.21	0.82	-0.48	-1.11

34	PH2	Involved everyone, managers and workers alike.	3.65	0.78	-1.17	1.48
35	PH3	Teamwork and commitment from direct contact and communication between the individual and his boss.	3.66	0.94	-0.59	0.83
36	PH4	Liberate the thinking of both management and employees at all levels and provide the climate in which creativity and value addition can flourish.	3.95	0.80	-0.68	0.81
37	PH5	Indicates small improvements as a result of ongoing efforts.	4.07	0.80	-0.47	-0.43
38	PH6	Making small changes on a regular basis—reducing waste and continuously improving productivity, safety, and effectiveness.	3.69	0.85	-0.37	0.33

Appendix III: Communalities

		Initial	Extraction
PC1	Standardization and designing full proof implementation processes to minimize errors	1.000	.858
PC4	Discussion of all employees Kaizen - related issues in meetings	1.000	.865
RR1	A salary promotion system to encourage employee participation in Kaizen	1.000	.830
RR2	Financially rewarding for excellent suggestions to get shop floor commitment and employee trust	1.000	.831
RR3	Value employees as long term resources at all levels of the organization	1.000	.838
CE1	Regularly top management and relatives auditing the implementation	1.000	.625
CE2	Establishing evaluation systems to measure the performance of all employees	1.000	.736
CE3	Continually providing feedback to employees concerning the implementation	1.000	.624
ET2	Change in organizational culture by build systems, procedures, and structures conducive to Kaizen	1.000	.659
ET3	Providing training and education for all personnel in Kaizen - related concepts and skills	1.000	.749
O2	Maximizing ownership with management and employees commitment	1.000	.612
T2	All employees recording Kaizen related data during implementation	1.000	.516
EA1	The company employees openness for accepting feedbacks	1.000	.626
EA2	Having positive attitude to actively involved employees in problem solving, quality & productivity improvement	1.000	.793
EC1	Establish policy for Kaizen and cross functional goals realize through policy deployment and audits	1.000	.644
EC3	Clarifying the organization's goals and objectives formulated	1.000	.833
EP2	The company implements various inspections effectively (incoming, process, and final products).	1.000	.616
EL1	Focusing on bench marking activities for best practicing	1.000	.937
EL2	Top management's pledging to the development of the entire workforce and encourage participation, learning, innovation, and creativity throughout the organization to get shop floor commitment and employee trust	1.000	.904
EL3	Aligning of short & long term plans with a company's vision	1.000	.951
EL4	Testing the organization's mission and vision statements against the principles implicit in Kaizen	1.000	.889

Extraction Method: Principal Component Analysis.

Appendix IV: Factor Analysis Results

Correlation Matrix

Correlation Matrix[a]

