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The Effect of Kaizen Implementation and Sustainability on Performance of the Manufacturing Sector in Ethiopia

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Abstract

Today's modern society, where business dynamism is changing fast, requires going beyond the traditional managerial approach. This research examines how and the context of Kaizen implementation affects the sustainability and Performance of manufacturing companies in Ethiopia. The study follows the framework of the Kaizen practices implemented in Ethiopia as the application of Kaizen tools, kaizen thinking, and culture. The findings indicate that there is a positive correlation between Kaizen Implementation factors (input factors) and sustainability factors in relation to the Performance of manufacturing companies in Ethiopia. The results of the study suggest that manufacturing companies in Ethiopia should emphasize working on promoting the Kaizen culture and empowerment of employees coupled with the use of the Kaizen tools effectively and adapted to the context of each company to enhance the Performance and achieve competitive advantage. Empowerment factors include all variables that measure thinking and culture. The variables are critical for sustaining Kaizen in terms of maintaining improved culture. For Kaizen to be sustainable, employees need to be empowered to learn, apply and own the changes. The results from the PLS path model analysis indicate that the dependent variable (improved culture) is found to have a strong relationship with two implementation variables (independent variables): empowerment and leadership commitment.

Keywords: *Culture, Empowerment, Leadership Commitment, Sustainability, Performance.*

Introduction

Kaizen Philosophy as a key to Japan's competitive success [1] has become a management style and has been practiced throughout most countries to improve productivity, efficiency, quality, and work area. It has been implemented in both developing and developed economies and encountered challenges in the transferability process.

The sustainability of Kaizen practice has also been challenging in many cases [2]. Transferring Kaizen outside Japan has faced various challenges depending on the context or culture of a country where Kaizen is implemented. Many studies indicate that the adoption and effectiveness of the Kaizen transfer process outside Japan's culture have been facing difficulties in several countries [3, 4].

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

Most local studies done had concentrated on the relationship between the implementation of *kaizen* and operational performance improvement. This research is necessary

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because no known studies have been done locally on the sustainability of Kaizen [5].

In Ethiopia, the manufacturing sector operates in a very complex and unfavorable business operating environment characterized by low productivity, high operating costs, poor infrastructure, inadequate and expensive financing, and inadequate managerial and 5. technical skills [6-8]. Unskilled labor with limited experience and low productivity coupled with other factors have been major challenges in the manufacturing sector in Ethiopia [9].

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

To study the effect of Kaizen Implementation and Sustainability on Performance, the following were research questions:

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

Hypothesis of the Study

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

1. H1: Kaizen Implementation significantly affects Kaizen Sustainability.
2. H2: Kaizen Sustainability significantly affects Performance.
3. H3: Kaizen Implementation significantly affects Performance.

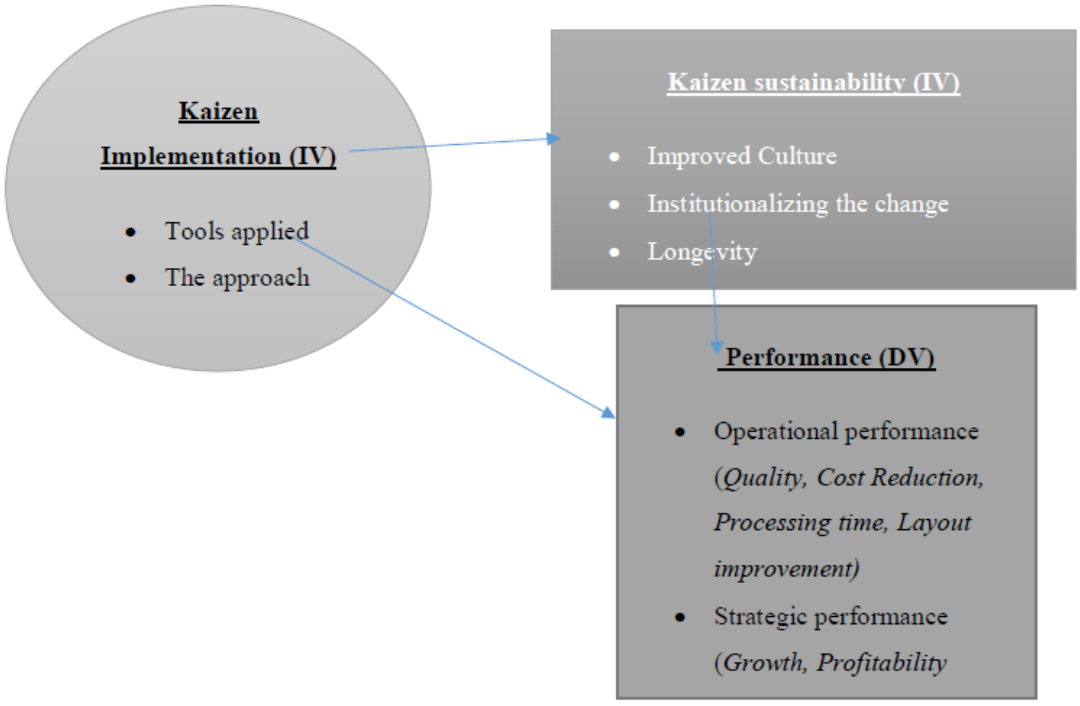

Figure 1. Conceptual Framework structured to design the thesis work

Note: The model is structured with three separate pairs: Kaizen Implementation vs. Kaizen Sustainability, Kaizen Implementation Vs. Performance, Kaizen Sustainability Vs. Performance

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

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

Methodology

According to [10] research design is the plan and structure of tools to obtain answers to research questions or test the research hypothesis. The Plan represents the approach to be used in collecting and analyzing data in order to answer the research questions [11]. The research design summarizes the essentials of the research activity and time frame. Based on the research questions driven by the research objectives and types of data obtained, it establishes a framework to define the relationship among the study variables and outlines the procedures for every research activity.

