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Critical Success Factors (CSFs) For Implementation of Lean Six Sigma in Commercial Banks in Kenya

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Abstract: *This study sought to examine the Critical Success Factors for the implementation of Lean Six Sigma in commercial banks in Kenya. All commercial banks agreed on the following as the main Critical Success Factors in the implementation of Lean Six Sigma; Effective Communication, Understanding tools and techniques within Lean Six Sigma, Effective use of Technology, Top down management commitment and participation, linking Lean Six Sigma to customers, Leadership and Environment that encourages the constant improvement of product and services.*

Keywords: *Lean Six Sigma*

I. Introduction

Critical success factors (CSFs) are tasks or attributes that should receive priority attention by management because they most strongly drive performance. CSFs have been defined as "any characteristic, condition, or variable that significantly drives business performance" Jaramillo & Marshall (2004). They further argue that due to competition, key success factors are the minimum capabilities that a company must master to enter the competition. According Banuelas & Antony, 2002, the essential ingredients necessary for effective implementation of Six Sigma projects are cultural change, organization infrastructure, communication, and training. Others are linking Six Sigma to business strategy, Human Resources, Customers, employees, business suppliers, management involvement and commitment, project management skills, understanding tools and techniques with Six Sigma, project prioritization and selection.

Regarding Lean management project implementation, Achanga et al., (2006) stressed that management involvement and commitment are perhaps the most essential factors in aiding any of the desired productivity improvement initiatives, followed by financial capabilities, skills and expertise and an organizational culture of sustainable and proactive improvement. It is generally acknowledged that the factors discussed above can be equally applicable to services as they are to manufacturing (Achanga et al., 2006; Chakrabarty & Tan, 2007).

Over the years, the commercial banking sector in Kenya has grown into banking institutions of different types and ownership. According to the statistics by the central bank of Kenya website (www.centralbank.go.ke), currently there are there are 43 licensed commercial banks and1mortgage finance company. Out of the 44 institutions, 31 are locally owned and 13 are foreign owned. The locally owned financial institutions comprise 3 banks with significant shareholding by the Government and State Corporations, 27 commercial banks and 1 mortgage finance institution. The core businesses of most commercial banks is to offer corporate and retail banking services but a small number offer other services including investment banking.

For global competitiveness, banking industries need overall operational and service excellence and are currently engaged in Quality Circles and Cost cutting. According to Antony et al. (2009), initially the focus has been on large-scale manufacturing organizations, but after globalization and liberalization, quality improvement and cost reduction surfaced as the major areas of concern along with productivity. With the reduction of geographical barriers and the pressure of competing in the global market, overall operational and service excellence have become necessities for the industries to remain globally competitive.

II. Literature Review

Six Sigma Philosophy

Six Sigma evolved from scientific management and continuous improvement theories by combining the finest elements of many former quality initiatives. Originally, Motorola was the first to launch a Six Sigma program in the 1980s. In 1988, it was the first company awarded the Baldrige Award, which led other organizations to show an increased interest in adopting and modifying Six Sigma methodology (Aboelmaged, 2010). Companies such as Allied Signal, IBM, and General Electric adopted Six Sigma as a corporate requirement for strategic and tactical operations to produce high-level results, improve work processes, expand employees' skills and change the culture. This was followed by high profile adoption in organizations such as Sony, Dow Chemicals, Bombardier and GSK (Banuelas &Antony, 2002).

In recent years Six Sigma as a quality improvement methodology has gained considerable attention .Many service organizations such as Citibank, Bank of America, American Express, Caterpillar, Mount Carmel Health System and Baxter Healthcare in USA and Europe have registered success by Six Sigma implementation (Chakrabarty & Chuan (2009). For the term "Six Sigma" there appears to be little consensus on its definition. Proposing an emergent definition of Six Sigma based on a grounded theory approach, Schroeder et al. (2008) concluded that Six Sigma offers a new structure that promotes both control and exploration in improvement efforts. From a statistical perspective, Six Sigma is a metric of process measurement symbolized by the Greek letter that represents the amount of variation with a normal data distribution. Fundamentally, Six Sigma quality level relates to 3.4 defects per million opportunities (DPMO). The focus of Six Sigma is not on counting the defects in processes, but the number of opportunities within a process that could result in defects so that causes of quality problems can be eliminated before they are transformed into defects (Antony, 2004). From a business perspective, Six Sigma could be described as a process that allows companies to drastically focus on continuous and breakthrough improvements in everyday business activities to increase customer satisfaction