		PC1	PC4	RR1	RR2	RR3	CE1	CE2	CE3	ET2	ET3	O2	T2	EA1	EA2	EC1	EC3	EL3	EL4
Correlation	PC1	1.000	.957	.721	.691	.730	.416	.552	.411	.440	.316	.258	.352	.364	.505	.300	.470	.480	.399
	PC4	.957	1.000	.717	.724	.756	.492	.570	.436	.445	.305	.304	.407	.371	.497	.335	.494	.470	.380
	RR1	.721	.717	1.000	.938	.861	.431	.685	.428	.396	.267	.340	.424	.389	.417	.354	.468	.499	.445
	RR2	.691	.724	.938	1.000	.905	.452	.657	.444	.396	.264	.324	.387	.437	.387	.375	.515	.558	.494
	RR3	.730	.756	.861	.905	1.000	.466	.674	.392	.398	.211	.371	.344	.480	.381	.386	.476	.561	.503
	CE1	.416	.492	.431	.452	.466	1.000	.514	.266	.222	.005	.366	.338	.217	.284	.245	.222	.302	.212
	CE2	.552	.570	.685	.657	.674	.514	1.000	.490	.470	.292	.458	.396	.397	.528	.378	.439	.540	.508
	CE3	.411	.436	.428	.444	.392	.266	.490	1.000	.140	.161	.265	.157	.423	.608	.089	.459	.251	.220
	ET2	.440	.445	.396	.396	.398	.222	.470	.140	1.000	.481	.265	.453	.263	.346	.462	.588	.572	.499
	ET3	.316	.305	.267	.264	.211	.005	.292	.161	.481	1.000	.185	.208	.111	.221	.418	.647	.299	.214
	O2	.258	.304	.340	.324	.371	.366	.458	.265	.265	.185	1.000	.332	.190	.207	.343	.319	.287	.243
	T2	.352	.407	.424	.387	.344	.338	.396	.157	.453	.208	.332	1.000	.112	.138	.232	.220	.134	.162
	EA1	.364	.371	.389	.437	.480	.217	.397	.423	.263	.111	.190	.112	1.000	.729	.138	.442	.362	.300
	EA2	.505	.497	.417	.387	.381	.284	.528	.608	.346	.221	.207	.138	.729	1.000	.089	.505	.322	.291
	EC1	.300	.335	.354	.375	.386	.245	.378	.089	.462	.418	.343	.232	.138	.089	1.000	.536	.251	.191
	EC3	.470	.494	.468	.515	.476	.222	.439	.459	.588	.647	.319	.220	.442	.505	.536	1.000	.518	.424
	EP2	.204	.241	.336	.376	.314	.315	.465	.440	.220	.249	.053	.111	.368	.498	.356	.521	.218	.224
	EL1	.480	.466	.475	.531	.536	.261	.532	.255	.535	.320	.263	.152	.357	.336	.228	.530	.939	.940
	EL2	.462	.450	.530	.585	.591	.237	.582	.269	.561	.339	.326	.123	.425	.350	.209	.561	.933	.814
	EL3	.480	.470	.499	.558	.561	.302	.540	.251	.572	.299	.287	.134	.362	.322	.251	.518	1.000	.888
	EL4	.399	.380	.445	.494	.503	.212	.508	.220	.499	.214	.243	.162	.300	.291	.191	.424	.888	1.000
Sig. (1-tailed)	PC1		.000	.000	.000	.000	.000	.000	.000	.000	.000	.001	.000	.000	.000	.000	.000	.000	.000
	PC4	.000		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	RR1	.000	.000		.000	.000	.000	.000	.000	.000	.001	.000	.000	.000	.000	.000	.000	.000	.000
	RR2	.000	.000	.000		.000	.000	.000	.000	.000	.001	.000	.000	.000	.000	.000	.000	.000	.000
	RR3	.000	.000	.000	.000		.000	.000	.000	.000	.006	.000	.000	.000	.000	.000	.000	.000	.000
	CE1	.000	.000	.000	.000	.000		.000	.001	.004	.478	.000	.000	.005	.000	.002	.004	.000	.006
	CE2	.000	.000	.000	.000	.000	.000		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	CE3	.000	.000	.000	.000	.000	.001	.000		.050	.029	.001	.032	.000	.000	.149	.000	.001	.004
	ET2	.000	.000	.000	.000	.000	.004	.000	.050		.000	.001	.000	.001	.000	.000	.000	.000	.000
	ET3	.000	.000	.001	.001	.006	.478	.000	.029	.000		.014	.007	.095	.004	.000	.000	.000	.006
	O2	.001	.000	.000	.000	.000	.000	.000	.001	.001	.014		.000	.012	.007	.000	.000	.000	.002
	T2	.000	.000	.000	.000	.000	.000	.000	.032	.000	.007	.000		.093	.052	.003	.005	.057	.028
	EA1	.000	.000	.000	.000	.000	.005	.000	.000	.001	.095	.012	.093		.000	.052	.000	.000	.000
	EA2	.000	.000	.000	.000	.000	.000	.000	.000	.000	.004	.007	.052	.000		.147	.000	.000	.000
	EC1	.000	.000	.000	.000	.000	.002	.000	.149	.000	.000	.000	.003	.052	.147		.000	.001	.012
	EC3	.000	.000	.000	.000	.000	.004	.000	.000	.000	.000	.000	.005	.000	.000	.000		.000	.000
	EP2	.008	.002	.000	.000	.000	.000	.000	.000	.005	.002	.269	.096	.000	.000	.000	.000	.005	.004
	EL1	.000	.000	.000	.000	.000	.001	.000	.001	.000	.000	.001	.037	.000	.000	.003	.000	.000	.000
	EL2	.000	.000	.000	.000	.000	.002	.000	.001	.000	.000	.000	.074	.000	.000	.007	.000	.000	.000
	EL3	.000	.000	.000	.000	.000	.000	.000	.001	.000	.000	.000	.057	.000	.000	.001	.000		.000
	EL4	.000	.000	.000	.000	.000	.006	.000	.004	.000	.006	.002	.028	.000	.000	.012	.000	.000	

a. Determinant = 9.054E-011

Appendix V: Anti-Image Matrices (Measuring Sampling Adequacy (MSA))

