

Defects Prevention Forecasting Methodology

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Abstract

The new methodology for quality control system of manufacturing technological process, particularly the defects preventing forecasting methodology is developed in the given paper. The methodology is based on statistical control methods. But unlike a method of the control charts, the offered methodology provides early forecasting and diagnostic of emergence of defective products. On the base of available historical information (data) the offered methodology uses different quantitative methods of forecasting as a continuation of control charts. Forecasting of possible consequences is carried out permanently that warns a deviation of control characteristics from admissible borders (limited area of quality characteristics).

Competent use of early diagnostics will repeatedly increase efficiency of statistical control of manufacturing technological process by avoiding its preventive stop. Defects Prevention Forecasting Method creates a basis for successful development of a business-company, improving its financial and strategic objectives on the basis by minimization of rejected production and increasing the quality of the production.

Keywords: defects prevention, early diagnostic, forecasting, quality, quality control system, rejected production, statistical control

JEL: C18, C53

1. Introduction

Efficiency of the business company, its financial and strategic performance, along with productivity, revenue, cost, profit, etc. are in many respects predetermined by quality of the company's production. Quality of production creates a basis of success of the company. High quality of production forms a basis of durability and reliability of products that not only promotes increase in output and productivity growth, but also makes emotional impact on consumers, the company becomes recognizable as the producer of high-quality production, it promotes the statement of a trademark, creates conditions for acquisition by the company of high reputation - a brand.

Quality of production is the main indicator depending on the level of science and technology, standardization and metrology, culture of production, working conditions at the given enterprise. Depending on the levels of each of the specified elements a Business Company can solve the corresponding problems of quality management and reach demanded financial and strategic objectives that is dictated by conditions of the market and the competitive environment.

Existence of numerous production factors influencing the quality and impossibility of their full account predetermines application of methods of mathematical statistics. The developed methods of statistical control and management allow to prevent the emergence of rejected production by supervision of technological process (the current quality control) and also check of compliance of details to standard requirements and conditions (statistical acceptance control by sampling methods).

Now the set of methods of statistical control of the production quality is developed (Storm, 1967; Taguchi, 1995; Wadsworth, 1997; Pyzdek & Keller, 2003; Feldman, 2005; Meisinger & Wagner, 2006; Oakland, 2007; Almeida, Alvaro & Meria, 2007; Juran & Defeo, 2010). Their usage has to provide release of quality products. Nevertheless, unlike methods

of the theory of optimal control statistical quality management do not consider research of technological process for establishment of transformation model of an entrance variable (say, raw materials or a semi-finished product) in output (in ready product). It is clear that statistical quality control is less effective than optimal management - at detection of a tendency of an exit of controlled characteristics out of control borders it is necessary to stop production for the purpose of identification of the reasons causing violations of normal course of a process. On the other hand, use of methods of optimal management isn't always expedient (e.g., from the financial point of view). By finding the Defect and failures you highlight to everyone that many risks for the business previously considered as minor are actually high and they require a strong proactive management plan to be put into place to address those risks. The frequency of occurrence maybe low but the cost consequences are massive and so the real risk for the organization is actually high

In the present work use of methods of forecasting for the purpose of early diagnostics of possible violations of normal course of process is offered. Competent use of early diagnostics will repeatedly increase efficiency of statistical control of technological process by prevention of its preventive stop. "Prevention is better than cure" applies to defects in the software development life cycle as well as illnesses in medical science. And when a defect gets through during the development process, the earlier it is diagnosed, the easier and cheaper is the rectification of the defect. Analysis of the defects at early stages reduces the time, cost and the resources required. The knowledge of defect injecting methods and processes enable the defect prevention. Once this knowledge is used appropriately, the quality is improved. It also enhances the total productivity.

Defect prevention is an important activity in any project. In most organizations, the project team focuses on defect detection and rework. Thus, defect prevention, often becomes a

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neglected component. It is therefore advisable to make measures that prevent the defect from being introduced in the product right from early stages of the project. Although the cost of such measures are the minimal, the benefits derived due to overall cost saving are significantly higher compare to cost of fixing the defect at later stage. Thus analysis of the defects at early stages reduces the time, cost and the resources required. The knowledge of defect injecting methods and processes enable the defect prevention. Once this knowledge is practiced the quality is improved. It also enhances the total productivity. This new method is discussed about the defect prevention and forecasting the problem before it happens. If a manager has an accurate data he/she can have a better result for manufacturing processes operating that has to increase profitability and achieve the requirements of a winning strategy.

