

Applications of Six Sigma for Measuring Effectiveness and Efficiency of Banking Processes

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Abstract: Six sigma is a powerful system, basically it is measuring of quality that longs for perfection (3,4 defects on 1.000.000 transactions). From the business point of view, six sigma is the disciplined method of using extremely rigorous data gathering and statistical analysis to pin point source of errors and ways of eliminating them. The two key methodologies used in six sigma are DMAIC stands for Define, Measure, Analyze, Improve and Control and the second is DMADV stands for Define, Measure, Analyze, Design and Verify. DMAIC is used when improving an existing product or process where as DMADV is employed when developing a new product or process.

Key wards: Six sigma, DMAIC, DMADV, SQC.

Introduction:

Six Sigma process was pioneered by Bill Smith at Motorola in 1986. It is evident that Bill Smith did not really invent. Six sigma applied methodologies that had been available since 1920s developed by luminaries like Shewhart, Deming, Juran, Ishikawa, Taguchi, and Shainin. All tools used in six sigma programs are actually a subset of the Quality Engineering Discipline. Six sigma is a powerful system, basically it is measuring of quality that longs for perfection (3,4 defects on 1.000.000 transactions). The word "sigma" is a Greek letter which represents standard deviation, the term that describes how distant is the data from average or middle.

"Six" parts is involved when one measures the things the company does right. Three sigma level of quality is the level at which most of companies work it is equal to 66.807 defects on million opportunities, while Six sigma equals 3.4 defects on million opportunities or 99.99996 error free work-statistically possible almost perfection. Six sigma quality requires right people on right positions with the right knowledge.

From the business point of view, six sigma is the disciplined method of using extremely rigorous data gathering and statistical analysis to pin point source of errors and ways of eliminating them. The two key methodologies used in six sigma are DMAIC stands for Define, Measure, Analyze, Improve and Control and the second is DMADV stands for Define, Measure, Analyze, Design and Verify. DMAIC is used when improving an existing product or process where as DMADV is employed when developing a new product or process.

Six sigma is a powerful quality process used in finance industry. Many financial institutions use six sigma methodologies for improving the accuracy of allocation of cash to reduce bank charges, automatic payment, accuracy of reporting, reducing documentary credits defects, reducing cheque collection defects and reducing variation in collector performance. Many banks have attained the greater performance goals after implementing Six sigma.

Now a day's every human being wants change in service quality of almost in every service sector. In this research we have considered bank to make improvement in service quality to meet the customer satisfaction and to get the financial benefits to the service industries. The method which is applied to improve the existing process in banking is Six sigma initiative, which consist of DMAIC methodology (Define, Measure, Analyzed, Improve and Control). Revised model of Six sigma is developed that is DMAICM, (M-Maintain) and it is applicable to customer satisfaction data and get the inference about existing service quality level and try to maintain the consistency of service quality. Different types of case study have been demonstrated to explore the benefits of six sigma initiatives by considering primary and secondary data. Primary data has been collected by questionnaire method and secondary data is collected from internet by annual report and balance sheet of various banks.

Review:

(MuwafaqAlkubaisi 2013) [8] Applies the control chart X- bar and do conclusion that 3 – sigma does not provide the good quality so it necessary to make improvement in the process. The comparison made in 3-Sigma and six sigma control chart and concludes that there should be improvement in the process as sample points falls outside the limits.

The effect of six sigma control chart using number of fraction defectives and average number of defects per unit and found that when the process is centered with reduce variation some points fall outside the control limits this indicate that variation is in the process and it should be removed (R Radhakrishnan and Balamurugan 2011) [11].

He described that the construction of Range-control chart for six sigma initiatives with example. It indicates that process is centered with reduce variation. But many sample points falls outside the limit in six sigma as compared to 3-sigma limit.(Radhakrishnan R and Balamurugan 2011)[10].

The quality control techniques and lean six sigma are demonstrated, to measure the customer satisfaction level are. Algorithm controlled machine (ACM) consist of interacting trade selection algorithms. To measure and improve the performance of ACM, TQM and Lean six sigma is implemented. By using control chart technique the effectiveness of this trading machine is measured. X-Bar and R-chart show the process is out of control. Finally using lean

sigma in banking industries is beneficial as statistical process control SPC in trading machine. After implementing Lean six sigma the improvement were made (JawaherA Bin Jumah, MSN, MSIE Benjamin But tram 2012) [5].