According to Thomas (2009) Six Sigma can be considered both a business strategy and a science that has the aim of reducing manufacturing and service costs, and creating significant improvements in customer satisfaction and bottom-line savings through combining statistical and business process methodologies into an integrated model of process, product and service improvement. From an internal perspective, Six Sigma provides a way of improving processes so that the company can more efficiently and predictably produce world-class products and services. Traditionally under the Six Sigma approach a five-phased DMAIC methodology is applied which tackle specific problems to reach Six Sigma levels of performance, these phases are: Define, Measure Analyze, Improve and Control (Thomas, 2009).

Six Sigma Tools and Techniques

They can be described as practical methods and skills employed by Six Sigma project teams to tackle quality related problems for fostering performance improvement (Aboelmaged 2010). While Six Sigma tool has a specific role and is often narrow in focus, Six Sigma technique has a wider application and requires specific skills, creativity and training (Antony, 2004). Examples of Six Sigma tools include Pareto analysis, root cause analysis, process mapping or process flow chart, Gantt chart, affinity diagrams, run charts, histograms, quality function deployment (QFD), brainstorming, etc. Examples of Six Sigma techniques include statistical process control (SPC), process capability analysis, suppliers-input-process-output-customer (SIPOC), benchmarking, etc. Moreover, a Six Sigma technique can utilize various tools. For example, statistical process control (SPC) is a technique that utilizes various tools such as control charts, histograms, root cause analysis, etc.

The Lean Six Sigma Approach

According to Shah et al., (2008) both Lean production and Six Sigma are broadly classified under the umbrella of process improvement programmes. Lean and Six Sigma are the most recent manifestations of the process improvement evolution programmes. In the past, Six Sigma and the principles behind Lean management have often seemed more like competitors than co-conspirators (Shah et al 2008) and the recent Lean Six Sigma (LSS) approach in general is a powerful action plan for dramatically improving quality, increasing speed and reducing waste. Arnheiter & Maleyeff (2005) suggested that a LSS organization would capitalize on the strengths of both Lean management and Six Sigma.

To remain competitive, efficient and agile, companies in services need, increasingly a constant investment in the innovation processes. According to Delgado et al. (2010), LSS is a methodology that combines two of the most popular tools for improving performance of organizations; its advantages include the cost control and capital investment, and improvements in the quality of service and customer satisfaction. It is considered an accurate and efficient methodology to support the development of a system of integrated quality management in any business in order to perform virtually free of errors and waste of time.

Services are by nature very often bound by time in terms of the processes that are run and lead to the delivery of an outcome that benefits a customer. In services organizations, Lean comes in as a methodology to reduce waste (in terms of time) and to allow the process to become more efficient. It requires the examination of the process from the client's perspective, in order to eliminate the waste and inefficiency. Six Sigma however, focuses on refining the process, reducing the variability, to obtain the same result at least 99.9997 percent of the time (Delgado et al. 2010)

Similarities and Differences between Lean and Six Sigma

It is evident from the above review that both Lean and Six Sigma can be characterized in terms of their underlying philosophy and a set of practices, tools/techniques, implementation orientation, unit of analysis, and performance measures associated with them. Philosophy is implemented through a set of activities/practices and tools/techniques. The implementation orientation is the focus of how practices and techniques are

implemented. The unit of analysis is where the process improvements take place. And, finally, the performance measures spotlight what is typically improved upon.

According to Shah,et al. (2008),examining the philosophy, practices, and techniques of Lean and Six Sigma suggest striking similarities and some important differences between the two approaches .The most significant overlap is in the area of quality management. Proponents of Lean frequently include quality practices such as statistical process control and process capability measurements when defining and measuring it .Similarly, advocates of Six Sigma embrace quality management with a focus on advanced statistical method as the cornerstone of its definition.

Lean practices and techniques focus on streamlining processes, whereas Six Sigma practices and techniques help identify and eliminate root causes of problems. Lean emphasizes process flow and Six Sigma concentrates on process defects. In addition, 'Lean production addresses the visible problems in processes, for example, inventory, material flow, and safety. Six Sigma is more concerned with less visible problems, for example, variation in performance.

Most researchers agree that there is more commonality between Lean and Six Sigma tools and practices than differences. Even so, the employee involvement during their deployment differs considerably. Six Sigma deploys the practices through a parallel organizational structure that includes black belts and master black belts. In contrast Lean directly engages workers involved in the process to also improve it.