2. The Purpose of the Method

The main purpose of the article is to create a way to find the problem in a process line and forecasting the problem before it will be appeared in process line

- Find the accurate way to forecast the future
- Interpret the chart for preventing the problem which

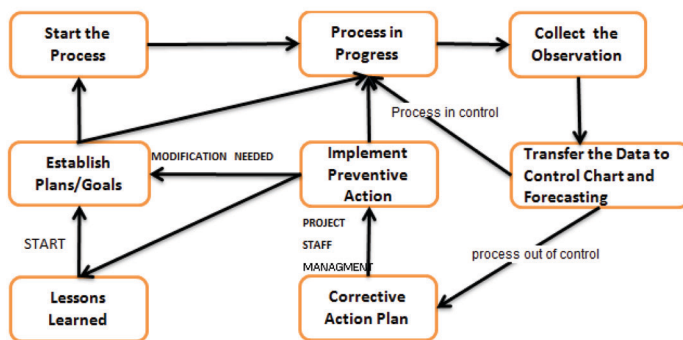


Fig. 1. The Algorithm of Defects Prevention Forecasting Method

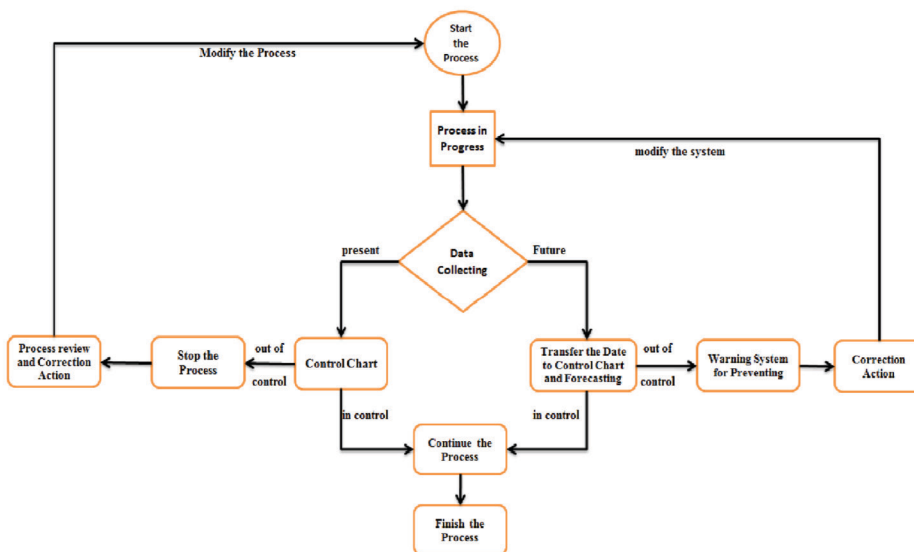


Fig. 2. Procedure of Defects Prevention Forecasting Method

will appear in process line

- Present all this in a clear and easy way
- Find a problems of the process line
- Develop a method to prevent the defect
- Make a process line without stop
- Close to the zero defect in process line

3. Defects Prevention Forecasting Method

The main purpose of this article is to develop a method for preventing the problems or defect in our process line before they happen. It means that a producer has an alarm system for defect prevention and this warning system can help an organization to continue the process without rejecting pieces. The methods structure is shown at Fig.1 .

In the first step we have a process line and from this process line we should make some observation. This observation depends on the type of the product and items which effects quality. In the next step we collect all of data and put the same data in one group, after that we have to change this data and observation into chart. We have two types of chart in this step. First chart is for the current situation and second chart should explain the future. In these charts (present and future) we determine the upper limit and lower limit of the product and we allow producing only in this tolerance.

After forecasting and control of the chart we should have a warning system to prevent the defect from our process line .If we have a point which tends to move up or down in the warning system, it informs the analyses team, which solves and prevents the problem.

