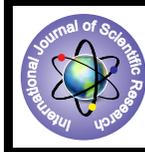


Comparisons of 3-Sigma and Six Sigma Control Chart Corresponding To X-Bar and R-Chart To Meet Customer Satisfaction in Banking Sector



Statistics

KEYWORDS : Control chart technique, Six sigma Concept, six sigma control limit.

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ABSTRACT

Shewhart's(1931) control chart is a simple device which enable to define more precisely the state of the statistical control and judging when the process is out of control. Its judging is based on 3-sigma limits. The basic idea of any process is to maintain the standard of the quality to meet the customers satisfaction . However every quality process is having Inherent variation. The related theory behind the possible devices of eliminating the avoidable sources from time to time is known as control chart technique. Now a day's every industry and organizations are trying to develop the quality service by applying Six sigma initiatives . The industry engaged in six sigma implementation are expected to produce 3,4 or less number of defects per million of opportunities. In 1980 Motorola company implemented six sigma initiatives and bring revolution in the world to improve the existing process and get financial benefits. According the six sigma concept if none of the sample points falls outside the control limit suggested by W A Shewhart , then the process is efficient, which satisfy the desired level of expectation. This paper has shown the comparison of 3-sigma and Six sigma control chart of the respondent in banking sector. Six sigma X- bar and Range control chart has shown that there is need to improve the existing process to get deserved level of satisfaction.

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 in the year 1980s; rather he applied methodologies that had been available since in 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. It 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.(Aditi Sharma 2013)

"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 nowadays – it is equal to 66.807 defects on million opportunities, while Six sigma equals 3.4 defects on million opportunities - statistically possible almost perfection. Six sigma quality requires right people on right positions with the right knowledge.(Muwafaq Alkubaisi 2013)

There is extensive research work is available on the benefits of business process Management implying how it will be beneficial to the organization to improve efficiency and effectiveness of the process.(Paul Soare 2015). The control char technique was based on 3 sigma limit if the same charts are used for the quality of the process which adopt six sigma initiatives in the process then no point fall outside the control limits as there is improved in the process.

Review of Literature :

In this paper it described the methods, tools and techniques of Six Sigma strategy which have greater impact on quality improvements and performance in various Banking Industries. 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)

Young Hoon Kwak and Frank T. Anbari (2006, 26,Technovatio) 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.

(Muwafaq Alkubaisi 2013) 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. In this paper comparison is made in 3-Sigma and six sigma control chart and suggest that there should be improvement in the process as sample points falls outside the limits (Radhakrishnan R 2011). This paper tries to put 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 this work Six sigma(R Radhakrishnan 2011).

Six sigma tools

Six sigma tolls help the professional to improve the existing process. Once information is given, by using tools we can take the decisions. Following are the some common tools. Process mapping, Cause and effect diagram, Pareto chart etc.

Terminologies

To know the terminologies in becoming more important to know the mathematical formula which can be used for six sigma implementation process.

USL: Upper Specification Limit

LSL : Lower Specification Limit

Process Capability : it the ratio of tolerance level to six times standard deviation of the process.

$$C_p = \frac{T_L}{6\sigma}$$

$$T_L = USL - LSL$$

is the difference between upper specification limit ad lower specification limit.

X-bar Control chart for 3-sigma limit

A typical control chart consists of three horizontal Lines

- 1) Upper Control Limit (UCL)
- 2) Lower Control Limit (LCL)
- 3) Central Line (CL)

$$UCL = \bar{\bar{X}} + Z\sigma \bar{x}$$

$$LCL = \bar{X} - Z\sigma_{\bar{x}}$$

$$CL = \bar{X}$$

R- Chart

$$UCL_R = \bar{R} + 3C\bar{R}$$

$$LCL = \bar{R} - 3C\bar{R}$$

$$CL = \bar{R}$$

Construction of Six sigma Control Chart for X-bar

x- Bar Chart

$$CL = \bar{x}$$

$$UCL = \bar{x} + l_{6\sigma} 6_{6\sigma}$$

$$LCL = \bar{x} - l_{6\sigma} 6_{6\sigma}$$

$\sigma_{6\sigma}$ can be calculated from table at $C_p = 2.5$

Construction of Six sigma Control Chart for Range.

R-Chart

$$CL = \bar{R}$$

$$UCL = \bar{R} + E_{6\sigma} 6_{6\sigma}$$

$$LCL = \bar{R} - E_{6\sigma} 6_{6\sigma}$$

To determine the process standard deviation fix (TL) and process Capability (Cp). Apply the value of $6_{6\sigma}$ in the control limits to get control limit based on six sigma for X-bar and R chart.