To increase the service quality of banking process, six sigma had been implemented to achieve best in class process. Here the bank has chosen crediting process as it is most important for banking sector. Firstly potential capability ratio is calculated by the formula

$$C_R = \frac{6\sigma_{ST}}{Tolerance}, \text{ where ST means Short Term}$$

Which indicates tolerance to fit into process.

$$\text{Process capability } C_p = \frac{Tolerance}{6\sigma_{SR}}$$

and short term specified tolerance limit is given by

$$C_{ST} = \frac{Tolerance}{\sigma_{ST}}$$

And $C_{PK} = \text{Minimum}(C_{PKDn}, C_{PKUp})$ is calculated

A relative concept C_{PM} is considered . It takes into consideration the variation between the mean value and the nominal value as well as the standard process deviation.

$$C_{PM} = \frac{Tolerance}{6T_{ST}}, \text{ where } T_{ST} \text{ is the function of standard deviation}$$

By using the technique we can measure the process.

C_{PM} Measure the whether the process meets specification and is on target. It compares the specification speared to the spread of these data as the process increase the C_{PM} index increase. And its Bench mark value is 1.33. It is calculated when we provide the target value. Midpoint of the specification limit is the target value (Vojislav Stoiljkovic, PedjaMilosavljevic and Sasarandjelovic 2010) [11].

A remarkable companies certified for at least is considered this shows that employees are having the experience and skilled workers. A research survey is carried out with certain questionnaire in Asia Country with the view in the concept that all the respondent are aware about TQM. Here response rate is 44.4 %. Firm is divide into three groups such as small firm,

medium size with 200 employees and large firm with more than 200 employees. Here both the type of firm is considered mainly service and manufactured product. Further gain it is divided into different category. Comparison result is observed in between respondent and non respondent sample. All chi-squared value of size, type of industry and owner ship is similar that the chi-square tabulated value and all the p-value were greater than 0.5. Thus respondent and non respondent are considered as similar.(Din Thai Hoang 2010) [3].

The service quality scale developed to measure the perception of quality service. This quality of service plays the important role in involvement of industries such as retail banks including gaps and utilities. However this quality of service created drastic change in financial service industry in India. Sample data has been collected from private and public sector bank such as HDFC, ICICI, SBI, SYN bank. Questionnaire is carried out through all these banks which represent the data collection, by using liker scale. Further analysis was carried out for 363 samples. Objective of this analysis is to reduce that set of data into two dimensional maps, it was proposed to find out the amount of variance explained by these two dimensions. The total inertia explained by this two dimension is found out and the Chi-square value found to be significant at 0.01 level . The observation done that there should be remarkable improvement in the service quality of banking sector to meet the customer requirement in all the selected banks. So top management is the important roll to make change in the quality service and internal thinking of the employee to do think positively (Clement Sudhahar, D Israel, M Selvan 2006) [2].

The quality service of banking sector related to internet banking facilities considered. Further relationship between customer satisfaction in handling private data and web quality is considered. All these data should be treated on line data handling. The aim of testing this concept in on line banking customer satisfaction the hypothesis is given as there will be positive relationship between web site quality and customer satisfaction. By using questionnaire method data was collected through various banks by different methods. Considering the proposed hypothesis it observer that Chi-square test is satisfied at 0.01 % level of significant . So the hypothesis was accepted at 0.01 % level. Hence it shows the positive influence of web site and customer satisfaction. So top management level can improve the quality of service to meet the customer requirement.(Zhengwei Ma 2012) [16].

Regression Analysis is concerned with the study of dependence of one variable, the dependent variable, on one or more other variables, the explanatory variables with a view of estimating and predicting the mean or average value of the former in terms of the known of fixed values of the latter. If we study the dependence of a variable on only single explanatory variable, such a study is known as two variable regression analysis however we can study the

dependence of one variable on more than one explanatory variable. In two variable regressions there is only one explanatory variable where as in multiple regression there is more than one explanatory variable. (Basic Econometrics by Damodar N Gujarathi) [1]. Six sigma in the financial service industry the impact of six sigma can be measured by regression equation of the form

$$R_i - R_j = \alpha + \beta_j (E(R_{mi}) - R_j) + \beta_2 D + \varepsilon_i$$

In which risk premium and percentage change to company share price that can be attributed Six Sigma. (Jason J Lin, Jane C Sung, Kirk Y Lin 2009) [4].

Various factors of TQM are considered such as role of leadership, TQM implementation on customer stratification, self involvement, process approach, decision making. By using correlation and regression analysis the study finding also infer that in defining the use of process approach ,necessary to achieve expected result. So this implies that proper implementation of methodology results in proper organizational performance (Karani, Sharon R 2012) [6].

The total quality management plays an important role in development of contemporary management. In today's global market quality is a main strategic factor in achieving business success and became the organization for comparative advantage in the field of liberalization, globalization and knowledgeable customers. The paper reflects the comparative study between the two factors that is total quality management and organizational characteristic such as industry ownership and innovation degree in the South East Asian Country.

