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## The analysis of the process of complaints' consideration using statistical methods of control

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# The analysis of the process of complaints' consideration using statistical methods of control

I V Plotnikova, L A Redko, N V Chicherina

National Research Tomsk Polytechnic University, Tomsk, Russia

E-mail: inna@tpu.ru

**Abstract.** The paper considers the task of reducing the time for processing claims using statistical methods for monitoring and analyzing data. The main significant factors of occurrence of inconsistencies are identified. Descriptive statistics were used to obtain primary information. Control charts of individual values were constructed and analyzed on the basis of the Pareto methodology. A statistically significant difference between groups of data was determined on the basis of analysis of variance and comparison of graphs. Based on the results of the analysis, the stage of the claims processing process was identified, which had the longest duration. Developed system solutions that reduce the length of the claims process.

## 1. Introduction

Formation of an effective control system of the organization is one of key factors of its success and stability [1]. Now the problem connected with low-quality products is the important reason of loss of financial resources by the state [2, 3]. For improvement of quality of products the organizations set the tasks of management of discrepancies and the reasons of defects of a product [4]. For the most effective management of low-quality products the statistical methods [5–7] are used which demonstrate a real situation in production and also simplify calculations for managers of the organization [8]. As the international practice shows, the effective mechanism of improving competitiveness is introduction of the process focused model of management of the organization. In this case activity of the organization is represented as the system of the interconnected and interacting processes [9–11]. Such model of management allows providing high extent of adaptation of the organization to the rapidly changing external environment [12]. For this purpose statement of the purposes on levels of management is regularly made [13], monitoring of achievement of the goals, assessment of effectiveness of activity [14] and actions for increase in efficiency and effectiveness of processes are developed.

## 2. Research description

The production company considered in this article is a modern industrial enterprise with a full production and design cycle on release of devices of measurement of pressure.

The product range includes more than two hundred names and also various modifications of products. The purpose of the enterprise is the set result of its activity.

The purposes of the enterprise can be corrected by results of the complex analysis of the external environment and internal opportunities of business [15]. In the organization the account and the analysis of the arriving information from consumers are kept. For a research data for the first and fourth quarters 2016 and for the first quarter 2017 were obtained.



For the initial analysis the method of descriptive statistics was used. The task of descriptive statistics is to reduce values of selection to several totals using mathematical tools which give a representation of selection [16].

Control cards are considered as one of the most important tools of statistical management of the quality. They represent rather simple graphic means of assessment of controllability (stability) of process of production by results of comparison of separate measurements with the set control borders.

The theory of control cards distinguishes two types of variability.

The first type is variability because of "accidental (of usual sizes), caused by an uncountable set of the various reasons which are present constantly and which hardly or cannot be revealed. Each of such reasons makes very small share of the general variability, and none of them is significant in itself. Nevertheless, the sum of all these reasons is measurable and is supposed that it is internally inherent in process. The exception or reduction of influence of the usual reasons requires management decisions and allocation of resources on improvement of process and a system.

The second type is connected with the real changes in process. They can be a consequence of some defined reasons not inherent in process internally, and can be eliminated. These established reasons are considered as the "nonrandom" or "special" reasons of change. Breakage of the tool, insufficient uniformity of material, the production or control equipment, qualification of personnel, failure to follow procedures, etc. can be referred to them. The main objective of control cards using is to find and separate the accidental deviations connected with the usual reasons from the deviations caused by action of the special reasons.

The considerable number of discrepancies and delays arises because of limited number of the reasons. For identification of the most significant and essential factors influencing emergence of discrepancies Pareto's chart is used. It gives the chance to establish a priority to the actions necessary for a solution. Besides, Pareto's chart and Pareto's rule allow to separate important factors from little significant and insignificant ones.

It is necessary to develop the form of the table in which enter for creation of the chart:

— types (signs) of cases, the facts (it is the better to have data in the decreasing order - at the beginning of the table the event type having the greatest number of repetitions, at the end of the table - the smallest one);

— number of emergence (repetitions) of each type;

— the saved-up sum of number of each type (with the accruing result: to number of the previous type the following increases);

— number percent on each sign in total amount;

— the saved-up percent (with the accruing result).

On the basis of creation of Pareto's charts, by rule 80/20, it is possible to reveal groups of devices on which repair it's spent more time.