$l_{6\sigma}$ value can be obtained using

$p(z \leq z_{6\sigma}) = 1 - \alpha_1, \alpha_1 = 3.4 \times 10^{-6}$ and Z is standard normal variate. For specified TL and Cp

the value of $6_{6\sigma}$ is calculated from $C_p = \frac{T_L}{6\sigma}$ for values for TL and Cp.

Objectives;

The objectives of this research paper is that to measure the customer satisfaction level of various banking sector in Amravati, Akola and Khamgaon. Process capability is measured by 3-sigma and six sigma control limits. Comparison is made in between 3-sigma and Six sigma control Limits.

Research methodology

The purpose of this study is to implementation of six sigma in banking sector to enhance the existing service of housing loan process in Vidharbha region. The case study tries to find out the benefits of

six sigma in banking sector in term of customer satisfaction level by comparing 3-sigma control chart with Six sigma Control Chart.

Importance of the study

The finding of this study explore the application of six sigma in banking sector at various level and in general to operation management Literature and six sigma literature. So this may be the opportunity for the researchers to do more work in the field of six sigma implementation in banking sector.

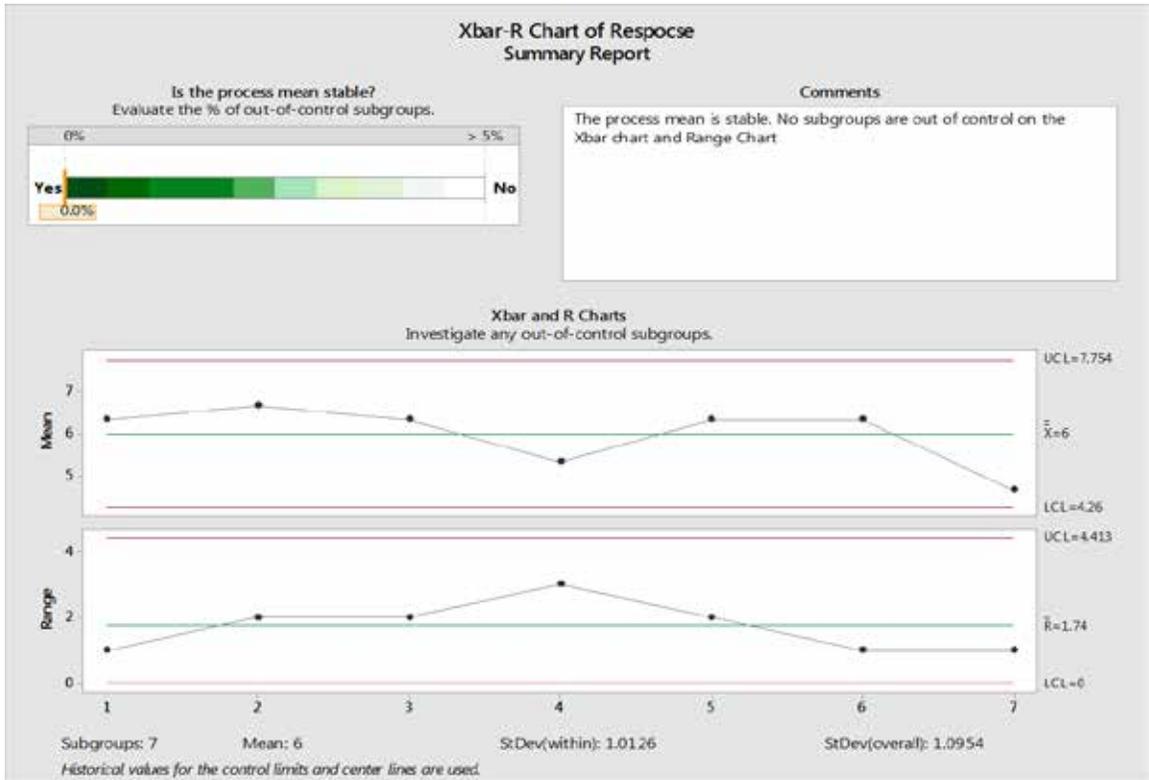
Data Collection

So a questionnaire technique is used in the survey (Olanrewaju Makinde Hassan 2014). This resource was used to source of primary data. The sample constitute entire bank customer who are availing the bank service. In this study 250 customer of 7 Banks (including 5 nationalize and two private) located in Vidharbha region that is Amravati, Akola and Buldhana region. A total structured 40 questionnaire were administered to 40 customer each of the 7 selected banks having 32 question in each questionnaire. Out of 280 structured questionnaires 250 where received through personal collection it represents 89.20 percent of collection which is very good survey collection. To consider equal sample size we consider 10 sample from each of 7 bank where considered from three places. So Total sample is 210. In this case study Simple Random Sampling technique has been applied. This technique provide each members of the banks customer have equal and independent chance of being selected or include in the sample. This case study is carried out in bank and public places. Data is given in Table 1