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

Research Design and Sampling Technique

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

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

The results of the data analysis were also validated through visits and conversations in the workplace with Kaizen officers, company managers, and employees met on the shop floor. The validation report is included in this thesis in chapter four of the paper. The excel analysis to

each of the samples taken during the visit is compared against the actual observation in the workplace and the conversation with employees. The charts for each company generated from excel analysis on the factor analysis by the company is attached to the report of each visit of the respective companies. The secondary data (periodic reports and kaizen-related data) and observations in the visit were used to validate the data analysis result obtained through the survey using questionnaire.

For both objectives, there was a need to measure the "influence" of a variable on another i.e., the influence of Kaizen implementation practice on sustainability factors and the effect on Performance, and that required the use of a regression parameter. Partial Least Square (PLS)-Path method Analysis was applied to test regression among the implementation and sustainability combined factors vis-à-vis the performance factors. The PLS analysis clearly shows which factors are related to which and the degree of the influence of the input factors on the output factors. The group factors of the input variables are also analyzed to see the level of the impact on out factors.

Partial least squares analysis is a multivariate statistical technique that allows comparison between multiple response variables and multiple explanatory variables. Partial least square is one of a number of covariance-based statistical methods that are often referred to as structural equation modeling [12].

Regression Model

The regression equation was:

$$(Y = \beta 0 + \beta 1X1 + \beta 2X2 + \cdots \varepsilon)$$

Where: β0 = Constants, Y = Performance outcomes, X1 = Kaizen Implementation factors, X2 = Kaizen sustainability factors and ε =standard error.

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

Implementation → Sustainability:

$$Sx = a + bI_1 + cI_2 + dI_3 + eI_4 + fI_5$$

Sustainability→ Performance:

$$Px = a + bS_1 + cS_2 + dS_3$$

Implementation → Performance:

$$Px = a + bI_1 + cI_2 + dI_3 + eI_4 + eI_5$$

Implementation =I_1 = tools

I_2 = leadership commitment

I_3 = empowerment

I_4 = communication of Kaizen/results

I_5 = outside Consultants

Sustainability = S_1 = improved culture

S_2 = longevity of Kaizen initiative

S_3 = institutionalized change

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

P_2= Strategic Performance (growth, profitability, competitiveness).

Results and Discussion

Table 1. Regression Analysis for H1

Independent variable	**Strategic Performance, P_1 (Dependent variable)**											
	Model Summary and ANOVA test						**Coefficients**					
	R	**R2**	**Adj. R2**	**Std. Error**	**F**	**Sig.**	**Unstandardized Coefficients**			**Standardized Coefficients**	**t**	**Sig.**
							(Constant β)	**B**	**Std. Error**	**Beta**		
Predictors: (Constant),I_1, I_2, I_3, I_4 I_5	0.591	0.349	0.309	0.75	8.68	**0.000**	(Constant)	0.61	0.46	-	1.33	0.189
							I_1	0.37	0.19	0.27	1.97	**0.042**
							I_2	-0.04	0.16	-0.04	-0.28	0.780
							I_3	0.34	0.18	0.26	1.93	**0.048**
							I_4	0.02	0.15	0.02	0.13	0.900
							I_5	0.18	0.08	0.21	2.11	**0.038**
	Operational Performance, P_2 (Dependent variable)											
Predictors: (Constant), I_1, I_2, I_3, I_4 I_5	0.671	0.450	0.416	0.64	13.26	**0.000**	(Constant)	0.63	0.38	-	1.65	0.103
							I_1	0.44	0.15	0.37	2.87	**0.005**
							I_2	0.11	0.13	0.1	0.82	0.415
							I_3	0.27	0.15	0.23	1.83	**0.071**
							I_4	0.03	0.12	0.03	0.24	0.814
							I_5	0.05	0.07	0.07	0.77	0.440
	Overall Performance, P_3 (Dependent variable)											
Predictors: (Constant), I_1, I_2, I_3, I_4 I_5	0.66	0.435	0.401	0.65	12.49	**0.000**	(Constant)	0.62	0.39	-	1.61	0.111
							I_1	0.42	0.15	0.35	2.69	**0.009**
							I_2	0.06	0.13	0.06	0.46	0.644
							I_3	0.29	0.15	0.25	1.95	**0.054**
							I_4	0.03	0.13	0.03	0.21	0.836
							I_5	0.09	0.07	0.12	1.29	0.200
I_1 = tools applied; I_2 =leadership commitment; I_3 = empowerment; I_4 = communication of *Kaizen*/results; I_5 = outside consultants												

