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Quality Improvement With Statistical Process Control In The Softwere Industry."

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Abstract

In this context of a worldwide market opening, economy defies with numerous challenges, is no longer enough to produce, the current principles are based on quality as a condition for achieving productivity and competitiveness. And given that the quality is no static, it is constantly being changed, and because customers are increasingly demanding, any business organization that aims to be competitive it has to innovate. in the Statistical Process Control (SPC) – a Powerful management method which enables quality improvement and waste elimination. This paper suggests the improvement of the quality of a process through the use of SPC in an enterprise of the Software industry makes a brief review of concepts related with the methodology. It was sought a way to adapt it to the reality of the company. This review systematic identified from the past studies from 2000 to 2012. The evidence of SPC application spread throughout the information Technology industry and need more research in this area.

Key Words:

Statistical Quality Control, Statistical Process control, Quality improvement, Software

1. Introduction

According to Montgomery (2005), quality is one of the most important verdict factors in the selection of Products and services. Therefore quality leads to big business achievement, development, and increases competitiveness. Ryan (1989) defined quality

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as a decision making technique that uses statistics to monitor the consistency of a Production Process and the resulting Product as improves the work environment. Quality Control (QC) is an important task in factory as it deals with product inspection before the product was shipped to customers. SPC is a dominant tool in order to improve the processes that augment productivity and quality. Many researchers have noticed the leaning the service quality improvement has become a inevitability in many software industries.

SPC is an approach that has been broadly used in many Industrial and non-industrial fields. The Primary application domain for SPC charts is in Process control and improvement in manufacturing. SPC is a Procedure developed based on Shewhart's formation of Process variability which generally applied not only in manufacturing Processes but also in service operations for quality sustainability purposes. SPC is defined by Montgomery (2009) as Powerful collection of Problem-Solving tools useful in achieving Process constancy and improving capability through the lessening of variability.

2. THE IMPLEMETATION OF SPC

Most of the Production and quality cost that SPC aims to reduce such as rework lost of sales and proceedings are measurable. The success and failure in SPC operation does not depend on company size or resources, but it relies on suitable planning and immediate actions taken by workers with regards to problem solving. According to Benton and Talbot, the advantages of implementing SPC could be categories into the following categories, viz, maintain a needed degree of conformance to design, raise product quality, eradicate any unnecessary quality checks, trim down the percentage of defective parts purchased from vendors, diminish returns, diminish returns from customers, lessen scrap and rework rates, afford evidence of quality, facilitate trends to be spotted, ability to reduce costs and lead times.

A Large variety of SPC schemes have been developed for quality and Productivity improvement since the 1960s SPC utilizes statistical methods to monitor manufacturing

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Processes with an aim to maintain and improve the product quality while decreasing the variance. Much research has been conducted on the issues of SPC and the consequential developments are readily available in the literature, see surveys of research on SPC by Lowry and Montgomery (1995,) The main difference between a manufacturing system and service system is that customers are involved into service operations. How to measure the customers professed quality is a challenge. Therefore, researchers investigated Modification of quality definition in services.

The Two basic Concepts in quality assurance:

i) **Process control:** To ensure that the Proportion of defective item in manufacture product is not too large. it is achieved through Control charts.

ii) **Product Control:** Controlling the quality of product by critical examination at strategic points and it is achieved through Sampling Inspection plan.

Software quality: It can be defined as the totality of functionality and features of a software product that bear on its ability to satisfy stated or implied needs. Based on requirements is classified as follows,

Functional Software quality: of Software that combines Low defect rates and high level of user satisfaction. This software should meet all functional requirements of user and adhere to international standards.

Structural Software quality: The Software quality that exhibits a robust architecture and comparable in a multi – tier environment without failures or degradation. It has low cyclamate complexity levels.

Aesthetic Software quality: The software quality with elegant and easy to use commands and interfaces attractive screens and well formatted outputs.

Software Quality Control: The function of software quality control is to measure / Check the standards, Processes, and procedures of the manufactured Product with the aid of software in order to ensure that the project produces the required internal and external (deliverable) products.

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Software Quality Assurance: Software Quality Assurance is assuring & correct implementation of the appropriate standards, Processes and procedures for the product.