Both Lean and Six Sigma underscore the value of management and employee involvement to improve performance, but the nature of involvement differs considerably in the two approaches. Lean is a bottom up approach where management plays a supportive and facilitating role in engaging shop-floor workers to form cross-functional self-directed work teams and apply Lean tools. In Six Sigma, management plays a more active role often selecting improvement projects based on financial and strategic goals, and championing and monitoring the improvement projects.

Lean Six Sigma Approach to Process Improvement

The manufacturing industry has invested in the systematic exploration of the opportunities for process improvement, cost reduction and efficiency improvement for many years. To do so, a large arsenal of tools and innovation approaches were deployed. Of these, Lean Thinking and Six Sigma are the two programmes that are currently popular (de Koning 2010).Both Lean Thinking and Six Sigma provide systematic approaches to facilitate the process of stimulating the innovations needed to improve the operational efficiencies and the quality. Lean Thinking and Six Sigma have gone through parallel developments in recent years.

There are many examples of implementing the LSS approach in the manufacturing and service industries. For instance, Toyota Motor Company's high productivity and quality performance is routinely attributed to practices associated with Lean production. Similarly, firms implementing Six Sigma have reported significant financial gains from their deployment efforts. For example, in 1999 General Electric (GE) reported $2 billion of net income benefits from Six Sigma initiatives (Shah et al., 2008). Wang et al., (2010), presented the application of LSS and TRIZ methodology in banking services, Thomas et al.,(2009) presented the application of LSS in small engineering company, Carleysmith et al.,(2009) looked at the implementation of Lean sigma in pharmaceutical research and development, Furterer & Elshennawy, (2005) presented a case study of applying Lean and Six Sigma tools and principles to improving the quality and timeliness in a city's finance department, he observed that after implementing a LSS programme, the time to process payroll, purchasing and accounts payable were reduced by 60%, 40% and 87%, respectively.

Objective of the Study

The specific objectives of the study include;

(i) To examine the critical success factors for implementation of Lean Six Sigma in Commercial Banks in Kenya

Research Question

The research question includes;

(i) What are the critical success factors for implementation of Lean Six Sigma in Commercial Banks in Kenya?

III. Methodology

This was exploratory research. Exploratory research is chosen because research in LSS and its implementation in service organization are still at a very early stage. According to Delgado et al, (2010), this methodology offers advantages not found in more quantitative research tools because qualitative data allow researcher to explore more fully complex relationships difficult to capture in a quantitative study. The target population of this study were banking institutions in Kenya. The Kenyan commercial banking system is dominated largely by commercial banks and a small number of non-bank financial institutions which

concentrate mainly on mortgage finance, insurance and other related financial services. The Kenyan commercial banking sector has only 43 financial institutions (Source: Central Bank of Kenya Website).Due to the size of the banking industry, the whole population on banking institutions is included in this study, thus it is a census study. It was also noted that in comparison to similar studies conducted elsewhere, the size of the population in this study was small.

A questionnaire was used to collect information for this study. The correspondence containing the questionnaire and a cover letter was addressed to top-level corporate managers heading the operations function in the institution, usually referred to as the Head of operations, or the General Manager - operations at most banks. The head of the operations function were identified as the most suitable person to comment on the LSS implementation process in the bank.

The survey questionnaire had five parts to collect the following details, Company background and preliminary data, LSS implementation details, Knowledge and usage of quality and process improvement tools, and techniques as used within Lean Six Sigma initiatives, CSFs of Lean and Six Sigma deployment and Key benefits from LSS implementation. The data was collected and analyzed using descriptive statistics (pie charts, tables, mean and standard deviation) and factor analysis. Factor analysis attempts to identify underlying variables, or factors that explain the pattern of correlations within a set of observed variables. The goal of factor analysis is to try to identify factors which underlie the variables to discover simple patterns in the pattern of relationship among variables (Richard, 1973). The data was analyzed according to themes and presented in pie charts and frequency distribution tables.