Anti-image Matrices

		PC1	PC4	RR1	RR2	RR3	CE1	CE2	CE3	ET2	ET3	O2	T2	EA1	EA2	EC1	EC3	EL3	EL4
Anti-image Covariance	PC1	.061	-.051	-.027	.019	-.006	.019	.004	.000	-.003	-.015	.022	.022	.002	-.009	-.001	.006	.000	-.001
	PC4	-.051	.055	.023	-.017	-.011	-.033	.004	-.008	.002	.007	-.005	-.035	.018	-.013	-.009	-.005	.000	.009
	RR1	-.027	.023	.082	-.054	-.005	.009	-.023	.015	.008	.002	-.010	-.033	.031	-.024	-.005	.002	.001	.002
	RR2	.019	-.017	-.054	.062	-.034	-.008	.016	-.025	.008	-.007	.024	-.003	-.015	.016	-.001	-.005	-.002	-.003
	RR3	-.006	-.011	-.005	-.034	.116	-.003	-.036	.018	-.005	.029	-.029	.041	-.063	.041	-.003	-.006	.004	-.014
	CE1	.019	-.033	.009	-.008	-.003	.484	-.086	.068	.013	.093	-.121	-.037	.002	.009	.048	-.013	-.048	.037
	CE2	.004	.004	-.023	.016	-.036	-.086	.228	-.085	-.016	-.056	-.038	-.056	.053	-.061	-.085	.087	.022	-.002
	CE3	.000	-.008	.015	-.025	.018	.068	-.085	.438	.077	.056	-.071	.001	.014	-.054	.094	-.096	-.023	-.001
	ET2	-.003	.002	.008	.008	-.005	.013	-.016	.077	.331	-.025	.075	-.185	.046	-.062	-.095	-.053	-.018	-.011
	ET3	-.015	.007	.002	-.007	.029	.093	-.056	.056	-.025	.446	.008	-.030	.046	.000	-.023	-.131	.006	.038
	O2	.022	-.005	-.010	.024	-.029	-.121	-.038	-.071	.075	.008	.554	-.115	.037	-.040	-.133	-.033	.019	-.006
	T2	.022	-.035	-.033	-.003	.041	-.037	-.056	.001	-.185	-.030	-.115	.481	-.079	.084	.097	.002	.011	-.028
	EA1	.002	.018	.031	-.015	-.063	.002	.053	.014	.046	.046	.037	-.079	.288	-.163	-.069	.003	.011	.029
	EA2	-.009	-.013	-.024	.016	.041	.009	-.061	-.054	-.062	.000	-.040	.084	-.163	.179	.099	-.032	-.007	-.018
	EC1	-.001	-.009	-.005	-.001	-.003	.048	-.085	.094	-.095	-.023	-.133	.097	-.069	.099	.368	-.098	-.037	-.007
	EC3	.006	-.005	.002	-.005	-.006	-.013	.087	-.096	-.053	-.131	-.033	.002	.003	-.032	-.098	.199	.018	.016
	EP2	.014	.008	.014	-.019	.001	-.099	-.058	-.035	.061	.021	.176	-.018	.040	-.077	-.103	-.074	.020	-.008
	EL1	-.003	-.004	.002	.001	.006	-.001	-.010	.013	.016	-.022	.000	.005	-.017	.012	.020	-.020	-.022	-.048
	EL2	.000	.001	-.001	-.003	-.004	.054	-.046	.034	-.019	-.004	-.044	.036	-.033	.025	.073	-.034	-.041	.006
	EL3	.000	.000	.001	-.002	.004	-.048	.022	-.023	-.018	.006	.019	.011	.011	-.007	-.037	.018	.048	-.007
	EL4	-.001	.009	.002	-.003	-.014	.037	-.002	-.001	-.011	.038	-.006	-.028	.029	-.018	-.007	.016	-.007	.089
Anti-image Correlation	PC1	.826[a]	-.878	-.379	.306	-.072	.113	.031	.002	-.018	-.089	.119	.127	.014	-.086	-.007	.054	-.007	-.008
	PC4	-.878	.825[a]	.337	-.288	-.143	-.199	.040	-.051	.016	.044	-.031	-.212	.143	-.130	-.060	-.044	.004	.125
	RR1	-.379	.337	.852[a]	-.761	-.051	.044	-.166	.081	.049	.011	-.046	-.168	.201	-.201	-.028	.017	.015	.028
	RR2	.306	-.288	-.761	.854[a]	-.401	-.047	.137	-.153	.053	-.044	.128	-.020	-.111	.155	-.004	-.044	-.042	-.034
	RR3	-.072	-.143	-.051	-.401	.918[a]	-.013	-.221	.081	-.025	.127	-.115	.173	-.345	.283	-.016	-.036	.056	-.138
	CE1	.113	-.199	.044	-.047	-.013	.811[a]	-.259	.147	.032	.200	-.233	-.077	.005	.031	.113	-.042	-.313	.178
	CE2	.031	.040	-.166	.137	-.221	-.259	.853[a]	-.271	-.058	-.175	-.107	-.171	.207	-.304	-.295	.409	.208	-.015
	CE3	.002	-.051	.081	-.153	.081	.147	-.271	.840[a]	.201	.127	-.143	.001	.039	-.192	.234	-.326	-.159	-.006
	ET2	-.018	.016	.049	.053	-.025	.032	-.058	.201	.861[a]	-.064	.175	-.463	.148	-.256	-.272	-.207	-.143	-.061
	ET3	-.089	.044	.011	-.044	.127	.200	-.175	.127	-.064	.825[a]	.015	-.066	.129	.001	-.056	-.440	.039	.188
	O2	.119	-.031	-.046	.128	-.115	-.233	-.107	-.143	.175	.015	.769[a]	-.223	.092	-.127	-.295	-.100	.115	-.025
	T2	.127	-.212	-.168	-.020	.173	-.077	-.171	.001	-.463	-.066	-.223	.709[a]	-.213	.288	.230	.005	.069	-.135
	EA1	.014	.143	.201	-.111	-.345	.005	.207	.039	.148	.129	.092	-.213	.732[a]	-.717	-.210	.012	.093	.180
	EA2	-.086	-.130	-.201	.155	.283	.031	-.304	-.192	-.256	.001	-.127	.288	-.717	.720[a]	.384	-.171	-.076	-.146
	EC1	-.007	-.060	-.028	-.004	-.016	.113	-.295	.234	-.272	-.056	-.295	.230	-.210	.384	.656[a]	-.363	-.275	-.041
	EC3	.054	-.044	.017	-.044	-.036	-.042	.409	-.326	-.207	-.440	-.100	.005	.012	-.171	-.363	.832[a]	.188	.119
	EP2	.091	.054	.078	-.120	.006	-.222	-.188	-.083	.165	.049	.368	-.041	.117	-.284	-.263	-.258	.139	-.041
	EL1	-.046	-.071	.027	.021	.079	-.005	-.093	.089	.123	-.145	.002	.029	-.140	.125	.143	-.200	-.439	-.704
	EL2	.004	.012	-.011	-.049	-.040	.287	-.357	.187	-.120	-.020	-.217	.188	-.228	.215	.441	-.280	-.693	.075
	EL3	-.007	.004	.015	-.042	.056	-.313	.208	-.159	-.143	.039	.115	.069	.093	-.076	-.275	.188	.840[a]	-.104
	EL4	-.008	.125	.028	-.034	-.138	.178	-.015	-.006	-.061	.188	-.025	-.135	.180	-.146	-.041	.119	-.104	.864[a]