Metrics: The measurements which satisfies the validity, Reliability & Robustness of any Product.

Software Quality metrics: A measure of Some property of a piece of software or its specifications. When applied to the software Product, a software metric measures (or quantifies) a characteristic of the software.

Software Standards.

Software standards can be split into two categories:

a) Product Standards
b) Process Standards

COMPARISON OF SOFTWARE METRICS STRENGTHS AND WEAKNESSES

A. Source Code Metrics
B. Function Point Metrics
C. Object – Oriented Metrics

Andras Ittzes (2000) in his paper evaluated that the application of SPC is that of the several variance components of the variable in the control of the dry matter content in butter cream. He evaluated the data of Analysis of Variance (ANOVA) based on the nested model. is it important to realize the intergradations between SPC are seven tools, and how to effectively implement and to earn the full strength of these tools. They also carried out a case study to monitor real life data in a Jordanian manufacturing company that specialized in producing steel and found that the steel tensile strength is the vital few Problem and account for 72% of the total results of the problems. They specified the major causes of nonconformities and root causes of the quality problems and possible remedies were also proposed.

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They also explained the necessity of SPC tools in Jordan Steel to introduce ongoing education and training programs of management and line staff.

Ben Mason and jiju Antony (2000) in their paper discussed the ingredients that are needs for the victorious Performance of SPC They attempt to eradicate the myth that SPC is concerned with only the control charting of Processes. A major issue addressed by them in this paper is the need for the organized and realistic methodology for the execution of SPC in industry.

Dr. Paul Anderson, June (2000): Many aspects of our lives are governed by large, complex systems with increasingly complex software, and the safety, security, and reliability of these systems has become a major concern. As the software in today's systems grows larger, This article explains why the common test –and – fix software quality strategy we must pursue to solve the software quality problem in the future.

Khong sak Srikaeo et.al (2004) analyzed in their paper that the association between raw material variables. They adopted SPC techniques such as histogram to found that the data were not normally distributed ANOM detect a association between the production line from the grand mean in all Product variables, P. control charts showed that the Process is not in statistical control for some variables, Since they use the historical data the out of control points where removed to simulate the situation where the process is in statistical control for further studies. With the Process can capability studies the process precision and accuracy can be clearly assessed. Gauge R and R studies suggest that the variations found in the process are caused by the measurement system used in the plant.

Jeff Tian, (2004): The international standard ISO /IEC 9126 defines a quality model for software Products. The model Categorizes software product attributes into six characteristics, which are further subdivided into 27 sub characteristics. Based on a user survey, this exploratory study empirically investigates whether the ISO/IEC 9126 categorization is correct and reliable in evaluating user satisfaction with judgment of the

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quality of a packaged software Product. The results help clarify our understanding of Product – quality attributes and provide guidance for revising the standard.

(Xu-Ying liu, 2008) had purposed two algorithms. Deficiency that needs to be over looked is majority instances are not considered. Easy Ensemble and Balance Cascade were the techniques used by the author to overcome this deficiency. These two algorithms use the majority class examples that are not by under- Sampling. These two algorithms perform better than under – sampling because they better use majority instances results showed that these two methods have higher performance than other class – imbalance learning methods.

(Seliya Tagi M.Khoshgoftaar, & Jason Van Hulse, 2010) had addressed the class imbalance problems while developing fault perdition model. He had proposed Roughly balance Bagging Algorithm that combines data sampling and Bagging in to one technique that helps in building software fault prediction model classification Algorithms i.e.native bayes and c 4.5decision tree are used by the author. In this paper, software metrics and faulty data sets are considered as adapt set that is taken from software quality assurance system. Each data set includes number of faulty, non- fault modules and metrics. the results showed that model based on the roughly balanced bagging is better than c4.5 but when combined with roughly balance Bagging, c405 performs better that that naïve Bayes.

(Sunil, Arashdeep, Mehak, &Kaur, 2010) had proposed K.Sorenson means clustering that uses Sorensen distance for calculating cluster distance to predict fault in software. In this paper, data set was collected from NASA MDP repository online. The Proposed method is implemented on MATLAB. It took only three projects and information about requirement and code metrics is considered. author had joined requirement metrics and code metrics to develop a model that called as alliance metrics model. The results showed that the results are more accurate than model developed using K-Canberra-means algorithm and give better fault prediction. Proposed model will thus more correctly categorize components into fault prone.