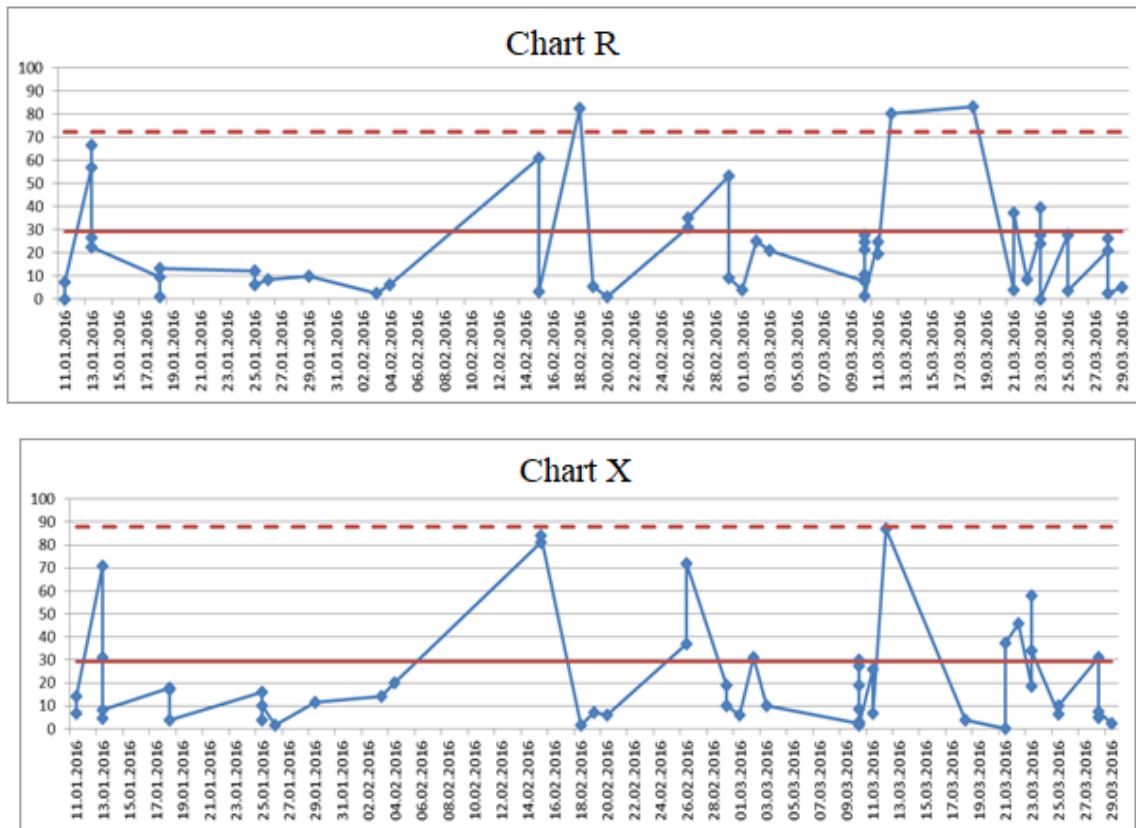
For more detailed comparison of the maximum terms of inquiry consideration, having data for every quarter, we will divide the period for decades and we will construct schedules.

For comparison of the maximum number of days for considerations of the complaints in a quarter we will carry out the dispersive analysis. A task of the dispersive analysis is studying of influence of one or several factors on the considered sign.

### 3. Interpretation of results

On the basis of the conducted selective research and indicators of descriptive statistics calculated on this selection with the level of reliability of 95%, it is possible to draw a conclusion that the average value of time of consideration of the complaints counting on one device is twenty days in 2016; nine days in the first quarter of 2017. The minimum quantity of days of consideration of the complaints counting on device in 2016 is one day, in first quarter 2017 is one day. The maximum number of days of consideration of the complaints counting on one device in 2016 is eighty-seven days; in first quarter 2017 is twenty-eight days.

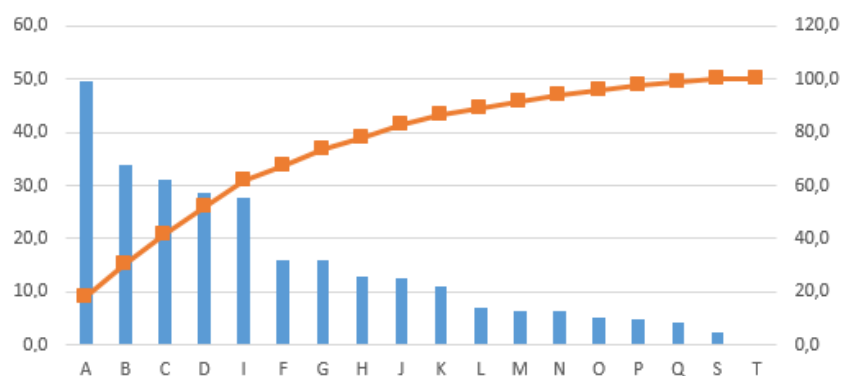
On the provided data the control cards of individual values and the sliding swings are constructed. The example of the control card is presented in Figure 1.