a. Measures of Sampling Adequacy(MSA)

Appendix VI: Reproduced Correlation Matrix

Reproduced Correlations

		PC1	PC4	RR1	RR2	RR3	CE1	CE2	CE3	ET2	ET3	O2	T2	EA1	EA2	EC1	EC3	EP2	EL1	EL2	EL3	EL4
Reproduced Correlation	PC1	.858[a]	.857	.814	.810	.804	.370	.560	.407	.429	.323	.192	.392	.401	.449	.300	.480	.233	.457	.477	.468	.392
	PC4	.857	.865[a]	.832	.825	.819	.428	.600	.428	.437	.318	.254	.439	.403	.458	.337	.487	.261	.440	.463	.453	.377
	RR1	.814	.832	.830[a]	.828	.829	.508	.662	.440	.442	.258	.351	.459	.415	.457	.337	.468	.279	.496	.517	.514	.445
	RR2	.810	.825	.828	.831[a]	.833	.501	.677	.451	.463	.267	.353	.436	.441	.479	.331	.493	.295	.551	.569	.567	.499
	RR3	.804	.819	.829	.833	.838[a]	.516	.679	.437	.448	.229	.363	.437	.430	.459	.308	.460	.270	.563	.579	.581	.516
	CE1	.370	.428	.508	.501	.516	.625[a]	.582	.351	.202	-.050	.541	.435	.259	.287	.256	.185	.264	.232	.252	.257	.233
	CE2	.560	.600	.662	.677	.679	.582	.736[a]	.496	.466	.237	.533	.416	.471	.516	.395	.528	.449	.549	.569	.565	.514
	CE3	.407	.428	.440	.451	.437	.351	.496	.624[a]	.161	.119	.204	.122	.596	.687	.141	.430	.544	.237	.272	.232	.194
	ET2	.429	.437	.442	.463	.448	.202	.466	.161	.659[a]	.594	.337	.333	.200	.229	.550	.644	.281	.576	.575	.581	.519
	ET3	.323	.318	.258	.267	.229	-.050	.237	.119	.594	.749[a]	.109	.220	.142	.218	.571	.686	.312	.311	.319	.301	.231
	O2	.192	.254	.351	.353	.363	.541	.533	.204	.337	.109	.612[a]	.437	.132	.149	.404	.270	.260	.287	.297	.310	.289
	T2	.392	.439	.459	.436	.437	.435	.416	.122	.333	.220	.437	.516[a]	.020	.057	.439	.249	.121	.121	.137	.144	.100
	EA1	.401	.403	.415	.441	.430	.259	.471	.596	.200	.142	.132	.020	.626[a]	.694	.081	.460	.516	.388	.412	.378	.343
	EA2	.449	.458	.457	.479	.459	.287	.516	.687	.229	.218	.149	.057	.694	.793[a]	.153	.552	.622	.341	.375	.329	.283
	EC1	.300	.337	.337	.331	.308	.256	.395	.141	.550	.571	.404	.439	.081	.153	.644[a]	.563	.313	.224	.239	.231	.171
	EC3	.480	.487	.468	.493	.460	.185	.528	.430	.644	.686	.270	.249	.460	.552	.563	.833[a]	.559	.528	.547	.519	.444
	EP2	.233	.261	.279	.295	.270	.264	.449	.544	.281	.312	.260	.121	.516	.622	.313	.559	.616[a]	.223	.254	.212	.172
	EL1	.457	.440	.496	.551	.563	.232	.549	.237	.576	.311	.287	.121	.388	.341	.224	.528	.223	.937[a]	.919	.943	.908
	EL2	.477	.463	.517	.569	.579	.252	.569	.272	.575	.319	.297	.137	.412	.375	.239	.547	.254	.919	.904[a]	.924	.886
	EL3	.468	.453	.514	.567	.581	.257	.565	.232	.581	.301	.310	.144	.378	.329	.231	.519	.212	.943	.924	.951[a]	.915
	EL4	.392	.377	.445	.499	.516	.233	.514	.194	.519	.231	.289	.100	.343	.283	.171	.444	.172	.908	.886	.915	.889[a]