IV. Findings And Discussions

Specific Reasons which prompted the Banks to Kick-off a Lean Six Sigma Initiative

The respondents were asked to state the specific reasons which prompted the banks to kick-off a Lean Six Sigma initiative. The findings are given in figure 4.3

Table 1: Reasons Which Prompted Banks to Kick-off a Lean Six Sigma Initiative

	Frequency	Percent	Cumulative Percent
To enhance operational excellence	9	23.7	23.7
To increase efficiency	11	28.9	52.6
To reduce costs	8	21.1	73.7
To optimize operational capacity	2	5.3	78.9
To improve customer satisfaction	4	10.5	89.5
To become world-class institution	3	7.9	97.4
To solve chronic problem	1	2.6	100.0
Total	38	100.0	

It was apparent that key reasons which prompted the banks to kick-off a Lean Six Sigma initiative were; to increase efficiency (28.9%), to enhance operational excellence (23.7%) and to reduce costs (21.1%).Customer satisfaction was also another driving factor for Lean Six Sigma implementation by some banks.

The Most Significant Barriers Faced in Implementing Lean Six Sigma Methodologies

The respondents were asked to state the most significant barriers faced in implementing LSS methodologies in their organization. The findings are given in table 4.8

Table 2: The Most Significant Barriers Faced in Implementing Lean Six Sigma Methodologies

	Frequency	Percent	Cumulative Percent
Lack of resources	28	73.7	75.7
Internal resistance	8	21.1	97.3
Poor project selection methodology	1	2.6	100.0
Total	37	97.4	
Missing System	1	2.6	
Total	38	100.0	

As indicated in table 4.8 above, the respondent identified Lack of resources (73.7%) and internal resistance (21.1%) as the most significant barriers faced in implementing LSS methodologies.

Factor Analysis of Critical Success Factors for Implementation of Lean Six Sigma

Factor analysis was used because of the concern of decomposing the information content in a set of variables into information about an inherent set of latent components/factors. This assisted in reducing a number of variables into fewer factors which are of similar characteristics. The analysis was carried out and the results presented in terms of: KMO and Bartlett's Test, Scree Plot, Total Variance Explained /Eigen values, Initial Component Matrix and Rotated Component Matrix (Varimax)

Table 3: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.439
Bartlett's Test of Sphericity	Approx. Chi-Square	753.216
	df	253
	Sig.	.000

In order to use factor analysis for further analysis it was important to test the significance of the technique. This was done by the use of P value (the smallest level at which null hypothesis can be rejected. P-value = 0.000 < 0.05 thus there is correlation between the variables and they can be reduced into fewer factors (Factor Analysis).

Table 4: Communalities

	Extraction
Effective communication	.901
Understanding tools and techniques within LSS	.878
Effective use of technology	.876
Top down management commitment and participation	.871
Linking LSS to customers(understanding customer requirements)	.855
Leadership	.849
Environment that encourages the constant improvement of product and services	.844
Measure the success in terms of financial benefits	.836
Effective service/ product design	.832
Ongoing evaluation, monitoring and assessment	.830
Proper planning prior to implementation	.824
Goal management culture	.818
Trust in organization and project selection, and prioritization	.816
Project management skills	.811
Linking LSS to suppliers	.809
Recognition and reward systems	.803
Training and learning LSS methodologies	.803
Teamwork	.792
Financial capabilities of the company	.783
Linking LSS to employees (human resources)	.768
Addressing the root cause of a problem	.757
Linking LSS to business strategy	.754
Organizational structure and culture	.678

Extraction Method: Principal Component Analysis.

Total percentage of variance explained in any variable accounted for by this seven factor model known as the communality of the variable are as shown in table 4.5 above. For example Total percentage of variance explained in the key variables was; Effective communication (90.1%), Understanding tools and techniques within LSS(87.8%), Effective use of technology (87.6%), Top down management commitment and participation (87.1%), Linking LSS to customers(understanding customer requirements)- (85.5%), Leadership (84.9%) and Environment that encourages the constant improvement of product and services (84.4%).
The results therefore indicates that critical factors in the implementation and utilisation of Lean Six Sigma are; Effective communication, Understanding tools and techniques within Lean Six Sigma and Top down Management commitment and participation.