Table 2. Multiple Stepwise Regression for H1

	Strategic Performance, P1 (Dependent variable)												
Model	**Independent variable**	**Coefficients**							**Model summary**				
		Unstandardized Coefficients	**Standardized Coefficients**	**Sig.**	**Correlations**		**Collinearity Statistics**						
		B	**Beta**		**Partial**	**Part**	**Tolerance**	**VIF**	**R**	**R2**	**Adj. R2**	**F**	**Sig.**
1	(Constant)	1.10	-	0.012	-	-	-	-	0.513	0.263	0.254	30.34	**0.000**
	Tool applied	0.69	0.51	**0.000**	0.51	0.51	1.00	1.00					
2	(Constant)	0.65	-	0.155	-	-	-	--	0.558	0.311	0.295	19.00	**0.000**
	Tool applied	0.44	0.33	**0.006**	0.29	0.26	0.59	1.68					
	Empowerment	0.38	0.29	**0.017**	0.26	0.22	0.59	1.68					
3	(Constant)	0.58	-	0.194	-	-	-	-	0.590	0.348	0.325	14.78	**0.000**
	Tool applied	0.36	0.27	**0.028**	0.24	0.20	0.56	1.80					
	Empowerment	0.33	0.25	**0.033**	0.23	0.19	0.58	1.71					
	Outside consultants	0.18	0.21	**0.033**	0.23	0.19	0.82	1.23					
	Operational Performance, P2 (Dependent variable)												
1	(Constant)	1.13	-	0.002	-	-	-	-	0.624	0.39	0.382	54.27	**0.000**
	Tool applied	0.75	0.62	**0.000**	0.62	0.62	1.00	1.00					
2	(Constant)	0.72	-	0.055	-	-	-	-	0.666	0.444	0.43	33.05	**0.000**
	Tool applied	0.53	0.44	**0.000**	0.41	0.34	0.59	1.68					
	Empowerment	0.35	0.29	**0.007**	0.29	0.23	0.59	1.68					
	Overall Performance, P_3 (Dependent variable)												
1	(Constant)	1.12	-	0.002	-	-	-	-	0.607	0.368	0.361	49.59	**0.000**
	Tool applied	0.73	0.61	**0.000**	0.61	0.61	1.00	1.00					
2	(Constant)	0.70	-	0.066	-	-	-	-	0.649	0.442	0.408	30.62	**0.000**
	Tool applied	0.50	0.42	**0.000**	0.39	0.32	0.59	1.68					
	Empowerment	0.36	0.30	**0.007**	0.29	0.23	0.59	1.68					

Table 3. Correlation Matrix and Collinearity between Implementation and Sustainability

	Improved culture	Longevity	Institutionalized change	Overall sustainability	Tool applied	Leadership commitment	Empowerment	Communication	Outside consultants	Overall implementation
Improved culture	1	-	-	-	-	-	-	-	-	-
Longevity	0.721**	1	-	-	-	-	-	-	-	-
Institutionalized change	0.554**	0.563**	1	-	-	-	-	-	-	-
Overall sustainability	0.973**	0.839**	0.677**	1	-	-	-	-	-	-
Tool applied	0.707**	0.524**	0.434**	0.698**	1	-	-	-	-	-
Leadership commitment	0.648**	0.424**	0.598**	0.655**	0.646**	1	-	-	-	-
Empowerment	0.741**	0.484**	0.522**	0.725**	0.637**	0.659**	1	-	-	-
Communication	0.686**	0.461**	0.473**	0.673**	0.680**	0.647**	0.663**	1	-	-
Outside consultants	0.384**	0.202	0.185	0.352**	0.410**	0.278**	0.357**	0.345**	1	-
Overall implementation	0.798**	0.553**	0.540**	0.786**	0.947**	0.791**	0.821**	0.779**	0.487**	1
** Correlation is significant at the 0.01 level (2-tailed).										

Table 4. Regression Analysis for H2

Independent variable	**Improved culture, S_1 (Dependent variable)**											
	Model Summary and ANOVA test						**Coefficients**					
	R	**R2**	**Adj. R2**	**Std. Error**	**F**	**Sig.**	**Unstandardized Coefficients**			**Standardized Coefficients**	**t**	**Sig.**
							(Constant β)	**B**	**Std. Error**	**Beta**		
Predictors:	-	-	-	-	-	-	(Constant)	0.201	0.27	-	0.73	0.465
(Constant), I_1, I_2,	-	-	-	-	-	-	I_1	0.291	0.11	0.261	2.65	0.010
I_3, I_4 I_5	0.818	0.669	0.649	0.46	32.74	0.000	I_2	0.105	0.09	0.108	1.13	0.262