**Figure 1.** Control charts of individual values and sliding ranges.

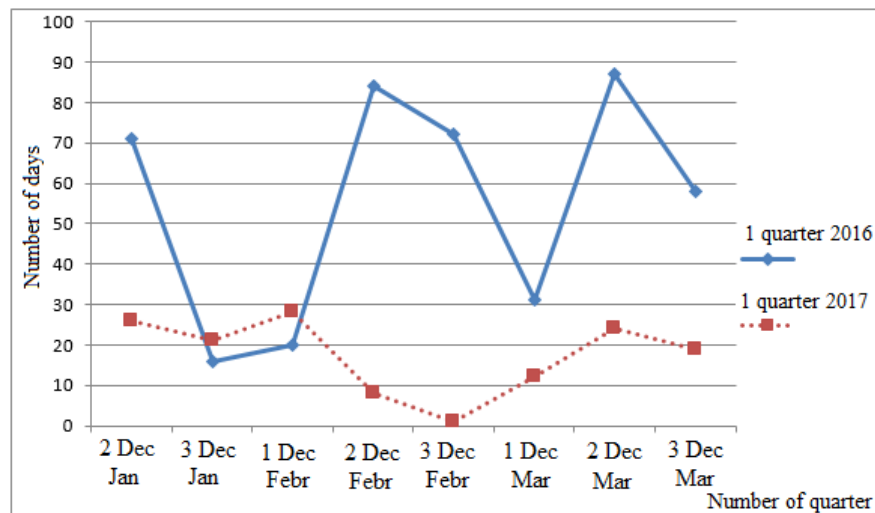
At interpretation of control cards, it was revealed that the most stable indicators are indicators in the 1st quarter 2017. Control cards for 2016 show a significant amount of the points overstepping the upper control bounds.

On the basis of creation of Pareto's charts, using the principle 80/20, revealed groups of devices on which repair it's spent more time, the maximum number of days of consideration of the complaints counting on one device. Such groups on all available data in the first quarter 2016, for the fourth quarter 2016, in the first quarter 2017 were defined. The example of the Pareto's chart on types of devices is given in Figure 2.



**Figure 2.** A type of the Pareto's chart on types of devices.

Or more detailed comparison of the maximum terms of inquiry consideration, having data for every quarter it is possible to construct the schedule. The example of comparison of the maximum terms of inquiry consideration between the first quarters 2016 and 2017g., is shown in Figure 3. The same way schedules of inquiries between other quarters 2016 and 2017.



**Figure 3.** The schedule of comparison of the maximum terms of inquiry consideration between the first quarters 2016 and 2017.

In the course of analysis of variance, comparing the figures for 2016 and 2017, we found out that there is a big difference between the first quarter of 2016 and the first quarter of 2017. This is due to the fact that in 2017, a number of indicators have improved.

In spite of the fact that indicators of 2017 most answer the purpose of the enterprise, nevertheless there is a group of devices, time of consideration of complaints for which goes beyond average value. Having studied the register of receipt of complaints for devices, it is possible to divide the entire period of complaints consideration into three stages:

- Date of receipt of the complaints for the device.
- Date of drawing up of the act (control dismantling).
- Date of a release of the order.

Further time to the control dismantling and the general time of complaints consideration are analyzed. It is established that time of complaints consideration is defined by time of dismantling of the device. Then devices for which more working days is spent are revealed.

#### 4. Conclusions

Being based on the statistical data it is possible to draw a conclusion that the reasons causing a delay of consideration complaints of devices in most cases are:

- a delay of terms of adoption of the response decision (letter) from the consumer.
- the increased terms of the procedure of consideration of the complaints, namely time to control dismantling.

Having adapted this method of process optimization, improvements of process of complaints consideration at a stage from receipt of the device on the claim to control dismantling were developed.

Thus, in order to achieve the target time for processing claims, the stage of the process was optimized, the loss of time on which was most significant. As measures, parallel execution of work and elimination of unnecessary coordination between those responsible for the stages of the process were used.

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