Most of the banking sector believes that bank is for finance sector not for business or service industry. Therefore they compete with finance power relative to service quality. This paper verify the application of Total Quality Management (TQM) in Jordhan Banking sector for quality purpose. It reflects that the implementation of TQM can be great benefits to the banking sector in Jordhan. Application of TQM to increase in performance of service quality has been conducted. Questionnaire of 100 sample is distributed to bank employee and 400 for customer out of which 219 of customer and 100 of employee. Several hypotheses are placed related to the management, employee and customer satisfaction. The hypothesis is tested by one way analysis of variance with confidence level 95% and produces the result that Jordhan banks adopt TQM and performing well. This result shows that the application of TQM in the Jordhan Banking sector is growing in financial aspect and provide good quality of service.(Salman D Ahobaki, Rami Fouad, Adnan Al Bashir 2010) [12].

For developing country, economy is the core aspect and banking is the main financial industry in bank of Pakistan. Service is the kind of performance of the employees which is to be offered to another. To find out the relationship between this three factor ANOVA has been calculated and observed that the model as a whole, is a significant fit to data , hence there is impact of service quality , customer satisfaction and loyalty in banking sector of Pakistan (SamrazHafeez 2012) [13].

Six sigma is a planned approach to business enhancement with the target of reducing error and inconsistencies. The study two types of different banks are consider one who is engaged in six sigma and other who has not implemented six sigma methodology. Comparison of this types of bank is done by financial ratios. In the first case Bank of America with Wells Fargo is consider. Some financial ratios such as current, Debt/Equality, Profit margin, Price earning, and finally Tobin's Q ratio is calculated. Current ratio measure the degree of liquidity or short term solvency. Debt ratio measure the financial leverage. Profit margin of each firm to determine the degree of profitability has been demonstrated. To asses each of the competing firm in terms of market value, two ratios is calculated that is price to earnings and Tobin's Q ratio. In second case country wide and Fannie Mae bank is considered and third case City Bank and Deutsche bank is considered for comparison and the same ratio is calculated. Based on all this financial ratios the bank who has implemented six sigma is performing well than those who has not implemented. (Jason J. Lin, Jane c. Sung, Kirk Y.Lin 2009) [11].

Young HoonKwak and Frank T. Anbari (2006, 26,Technovatio) [15] examine the evaluation , benefits and challenges of six sigma practice and identify the key factors influencing successfully six sigma project implementation. It described that Six sigma project include management involvement and organizational commitment, project management and control skill, culture change and continuous training. Understanding the key feature obstacles and short coming of six sigma provides opportunities to practitioners for better implement of six sigma project. It noticed that effectively six sigma principle and practice are more likely to succeed by refining the organizational culture continuously.

The methods, tools and techniques of Six Sigma strategy which have greater impact on quality improvements and performance in various Banking Industries are described. The study examines the gainful effects of the knowledge management and also gives a critical analysis of the impact of six sigma on banking performance and customer service. The study describe that the quality assurance practice , like six sigma with knowledge management can be more effective strategy of banking sector in china (Lixia Wang 2011) [7].

Research Methodology:

In this research study the research methodology we used DMAIC (Define, Measure, Analyze, Improve, and Control) method to improve the existing process and to meet the customer satisfaction. Some statistical methods and techniques such as process mapping, cause and effect diagram, control charts, measure of dispersion, SD, tolerance limit, Chi-square Test, Analysis of Variance (ANOVA), Testing of Hypothesis, Various Financial Ratios of Banking, sample survey, questionnaire method.

Objectives:

- To develop the revised version of DMAIC process to increase the effectiveness and efficiency of banking operations.
- To establish the revised model for measuring the customers satisfaction.
- To develop the model for reducing housing loan processing time.
- To compare the efficiency of previous model and improved model.
- To obtain the improved specified Tolerance Index.
- To demonstrate the results through numerical illustration by considering secondary and primary data.

Hypothesis:

Ho: There is no significant difference between the customer satisfaction data.

H1: Housing loan process time should be not reducing.

H2: Banking loan process should be paperless and eco-friendly.

H3: Customers are satisfied by banking service process.

H4: Both the banks SBI and HDFC are performing in the same flow.

H5: Bank of Maharashtra and ICICI are performing in the same way.

H6: ICICI and bank of Baroda are performing in the same way.

H7: There is no significant difference between various factors of management in this region.

H8: There is no significant difference between ICICI and Bank of Maharashtra.

H9: There is no significant difference between the two banks HDFC and SBI.