	-	-	-	-	-	-	I_3	0.404	0.11	0.367	3.81	0.000
	-	-	-	-	-	-	I_4	0.159	0.09	0.177	1.80	0.076
	-	-	-	-	-	-	I_5	0.039	0.05	0.055	0.78	0.441
	Longevity, S_2 (Dependent variable)											
Predictors:	-	-	-	-	-	-	(Constant)	0.905	0.45	-	2.00	0.049
(Constant), I_1, I_2,	-	-	-	-	-	-	I_1	0.418	0.18	0.325	2.30	0.024
I_3, I_4 I_5	0.565	0.319	0.277	0.76	7.61	0.000	I_2	0.025	0.15	0.022	0.16	0.873
	-	-	-	-	-	-	I_3	0.271	0.18	0.213	1.54	0.127
	-	-	-	-	-	-	I_4	0.106	0.15	0.102	0.72	0.471
	-	-	-	-	-	-	I_5	-0.040	0.08	-0.049	-0.48	0.632
	Institutionalized change, S_3 (Dependent variable)											
Predictors:	-	-	-	-	-	-	(Constant)	0.077	0.51		0.15	0.881
(Constant), I_1, I_2,	-	-	-	-	-	-	I_1	-0.031	0.21	-0.020	-0.15	0.881
I_3, I_4 I_5	0.624	0.390	0.352	0.86	10.36	0.000	I_2	0.580	0.17	0.430	3.32	0.001
	-	-	-	-	-	-	I_3	0.317	0.20	0.208	1.59	0.116
	-	-	-	-	-	-	I_4	0.100	0.17	0.081	0.60	0.547
	-	-	-	-	-	-	I_5	-0.027	0.09	-0.028	-0.29	0.772
	Overall sustainability, S4 (Dependent variable)											
Predictors:	-	-	-	-	-	-	(Constant)	0.329	0.27		1.20	0.232
(Constant), I_1, I_2,	-	-	-	-	-	-	I_1	0.284	0.11	0.263	2.59	0.011
I_3, I_4 I_5	0.805	0.647	0.626	0.46	29.76	0.000	I_2	0.136	0.09	0.144	1.47	0.146
	-	-	-	-	-	-	I_3	0.368	0.11	0.346	3.48	0.001
	-	-	-	-	-	-	I_4	0.142	0.09	0.164	1.61	0.111
	-	-	-	-	-	-	I_5	0.016	0.05	0.024	0.33	0.744
I_1 = tools applied; I_2 =leadership commitment; I_3 = empowerment; I_4 = communication of *Kaizen*/results; I_5 = outside consultants												

Table 5. Multiple Stepwise Regression for H2

	Improved culture, S1 (Dependent variable)													
Model	**Independent variable**	**Coefficients**								**Model summary and ANOVA test**				
		Unstandardized Coefficients	**Standardized Coefficients**	**t**	**Sig.**	**Correlations**			**Collinearity Statistics**					
		B	**Beta**			**Partial**	**Part**	**Tolerance**	**VIF**	**R**	**R2**	**Adj. R2**	**F**	**Sig.**
1	(Constant)	0.827	-	3.03	0.003	-	-	-	-	0.741	0.549	0.544	103.58	0.000
	Empowerment	0.815	0.741	10.18	0.000	0.74	0.74	1.00	1.00	-	-	-	-	-
2	(Constant)	0.280	-	1.03	0.306	-	-	-	-	0.801	0.642	0.634	75.45	0.000
	Empowerment	0.538	0.489	5.78	0.000	0.53	0.38	0.59	1.68	-	-	-	-	-
	Tool applied	0.441	0.396	4.68	0.000	0.46	0.31	0.59	1.68	-	-	-	-	-
3	(Constant)	0.282	-	1.06	0.291	-	-	-	-	0.813	0.662	0.649	54.12	0.000
	Empowerment	0.450	0.409	4.51	0.000	0.44	0.29	0.50	2.02	-	-	-	-	-
	Tool applied	0.341	0.306	3.31	0.001	0.34	0.21	0.48	2.10	-	-	-	-	-
6	Communication	0.186	0.207	2.18	0.032	0.23	0.14	0.45	2.23	-	-	-	-	-
	Longevity, S2 (Dependent variable)													
1	(Constant)	1.286	-	3.17	0.002	-	-	-	-	0.524	0.274	0.266	32.11	0.000
	Tool applied	0.674	0.524	5.67	0.000	0.52	0.52	1.00	1.00	-	-	-	-	-
2	(Constant)	0.904	-	2.08	0.041	-	-	-	-	0.559	0.312	0.296	19.08	0.000
	Tool applied	0.466	0.362	3.09	0.003	0.32	0.28	0.59	1.68	-	-	-	-	-
	Empowerment	0.322	0.253	2.16	0.034	0.23	0.20	0.59	1.68	-	-	-	-	-
	Institutionalized change, S3 (Dependent variable)													
1	(Constant)	0.461	-	1.05	0.297	-	-	-	-	0.598	0.358	0.350	47.38	0.000
	Leadership commitment	0.807	0.598	6.88	0.000	0.60	0.60	1.00	1.00	-	-	-	-	-
	Overall sustainability, S4 (Dependent variable)													
1	(Constant)	0.952	-	3.50	0.001	-	-	-	-	0.725	0.526	0.521	94.37	0.000
	Empowerment	0.773	0.725	9.72	0.000	0.73	0.73	1.00	1.00	-	-	-	-	-

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

Table 6. Correlation Matrix and Collinearity Between Implementation and Sustainability

	Strategic Performance	Operational Performance	Overall Performance	Improved culture	Longevity	Institutionalized change	Overall sustainability
Strategic Performance	1	-	-	-	-	-	-
Operational Performance	0.861**	1	-	-	-	-	-
Overall Performance	0.935**	0.986**	1	-	-	-	-
Improved culture	0.676**	0.763**	0.758**	1	-	-	-
Longevity	0.577**	0.676**	0.664**	0.721**	1	-	-
Institutionalized change	0.474**	0.576**	0.561**	0.554**	0.563**	1	-
Overall sustainability	0.693**	0.795**	0.786**	0.973**	0.839**	0.677**	1
** Correlation is significant at the 0.01 level (2-tailed).							