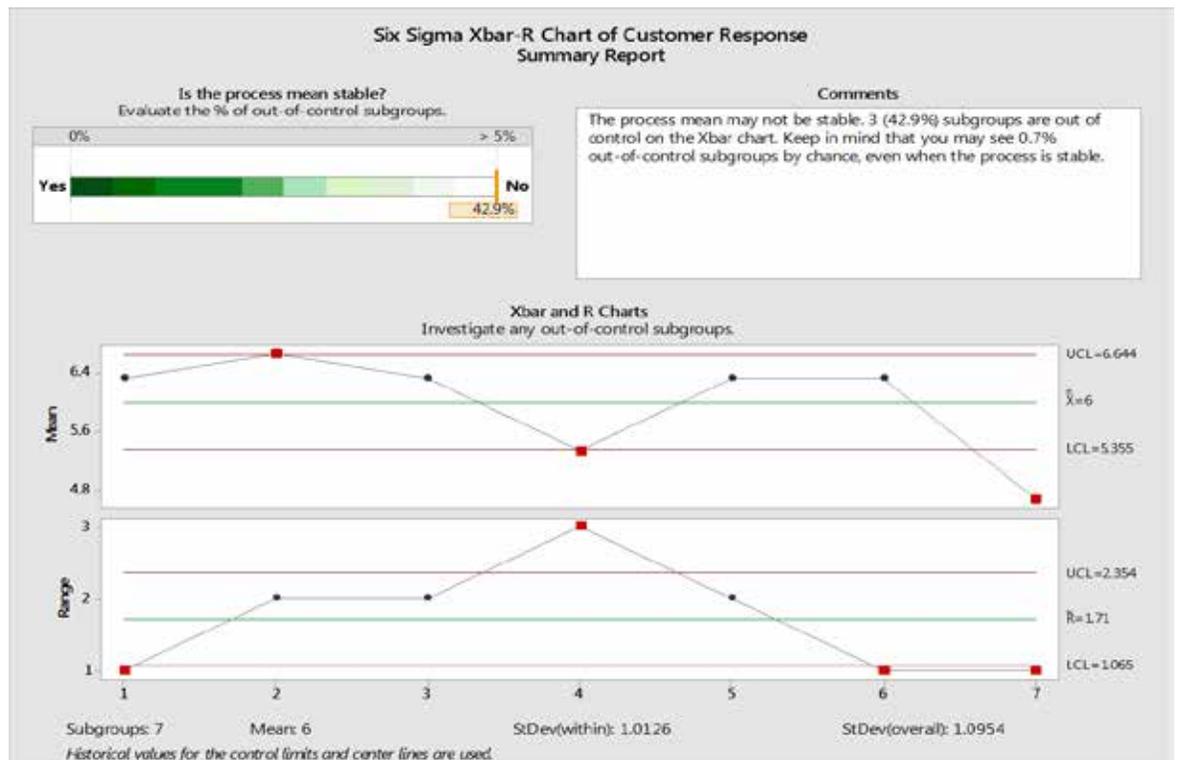
Table 1
Customer satisfaction Survey

S.No	A	B	C
1	6	7	6
2	8	6	6
3	7	5	7
4	4	5	7
5	7	5	7
6	6	7	6
7	4	5	5

3-Sigma Control Chart for X-bar and R chart is given below.



Six Sigma Control Chart for X-bar and R-Chart



From above 3-sigma \bar{X} -bar control chart we observe that $CL = 6$, $UCL = 7.754$ and $LCL = 4.246$ so all the sample points falls within the control limits that indicates process mean is stable its does not mean that there is no variation. That same condition is observed in range chart.

From Six sigma \bar{X} -bar Control chart we observed that $CL = 5.353$, $UCL = 6.644$, $LCL = 5.355$, it indicate that the process is out of control and the sample points are 2,4,7 lies outside the control limits.

For R- chart we observed that $CL = 1.71$, $UCL = 2.354$, $LCL = 1.065$, it indicates that the sample points 1,4,6,7 are outside the control limits. It means that there is variation in the service quality of banking sector. So the customer are not satisfied by the existing service quality. So it is very essential to improve the quality service of banking sector by implementing six sigma to meet the deserved level.

Conclusion:

This empirical study provide a procedure to construct Six sigma Control chart for \bar{X} -bar and R- Chart. Considering survey data it was found that the examined process were not in control by six sigma initiatives. This indicates that process does not meet the customer Satisfaction level. A correction in the service quality required to remove the variation. This chart may be useful to banking sector for practicing six sigma initiatives in the service quality. So 3-sigma control chart should be replaced by six sigma control chart to meet the deserved level of customer satisfactions and get financial benefits to the every service Industries.

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