Residual[b]	PC1		.100	-.094	-.119	-.074	.046	-.007	.003	.011	-.007	.066	-.041	-.037	.056	.000	-.009	-.029	.023	-.015	.013	.006
	PC4	.100		-.115	-.101	-.063	.063	-.030	.007	.008	-.013	.050	-.032	-.032	.039	-.002	.007	-.021	.026	-.012	.017	.003
	RR1	-.094	-.115		.110	.032	-.077	.023	-.012	-.047	.009	-.011	-.035	-.026	-.041	.018	.000	.058	-.021	.013	-.015	.000
	RR2	-.119	-.101	.110		.072	-.049	-.020	-.007	-.067	-.004	-.029	-.049	-.004	-.092	.044	.023	.081	-.020	.015	-.009	-.005
	RR3	-.074	-.063	.032	.072		-.050	-.005	-.045	-.050	-.018	.008	-.093	.050	-.078	.079	.017	.045	-.026	.011	-.020	-.013
	CE1	.046	.063	-.077	-.049	-.050		-.068	-.084	.020	.055	-.175	-.097	-.042	-.003	-.011	.037	.051	.029	-.015	.045	-.021
	CE2	-.007	-.030	.023	-.020	-.005	-.068		-.006	.004	.055	-.075	-.020	-.074	.011	-.017	-.089	.016	-.018	.013	-.024	-.006
	CE3	.003	.007	-.012	-.007	-.045	-.084	-.006		-.021	.041	.061	.035	-.173	-.079	-.052	.028	-.104	.018	-.003	.019	.026
	ET2	.011	.008	-.047	-.067	-.050	.020	.004	-.021		-.113	-.072	.120	.062	.117	-.088	-.056	-.062	-.041	-.014	-.009	-.020
	ET3	-.007	-.013	.009	-.004	-.018	.055	.055	.041	-.113		.076	-.011	-.031	.004	-.153	-.039	-.062	.009	.020	-.002	-.017
	O2	.066	.050	-.011	-.029	.008	-.175	-.075	.061	-.072	.076		-.106	.058	.058	-.061	.049	-.208	-.023	.030	-.023	-.045
	T2	-.041	-.032	-.035	-.049	-.093	-.097	-.020	.035	.120	-.011	-.106		.092	.080	-.207	-.030	-.010	.030	-.014	-.010	.062
	EA1	-.037	-.032	-.026	-.004	.050	-.042	-.074	-.173	.062	-.031	.058	.092		.035	.057	-.019	-.149	-.030	.013	-.017	-.043
	EA2	.056	.039	-.041	-.092	-.078	-.003	.011	-.079	.117	.004	.058	.080	.035		-.063	-.047	-.124	-.005	-.025	-.007	.008
	EC1	.000	-.002	.018	.044	.079	-.011	-.017	-.052	-.088	-.153	-.061	-.207	.057	-.063		-.027	.043	.004	-.030	.020	.020
	EC3	-.009	.007	.000	.023	.017	.037	-.089	.028	-.056	-.039	.049	-.030	-.019	-.047	-.027		-.038	.002	.015	-.001	-.019
	EP2	-.029	-.021	.058	.081	.045	.051	.016	-.104	-.062	-.062	-.208	-.010	-.149	-.124	.043	-.038		.029	-.011	.005	.052
	EL1	.023	.026	-.021	-.020	-.026	.029	-.018	.018	-.041	.009	-.023	.030	-.030	-.005	.004	.002	.029		-.046	-.004	.032
	EL2	-.015	-.012	.013	.015	.011	-.015	.013	-.003	-.014	.020	.030	-.014	.013	-.025	-.030	.015	-.011	-.046		.008	-.072
	EL3	.013	.017	-.015	-.009	-.020	.045	-.024	.019	-.009	-.002	-.023	-.010	-.017	-.007	.020	-.001	.005	-.004	.008		-.027
	EL4	.006	.003	.000	-.005	-.013	-.021	-.006	.026	-.020	-.017	-.045	.062	-.043	.008	.020	-.019	.052	.032	-.072	-.027	