Table 7. Regression Analysis for H3

Independent variable	**Strategic Performance, P_1 (Dependent variable)**											
	Model Summary and ANOVA test						**Coefficients**					
	R	**R2**	**Adj. R2**	**Std. Error**	**F**	**Sig.**	**Unstandardized Coefficients**			**Standardized Coefficients**	**t**	**Sig.**
							(Constant β)	**B**	**Std. Error**	**Beta**		
	-	-	-	-	-	-	(Constant)	0.353	0.355		1.00	0.322

Predictors: (Constant), S_1, S_2, S_3	0.693	0.481	0.462	0.68	25.63	0.000	S_1	0.611	0.142	0.508	4.30	0.000
	-	-	-	-	-	-	S_2	0.155	0.124	0.149	1.26	0.212
	-	-	-	-	-	-	S_3	0.094	0.086	0.109	1.10	0.276
	Operational Performance, P_2 (Dependent variable)											
Predictors: (Constant), S_1, S_2, S_3							(Constant)	0.505	0.267		1.89	0.062
	0.797	0.635	0.622	0.51	48.13	0.000	S_1	0.562	0.107	0.521	5.26	0.000
	-	-	-	-	-	-	S_2	0.189	0.093	0.203	2.03	0.045
	-	-	-	-	-	-	S_3	0.136	0.065	0.174	2.10	0.039
	Overall Performance, P_3 (Dependent variable)											
Predictors: (Constant), S_1, S_2, S_3							(Constant)	0.46	0.273		1.68	0.096
	0.787	0.62	0.606	0.52	45.15	0.000	S_1	0.577	0.109	0.533	5.28	0.000
	-	-	-	-	-	-	S_2	0.179	0.095	0.192	1.88	0.063
	-	-	-	-	-	-	S_3	0.123	0.066	0.158	1.86	0.066
S1 = Improved culture; S2 =Longevity; S3 = Institutional change												

Table 8. Multiple Stepwise Regression for H3

	Strategic Performance, P1 (Dependent variable)													
Model	**Independent variable**	**Coefficients**								**Model summary and ANOVA test**				
		Unstandardized Coefficients	**Standardized Coefficients**	**t**	**Sig.**	**Correlations**		**Collinearity Statistics**						
		B	**Beta**			**Partial**	**Part**	**Tolerance**	**VIF**	**R**	**R2**	**Adj. R2**	**F**	**Sig.**
1	(Constant)	0.509		1.46	0.149	-	-	-	-	-	-	-	-	-
	Improved culture	0.813	0.676	8.45	0.000	0.67	0.67	1.00	1.00	0.676	0.457	0.450	71.45	0.000
	Operational Performance, P2 (Dependent variable)													
1	(Constant)	0.709		2.58	0.012	-	-	-	-	-	-	-	-	-
	Improved culture	0.824	0.763	10.89	0.000	0.76	0.76	1.00	1.00	0.763	0.583	0.578	118.66	0.000
2	(Constant)	0.59		2.20	0.031	-	-	-	-	-	-	-	-	-
	Improved culture	0.692	0.64	7.90	0.000	0.65	0.53	0.69	1.44	0.785	0.617	0.608	67.60	0.000

	Institutionalized change	0.173	0.222	2.74	0.008	0.28	0.18	0.69	1.44					
3	(Constant)	0.505	-	1.89	0.062	-	-	-	-	-	-	-	-	-
	Improved culture	0.562	0.521	5.26	0.000	0.50	0.34	0.45	2.23	0.797	0.635	0.622	48.13	0.000
	Institutionalized change	0.136	0.174	2.10	0.039	0.22	0.13	0.64	1.57					
	Longevity	0.189	0.203	2.03	0.045	0.21	0.13	0.44	2.26					
	Overall Performance, P_3 (Dependent variable)													
1	(Constant)	0.649		2.34	0.022	-	-	-	-	-	-	-	-	-
	Improved culture	0.821	0.758	10.73	0.000	0.758	0.75	1.00	1.00	0.758	0.575	0.57	115.13	0.000
2	(Constant)	0.516		1.87	0.064									
	Improved culture	0.630	0.582	5.88	0.000	0.54	0.40	0.48	2.08	0.777	0.604	0.595	64.11	0.000
	Longevity	0.229	0.245	2.48	0.015	0.261	0.17	0.48	2.08					

Table 9. Regression Analysis for the Overall Kaizen Implementation, Sustainability and Overall Performance

Independent variable	**Overall Performance, (Dependent variable)**											
	Model Summary and ANOVA test						**Coefficients**					
	R	**R2**	**Adj. R2**	**Std. Error**	**F**	**Sig.**	**Unstandardized Coefficients**			**Standardized Coefficients**	**t**	**Sig.**
							(Constant β)	**B**	**Std. Error**	**Beta**		
Predictors: (Constant), Overall sustainability, Overall implementation	0.789	0.622	0.613	0.52	69.06	0.000	(Constant)	0.332	0.31		1.08	0.285
							Overall implementation	0.124	0.14	0.093	0.86	0.391
							Overall sustainability	0.796	0.12	0.713	6.58	0.000

Multiple Stepwise Regression for the Overall Kaizen Implementation, Sustainability and Performance

Multiple stepwise methods was used to determine the most significant impact of the Kaizen implementation or Kaizen sustainability activities on the overall Performance. Both overall Kaizen implementation and overall Kaizen sustainability activities were considered together. Upon fitting these two factors against the overall Performance using multiple linear regression and specifying the 'stepwise' method, Kaizen sustainability activities were positively and independently affecting overall Performance as indicated in the Table. 10.