Now we have a chart which includes the future observation. We cannot say definitely that the process line will go like this way but there are many ways to find the more accurate way and this chart for future is very close to the real chart.

After data collection from the process line we have to transform this data into control chart. Then we have to start forecasting the future. The result of the forecasting must be an answer regarding the question – what will happen if the process continues without changing. Does it need to change something in the process to get a better result? If there are any cases of quality reducing we have to find the problems of the process and before quality reducing it will be possible to conduct tooling of the process or modify something in order to support quality.

If in this chart we see any point which is out of control, we have to analysis the system and situation and find the solution before it happens. We should use the corrective action and modify the process line. This procedure is shown at the Figure 2.

4. Control Charts and Forecasting

Manufacturing quality products requires the monitoring of processes to ensure that they actually produce a quality output. Control charts are excellent tools for accomplishing this requirement and, because they are used

heavily in statistical process control, you will need to become very familiar with them. Control charts help a worker with the separation of a common cause variations and special cause variations. They are line graphs that display an ongoing picture of what is happening in a process, representing the variation of the process with respect to time. Different control charts monitor different types of measures, but all give a statistical signal that identifies whether a process is operating as expected or is “out of control.” These charts display the plot points of particular statistical values and, when their plots violate certain rules, a change in the process is indicated, requiring investigation. A particular pattern displayed within a chart provides hints to the cause of a variation. Technicians and engineers can take these hints, identify the source of the variation problem and eliminate it by making the necessary adjustments to bring the process back into control.

There are many benefits from the use of control charts. Some are:

- Gaining insight about the process
- Monitoring the process to observe performance
- Identifying particular types of variations in the process
- Identifying the present of trends, shifts and other patterns in the process
- Determining the capability of the process
- Controlling the process

A control chart represents a picture of a process over time. In order to use control chart effectively one must be able to interpret the picture. What is this control chart telling me about my process? Is this picture telling me that everything is all right and I can relax? Is this picture telling me that something is wrong and I should find out what has happened? A control chart tells you if your process is in statistical control. If we add to statistical control process technique of forecasting an early diagnostic of defective cases appearing will be realized. We suppose to use a system of forecasting technique (naive, averaging, moving average, smoothing, Box-Jenkins methods, regression models – (Armstrong, 2001; Hanke & Wichern, 2005; Bagaturia, 2011) for the testing of the historical data. The best method will be used for the prediction of the next result of a production process. Once again the better forecasting method will be tested.

Advantages of the method

In this method we can save many sources such as a labor, money and many other resources if you have an accurate data and find the problem. This method has many advantages for organization.

Tangible costs

1. Materials scrapped or junked
2. Labor and burden on product scrapped or junked
3. Labor, materials, and burden necessary to affect repairs on salvageable product
4. Extra operations added because of presence of defectives
5. Burden arising from excess production capacity necessitated by defectives
6. Excess inspection costs
7. Investigation of causes of defects

Intangible costs

1. Delays and stoppages caused by defectives
2. Loss in morale due to friction between departments

5. Conclusion

The main purpose of this article is developed new method for quality control system particularly was working out the defects preventing forecasting method. On the basis of analysis of quality strategy management process, various methods of quality management system and forecasting method gives advantages of forecasting and quality method is offered.

As it shows by experience of quality management system analysis, general system of quality control by control chart and with the quality chart we can evaluate our process line. If the defective cases appear the production process has to be stopped and organization must try to seek the reasons of defective conduction and to control the process. The method of defect prevention forecasting, which is developed in the article, assists organization in finding out the moment of incorrect operating of the process before defective production will appear.

Defect prevention is an important activity in any project. In most organizations, the project team focuses on defect detection and rework. Thus, defect prevention, often becomes a neglected component. It is therefore advisable to make measures that prevent the defect from being introduced in the product right from early stages of the project. While the cost of such measures are the minimal, the benefits derived due to overall cost saving are significantly higher compared to cost of fixing the defect at later stage

The mentioned method assists any organization with control process in correct way without defective results and organization can reduce many cost and resources by this method. It is possible to use the defect prevention forecasting method for various production process in order to avoid rejected pieces of the process and to increase profitability.

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