Extraction Method: Principal Component Analysis.

a. Reproduced communalities

b. Residuals are computed between observed and reproduced correlations. There are 64 (30.0%) nonredundant residuals with absolute values greater than 0.05.

Appendix VII: Component Score Coefficient Matrix

	Component				
	1	2	3	4	5
PC1	-.071	.354	-.062	.016	-.205
PC4	-.085	.330	-.056	.013	-.135
RR1	-.043	.254	-.045	-.041	-.014
RR2	-.016	.231	-.033	-.047	-.020
RR3	-.001	.231	-.045	-.076	.000
CE1	-.028	-.042	.033	-.165	.431
CE2	.030	-.050	.085	-.052	.254
CE3	-.069	-.024	.314	-.080	.013
ET2	.060	-.035	-.091	.268	.016
ET3	-.061	.005	-.036	.455	-.193
O2	.025	-.200	-.016	-.019	.524
T2	-.107	.077	-.145	.092	.278
EA1	.015	-.033	.309	-.091	-.087
EA2	-.044	-.032	.363	-.041	-.097
EC1	-.092	-.074	-.067	.341	.179
EC3	-.016	-.070	.128	.306	-.095
EP2	-.064	-.186	.321	.095	.089
EL1	.286	-.060	-.036	-.036	-.035
EL2	.266	-.057	-.017	-.033	-.031
EL3	.287	-.057	-.049	-.046	-.012
EL4	.303	-.081	-.046	-.079	.010

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Component Scores.