Overall, *Kaizen* sustainability activities alone came out strongly and independently significant in the first place and explained 61.8% (R2=0.618) of variation in the overall Performance. Regarding the sensitivity of beta (β), the results show that overall, *Kaizen* sustainability activities had a strong relationship with overall Performance in that for one unit increase of overall *Kaizen* sustainability activities, overall Performance improves by 87.8%, (β = 0.878, Sig = 0.000). Moreover, the standardized coefficient (Beta) for overall *Kaizen* sustainability activities was 0.786, which is statistically significant at a probability value less than 0.001. The linear regression model equation is presented as follows; $P = \beta 0 + \beta 1S$. Where P = overall Performance, S = *Kaizen* sustainability. Therefore, $P = 0.459 + 0.878S$.

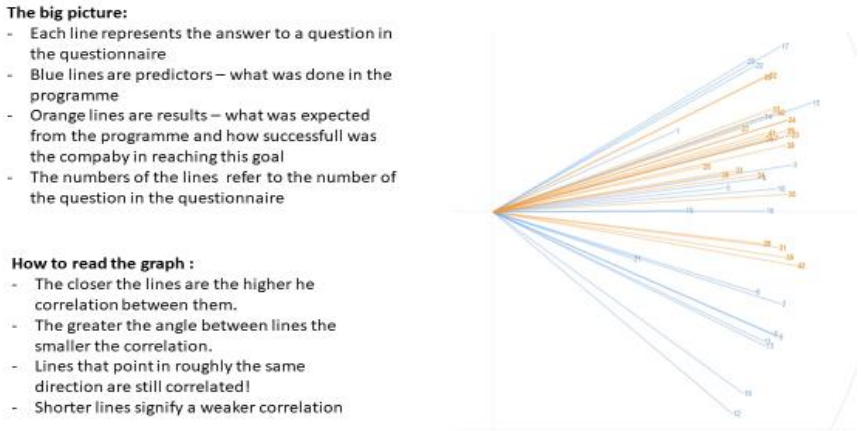

Figure 2. Individual Factor Analysis using Partial Least Square PLS- Path Modelling method

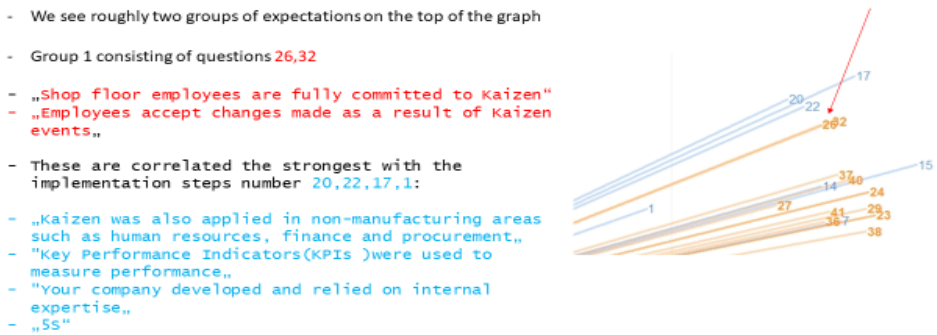

Figure 3. Correlation among Implementation Factor Groups

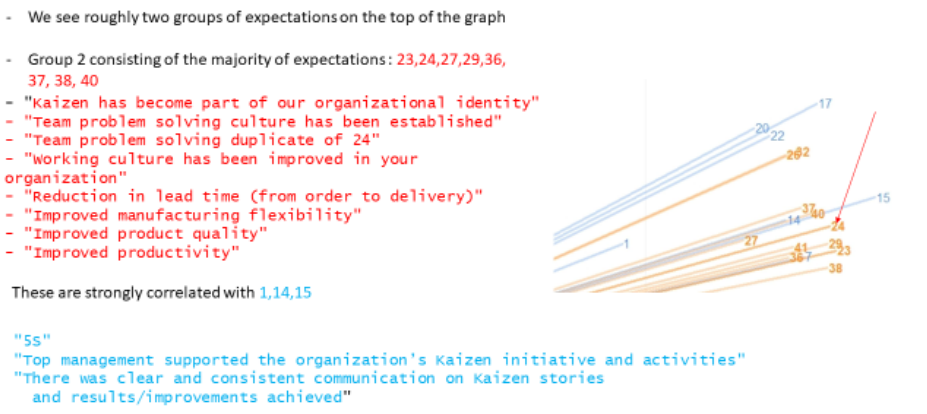

Figure 4. Correlation among Implementation Factor Groups, Sustainability and Impact Groups