Table 5: Total Variance Explain

Component	Initial Eigen values			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.586	28.636	28.636	6.586	28.636	28.636
2	4.738	20.600	49.236	4.738	20.600	49.236
3	1.987	8.639	57.875	1.987	8.639	57.875
4	1.705	7.413	65.288	1.705	7.413	65.288
5	1.510	6.567	71.855	1.510	6.567	71.855
6	1.229	5.342	77.197	1.229	5.342	77.197
7	1.078	4.685	81.882	1.078	4.685	81.882
8	.794	3.454	85.336			
9	.595	2.585	87.922			
10	.570	2.480	90.402			
11	.492	2.141	92.543			
12	.400	1.741	94.284			
13	.316	1.374	95.658			
14	.245	1.067	96.725			
15	.203	.881	97.606			
16	.158	.687	98.293			
17	.127	.554	98.847			

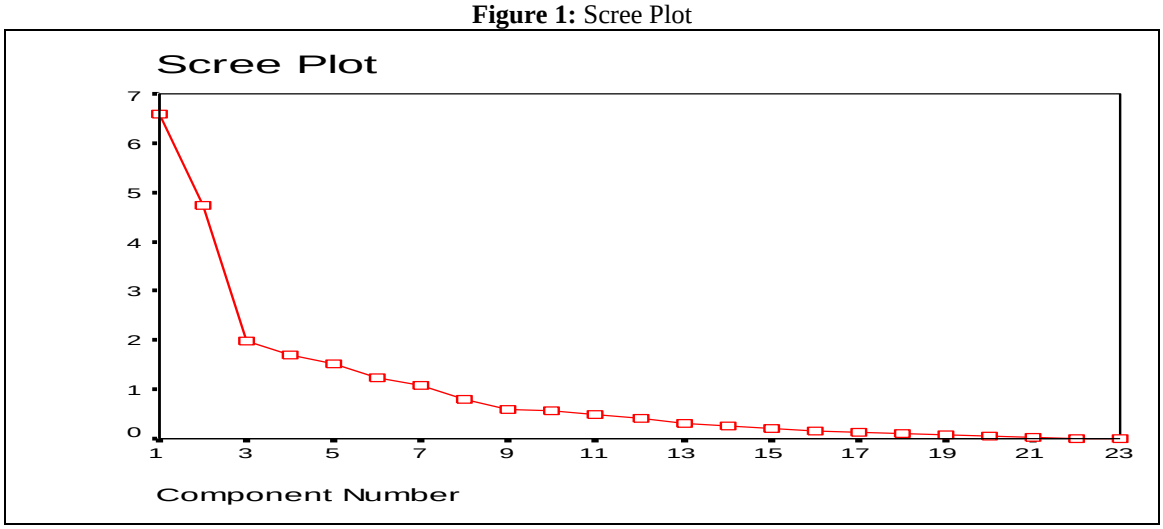
18	.111	.483	99.330			
19	.071	.309	99.639			
20	.048	.210	99.849			
21	.022	.094	99.942			
22	.007	.031	99.973			
23	.006	.027	100.000			

Extraction Method: Principal Component Analysis.

As shown in table 4.6, total variance explained/Eigen values (a measure of the variance explained by factors), factor extraction was done to determine the factors using Eigen values greater than 1. Factors with Eigen values less than 1.00 were not used because they account for less than the variation explained by a single variable.

The result indicates that 23 variables were reduced into 7 factors. The seven factors explain 81.882% (Cumulative percentage) of the total variation, the remaining 16 factors together account for 18.118% of the variance. The explained variation 81.882% > 70% and therefore, Factor Analysis can be used for further analysis. The model with seven factors may be adequate to represent the data.

Figure 1: Scree Plot



The Scree Plot is a plot of total variance associated with each factor and shows a distinct break between steep slop of the large factors and gradually trailing off of the rest of the factors. From the Scree Plot, it appears that a seven (7) factor model should be sufficient (factors with Eigen values greater than 1) in the analysis, that is, 23 variables have been reduced into seven distinct factors.