Data collection:

Primary data has been collected by questionnaire method from 8 Nationalize Banks as well as two private bank from three places, Amravati, Akola and Khamgaon such as SBI, Bank of Borada, Bank of Maharashtra, Punjab National Bank, Bank of Baroda, Central bank of India, PNB, ICICI, HDFC, AXIS, UCO. To find out the p-value, data has been collected by

questionnaire method. From each bank the questionnaire is filled by a employer and 4 employees officer level from three places that is Amravati, Akola and Khamgaon. From each places 10 bank has been selected. Out of which 7 banks from Amravati, 8 bank from Akola and 10 banks from Khamgaon is collected. In all 35 questionnaires from Amravati, 40 from Akola and 50 from Khamgaon has been collected for the views related to six sigma improvements. In all 125 filled questionnaire have been collected from three places, which cover three district that is Amravati, Akola and Buldhana. Customer satisfaction data has been collected by distributing the questionnaire at public places and various banks from Amravati, Akola and Khamgaon. 10 customer satisfaction questionnaires is distributed to each bank from Amravati and Akola. 20 questionnaire has been distributed to various banks in Khamgaon. In all 280 questionnaires is distributed out of which 250 been collected personally. Secondary data which is required for analysis is balance sheet and Annual Report 2015 of various banks HDFC, ICICI, Bank of Maharashtra, SBI and Bank of Baroda has been collected through website. It creates lot of trouble to collect the required data.

Data Source:

Secondary data have been collected from web site of HDFC, ICICI, Bank of Maharashtra, Bank of Baroda and SBI of the year 2015. Primary data has been collected through questionnaire method. Questionnaire has been collected from banks employees and bank customer of various banks from Amravati, Akola and Khamgaon. With the advice of Chartered Accountant Mr. Bajaj financial ratio is considered for the performance.

Analysis:

The data has been analyzed by using statistical technique and method such as ANOVA, Financial Ratios, Chi-square test, F- test, Regression Analysis, Control Chart Technique that 3-sigma and six sigma control limit are demonstrated and results are obtained. Two types of cases has been demonstrated on various ratios such as current ratio, Debt ratios, Price per earnings ratios, Net profit margin, Quick ratio, Tobin's Q ratios to know the banking performance, so that one who is engaged in Six sigma represents customer satisfaction. Implementation of this method reduces the process time, waiting time, and improves service quality so that the customer will be fully satisfied. By using Mini tab 17 software analysis of data has been done.

Discussion

Six Sigma is a very effective method to improve the existing process which is demonstrated by case study using analysis of variance. This method is applied to parameter which are responsible to improve the service quality and data which is collected from various banks of

Amravati, Akola and Khamgaon which is identified by p-values. Further Chi-square test has been applied to various parameter of customer satisfaction level which results to improve the existing process. Economically relationship has been done and identified by considering various Banking Profit Financial Ratios . Regression analysis has been done to compare the banking efficiency, which indicate that one who engaged in six sigma do perform well. Further comparison of 3-sigma and Six sigma control chart has been established by X-bar, R-Chart and Sigma chart and their process capability of customer satisfaction is measured. Which result 3-sigma is accepted but six sigma is rejected. It indicates that improvement in the process is necessary to meet the customer satisfaction. All the analysis has been done by using Minitab 17, which is easy to operate and understand. From here we can justify that six sigma should be implemented to every service sector to represent customer satisfaction and financial benefits to the organization.

Significance of the Study:

The Six sigma process is used recently for qualitative enhancement in banking sector to increase the efficiency and effectiveness of all the banking operations.. The results and findings of the present research work is illustrated.

- 1) Revised model of Six sigma has been developed for consistent efficiency of the service quality.
- 2) 3-sigma and six sigma control chart for X-bar and Range has been developed and measured the process capability, which indicates customer are not satisfied with the existing process though 3-sigma control chart is in control. It suggests improving the process.
- 3) Customer satisfaction level is measured by Chi-Square test which result all the said hypothesis are rejected. So it is essential to make improvements in quality service.
- 4) By regression analysis performance of two banks is measured by considering financial ratios. It proves that sample points are far away from the line of regression. It does not meet the specification limit of the bank who is engaged in six sigma.
- 5) Expected benefits of six sigma is measured by analysis of variance by considering p-values of different factors.
- 6) A role model of existing housing loan is developed and modified by using SIPOC process map. It reduces the processing time by 25 days, which is beneficial to service organization.
- 7) By using cause and effect diagram critical to quality control is identified. Improved modified phase is illustrated, which will be more useful in banking sector to increase the efficiency and effectiveness of all the banking operations.

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