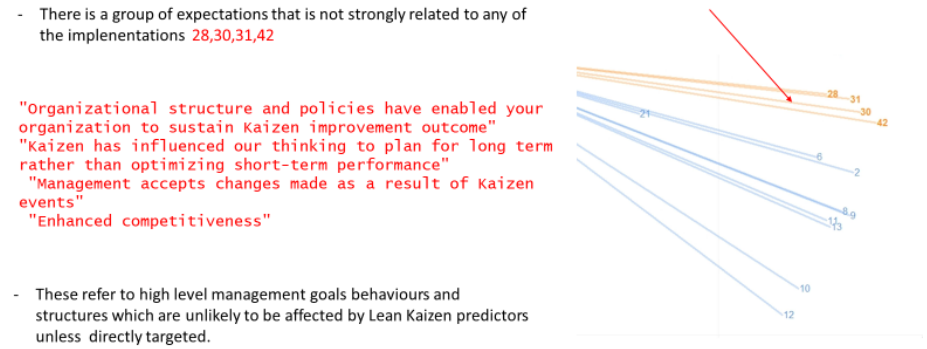

Figure 5. Correlation between Management and Structure Vs Kaizen Predictors

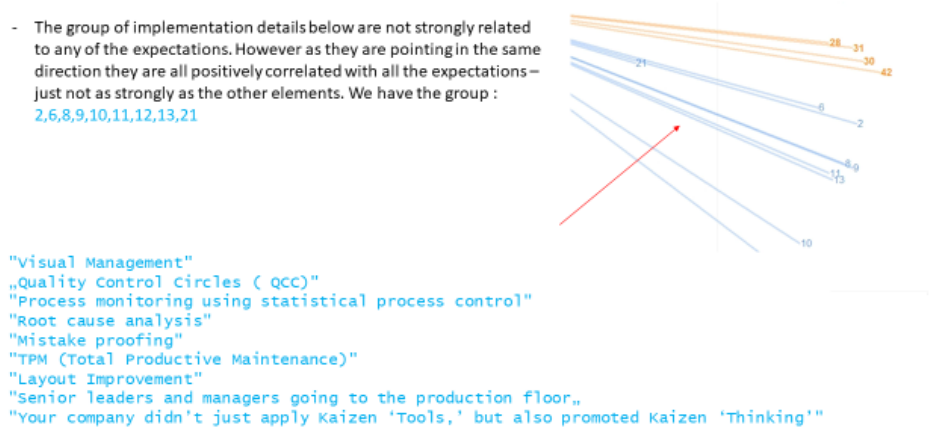

Figure 6. Correlation between Implementation Factors and Kaizen Tools

Table 10. Multiple Stepwise Regression for the Overall Kaizen Implementation, Sustainability and Performance

	Overall Performance, (Dependent variable)													
Model	**Independent variable**	**Coefficients**								**Model summary and ANOVA test**				
		Unstandardized Coefficients	**Standardized Coessfficients**	**t**	**Sig.**	**Correlations**		**Collinearity Statistics**						
		B	**Beta**			**Partial**	**Part**	**Tolerance**	**VIF**	**R**	**R2**	**Adj. R2**	**F**	**Sig.**
1	(Constant)	0.459		1.70	0.093									
	Overall sustainability	0.878	0.786	11.74	0.000	0.79	0.79	1.00	1.00	0.786	0.618	0.614	137.80	0.000

The Group Factors Analysis

The PLS –Path Modelling analysis shows the input category (Implementation and Sustainability factors combined) on each output category (Impact Factors).

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

The PLS –Path Modelling

Table 11 (a). $improvement Culture

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

Table 11 (b). $institutional_Change

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

Table 11 (c). $longevity

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

Table 11 (d). $operational perf

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

Table 11 (e). $strategic_perf

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

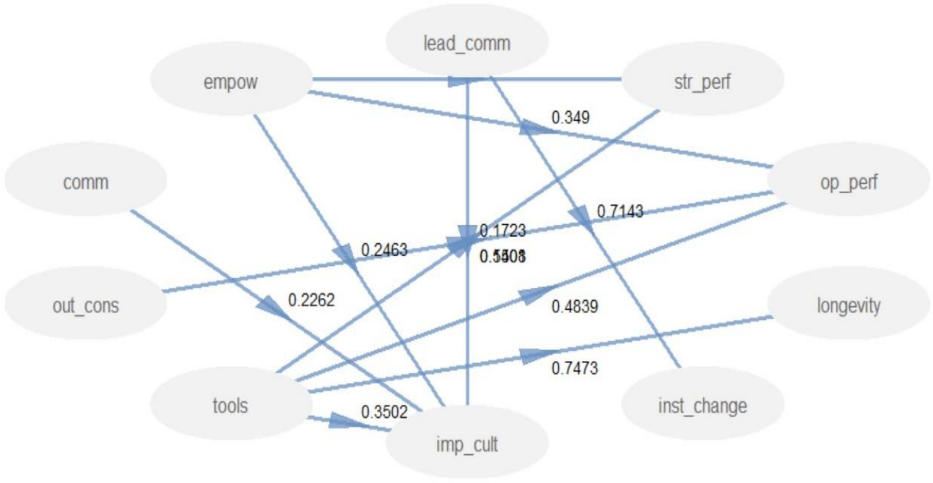

Figure 6. PLS Path Model

Model: PLS Path Model shows the Effects of the Input Factors on Output Group Factors

Description on the Model:

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

A path coefficient has a similar meaning as a standardized beta coefficient of an ordinary least square's regressions [13] cited (Hair et al., 2011). According to [14], a path coefficient may be considered meaningful if a critical value of 0.2 is exceeded. Therefore, a higher path coefficient means that the variable has a higher influence. Therefore, the higher the path coefficient, the greater effect the variable has. As we can see the path coefficients have different values, which indicate that some factors have a greater impact than others.