Table 6: Rotated Component Matrix

Variables		**Component**						
		1	2	3	4	5	6	7
Recognition and reward systems	X_1	.398	-.173	-.067	.380	-.365	**.542**	.195
Organizational structure and culture	X_2	.149	.146	-.033	.478	**-.585**	.119	.217
Training and learning LSS methodologies	X_3	.474	.186	-.132	.429	-.353	.444	.138
Linking LSS to customers(understanding customer requirements)	X_4	.371	.040	-.078	**.748**	-.232	.306	.060
Linking LSS to business strategy	X_5	.222	.225	.054	**.788**	.162	.012	.062
Linking LSS to employees (human resources)	X_6	.051	-.161	.091	**.836**	-.047	-.007	-.174
Linking LSS to suppliers	X_7	-.080	-.055	.394	-.030	.132	-.187	**.769**
Understanding tools and techniques within LSS	X_8	**.791**	-.158	.009	.198	-.135	.327	.252
Effective communication	X_9	**.867**	.135	.270	.082	-.092	-.101	-.180
Project management skills	X_{10}	.118	.039	.374	.014	.217	-.169	**-.761**
Teamwork	X_{11}	**.811**	.101	.117	.246	.063	-.046	-.207
Financial capabilities of the company	X_{12}	**.715**	.002	.065	.102	.262	.394	-.179
Measure the success in terms of financial benefits	X_{13}	.116	.248	-.022	.077	.032	**.866**	-.062
Effective use of technology	X_{14}	-.067	**.804**	.356	-.033	.039	.308	-.022
Effective service/ product design	X_{15}	-.017	**.861**	.267	-.104	-.070	-.042	-.043
Ongoing evaluation, monitoring and assessment	X_{16}	.227	**.760**	.169	.334	.204	.130	-.040
Goal management culture	X_{17}	.208	.157	**.862**	.065	-.024	.006	-.049
Top down management commitment and participation	X_{18}	.067	.317	**.816**	.118	.234	-.080	.155
Trust in organization and project selection, and	X_{19}	.028	.252	**.798**	-.085	.385	.018	-.086

prioritization								
Proper planning prior to implementation	X_{20}	.192	.077	.414	-.140	**.678**	.361	.015
Leadership	X_{21}	.033	.240	.249	.134	**.830**	-.136	.055
Addressing the root cause of a problem	X_{22}	.448	**.600**	-.011	.016	.439	-.019	-.053
Environment that encourages the constant improvement of product and services	X_{23}	**.659**	.455	.012	.222	.196	.243	.236

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.
Rotation converged in 10 iterations.

The rotated component matrix is to transform the complicated matrix (initial matrix into simpler one).The purpose of rotation is to achieve a simple structure i.e. we would like each factor to have non zero loading for only some of the variable so that we can easily interpret the factors. A factor loading of 0.5 has been used to determine the variable belonging to each factor.

Factor one is made up of the following variables; Understanding tools and techniques within LSS, Effective communication, Teamwork, Financial capabilities of the company and Environment that encourages the constant improvement of product and services.
Mathematically factor one is represented as follows.

$$\mathbf{F_1 = 0.791\ X_8 + 0.867X_9 + 0.811X_{11} + 0.715X_{12} + 0.659X_{23}}$$

Factor two is made up of the following variables; Effective use of technology, Effective service/ product design, Ongoing evaluation, monitoring and assessment and Addressing the root cause of a problem
Mathematically factor two is represented as follows.

$$\mathbf{F_2 = 0.804X_{14} + 0.861X_{15} + 0.760X_{16} + 0.600X_{22}}$$

Factor three is made up of the following variables; Goal management culture, Recognition and reward systems, Top down management commitment and participation
and Trust in organization and project selection, and prioritization
Mathematically factor three is represented as follows.

$$\mathbf{F_3 = 0.862X_{17} + 0.816X_{18} + 0.798X_{19}}$$

Factor four is made up of the following variables; Linking LSS to customers (understanding customer requirements), Linking LSS to business strategy and Linking LSS to employees (human resources)
Mathematically factor four is represented as follows.

$$\mathbf{F_4 = 0.748X_4 + 0.788X_5 + 0.836X_6}$$

Factor five is made up of the following variables; Organizational structure and culture, proper planning prior to implementation and Leadership.
Mathematically factor five is represented as follows.

$$\mathbf{F_5 = -0.585X_2 + 0.678X_{20} + 0.830X_{21}}$$

Factor six is made up of the following variables; Recognition and reward systems and Measure the success in terms of financial benefits.
Mathematically factor six is represented as follows.

$$\mathbf{F_6 = 0.542X_1 + 0.866X_{13}}$$

Factor seven is made up of the following variables; Linking LSS to suppliers and Project management skills
Mathematically factor two is represented as follows.

$$\mathbf{F_7 = 0.769X_7 - 0.761X_{10}}$$

Of the 23 variables only variable three (Training and learning LSS methodologies) was not included in the seven factors.

V. Conclusion

Most commercial banks which responded agreed on the following factors as the main Critical Success Factors in the implementation of LSS (communalities); Effective communication, Understanding tools and techniques within LSS, Effective use of technology, Top down management commitment and participation, linking LSS to customers, Leadership and Environment that encourages the constant improvement of product and services.

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