Rallabandi Srinivasu et. al (2011) recognized (SPC) as effective approaches for process monitoring and diagnosis. They suggested that SPC Principle and techniques would be at every stage of the production and to control quality characteristics on the methods, machine, goods, equipments both for the company and operators with magnificent seven. He explained the " seven basis quality control tools" which provide a very valuable and cost effective way to meet the objectives.

Muthammad Riaz et. al (2012) Strongly recommended that the control charts worth in the manufacturing industry. They also suggested that monitoring the key characteristics is most important in any manufacturing industry. They strongly believed that the inefficient of a quality control section may cause poor quality of a Product.

Dr.D.R.Prajapati (2012) adopted some SPC techniques in the industry for various applications in the automotive industry. He explained the power of SPC lies in the ability to examine a Process and the sources of variation in the process. He used only two main techniques i.e. cause and effect diagram and control charts are implemented in industry out of seven SPC techniques. Finally he found in his case study that after implementing the SPC tools to remove the root causes, the percentage refutation is reduced from 9.1% to 5% and process capability of 0.953 is achieved.

Zhonghua Li at al (2012) in their paper designed Conventional Phase II SPC charts using control limits. They suggested designing the SPC charts using P values. They demonstrated the P value approach to consider univariate Process monitoring.

(Ritika Sharma, 2012) had addressed the problem that large number of faultsare Present in less number of modules, therefore for improving the sotware quality, we need to predict number of faults as much as possible.

(A.A.Shahrooj Haghighi, 2012) had proposed a fault detection system with higher performance which decreases the cost of software fault detection. he had examined the performance of the 37 different classifiers overs 5 public NASA datasets. The Proposed technique is implemented on weka. By comparing different classification

algorithms, author figured that Bagging shows higer performance and accuracy compared to others. For verification of the selected classifiers, author had compared the performance of the Bagging. Naïve Bayes and classification via Regression on more datasets. The results demonstrated that Bagging has highest performance on fault detection system. Detection system employed with bagging is more accurate.

Ritika Sharma, N.B., "Study of Predicting Fault Phone software Modules, " International Journal of Advanced Research in Computer Science and Software Engineering 2012.

A.A.Shahjooj haghighi, M.A., " Appling Mining Shemes to software Fault Prediciton: A Proposed Approach Aimed at Test Cost Reduciton, "Proceedings of the World Congress on Engineering 2012.

(Catal, 2012) had investigated various performance evaluation metrics and categorized these metrics into two main groups. The first group of metrics evaluates the performance of the prediction system, which classifies the modules into faulty and non-faulty modules and the second group of metrics evaluates the performance of the system which predicts the number of faults in each module of the next release of the system. Metrics from one of these groups can be chosen according to the research objectives. the first group of the metrics is calculated by using confusion matrix and area under ROC curve (AUC). In addition to AUC, PD, and Pf, balance metrics are also wiedly used. Author suggested using the AUC value to evaluate the performance of fault prediction models from the second group of metrics, R and AAE/ARE can be used to ensure the performance of the system that predicts the number for faults.

3. DISCUSSIONS

This paper represents and understanding report on defining and carrying out a systematic review on SPC and software qualify which is well known in software develop contexts. Implementation of SPC tools at the company is expected to develop its software standard with reduced the software metrics. The measurement which satisfies, the validity reliability & Robustness of any product

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software quality metrics, A measure of some property of a piece of software (or) its specifications, when applied to the software product, a software metric measures (or) specifications. quantities a characteristic of the software. lines of code (LOC) dealing with this review indicates that SPC is applied in the software industry with large benefit in the business SPC can be a flexible technique for control quality improvement in the software product standard This review suggests that SPC is a powerful technique when implemented in the software company. The Software metrics To ensure that care proportion of defective item in manufacture product is not too large. it is achieved through control chart.

4. Conclusion:-

In the conclusion software developers should execution of product standards SPC implementation is s process standards Performance by the metrics it is concluded that SPC helps the software industry to improve software quality process measurement.

The measurement which satisfies, the validity reliability & Robustness of any product software quality metrics, A measure of some property of a piece of software (or) its specifications,

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