The connection between the strength path coefficient represents of the dependent variable in an explanatory variable when other variables in the model are held constant [15]. The path coefficient of a structural equation model is similar to the correlation of regression coefficients and is interpreted as follows [16].

1. A positive coefficient means that a unit increase in the activity measure of one structure leads to a direct increase in the activity measures of structures it projects to, proportional to the size of the coefficient.
2. A negative coefficient means that an increase in the activity measure in one structure leads to a direct, proportional decrease in the activity measure of the structure it projects.
3. From the PLS_SEM algorithm model, we can clearly see that the output factors are influenced/affected by the input factors with different path coefficients as follows.
4. Improved culture is influenced by the following input factors; 'leadership commitment', 'empowerment', 'tools applied' with path coefficient values of 0.1723, 0.2463, and 0.3502, respectively. We conclude that of the application of 'tools' had the greatest impact on culture.
5. 'Institutional change is significantly influenced by the input factor 'leadership commitment' with a path coefficient value of 0.7143 which means a high influence.
6. 'Longevity' is significantly influenced by the input factor 'tools applied' with a path coefficient value of 0.7473.
7. 'Operational performance is significantly affected by three input factors; 'empowerment', 'outside consultants', and

'tools used' with path coefficient values of 0.3490, 0.14401, and 0.4839, respectively, tools having the highest influence.

8. 'Strategic performance is affected by two input factors; 'empowerment' and 'tools used' with path coefficient values of 0.2877 and 0.5508, respectively.

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

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

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

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

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

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

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

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

From the analysis of individual responses, the finding on the 'tools applied in the implementation of Kaizen in all companies shows that on average, the extent of Kaizen tools applied is moderate. However, among the tools applied for standard work (40.2%), process mapping (43.7%), 7 Mudas (47.1%), root cause analysis (41.4%), layout improvement (44.8%), visual management (39.1%), employee suggestion program (35.6%), process

monitoring using statistical process control (36.8%), mistake proofing (36.8%), and total productive maintenance (34.5%) were rated moderate. However, 5S and Quality Circles are rated 'much extent' and 'very much extent', respectively. From this it can be understood that all the tools were applied in the implementation process with a 'moderate extent' except the 5S and Quality circles, which respondents recognized as being applied much more than tools.

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

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

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

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

The results from the PLS path model analysis indicate that the dependent variable (improved culture) is found to have a strong relationship with two implementation variables (independent variables): empowerment and leadership commitment. Therefore, the success of Kaizen implementation will have a higher influence when leadership is committed to the implementation and employees are empowered to think and practice Kaizen activities to identify and solve problems. The leadership's commitment to allowing employees to develop their skills and freedom for innovation is key for sustaining the changes.

Implications and Discussion

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

The results also confirm that the two factors 'commitment of Shop floor employees to Kaizen' and 'Change acceptance of employees' are strongly related to implementation steps 'Kaizen application in no operation functions', 'Key Performance Indicators (KPIs) were used

to measure performance, and 'companies' reliance on internal expertise', '5S'. Among the tools applied, 'QCC', '5s' and 'Muda' have a greater impact on the output factors compared to other variables.

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

This means that such Kaizen practices should be implemented in the organization to increase the sustainability of Kaizen. It is worth noting that other Kaizen tools such as 'Process monitoring using statistical process control Mistake proofing,' 'TPM (Total Productive Maintenance and 'Layout Improvement' also have a significant influence on the result of Kaizen implementation. This implies that Kaizen tools tend to be dependent on each other, and thus they should be implemented together to enhance the effect on the sustainability and Performance of companies.

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

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

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

The PLS model in this research also shows that the tools used in the Kaizen implementation and empowerment influence more output factors than any other input group factors. Tools applied affect operational performance and strategic performance (performance factors) and longevity, and improved culture (sustainability factors). At the same time, empowerment affects improved culture, and operational and strategic Performance. This implies tools used and empowerment are critical success factors for the implementation of Kaizen in the Ethiopian Manufacturing context.

The leadership commitment (input group factor) affects two output factors: improved culture and institutional change (sustainability factors). Therefore, from the results of the analysis, we can conclude that the role of leadership is critical to the sustainability of Kaizen.

Conclusion

This research examines the effect of the how and the context of Kaizen implementation on the sustainability and the Performance of manufacturing companies in Ethiopia. The study follows the framework of the Kaizen practices implemented in Ethiopia as the application of Kaizen tools, kaizen thinking, and EKI capacity-building initiatives. Statistical techniques such as SPSS, PLS path analysis, and regression analysis are applied to analyze the data collected from Kaizen implementing Ethiopian manufacturing companies through a questionnaire survey. The findings indicate that there is a positive correlation on Kaizen Implementation factors (input factors) and sustainability factors in relation to the Performance of manufacturing companies in Ethiopia.

The results of the study suggest that manufacturing companies in Ethiopia should emphasize working on promoting the Kaizen culture and empowerment of employees coupled with the use of the Kaizen tools effectively and adapted to the context of each company to enhance performance and achieve competitive advantage.

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

Recommendations

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

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

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Conflict of Interest

The author declares that there is no conflict of interest in any form.

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