

Identification and Tracking Costs in Organization

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Abstract: Identifying and monitoring costs represents a significant starting point for business improvement organization. Adequate monitoring and reporting on costs requires an appointed system of recording, tracking, summary, separation and processing of data, which includes all stakeholders organization. Although the cost is one of the major problems of most organizations, modern companies have this problem with different methods, which include a review of treatment safety, decision-making based on data analysis and the like, which often include not only the facts, but unspecified numbers, indexes of growth, trends ...

Keywords: identification, costs, organization

1. INTRODUCTION

Tools for quality control¹ are very important tool for achieving, monitoring and improving quality of products or services and processes, in terms of elimination of errors and their causes, in order to thereby reduce production costs and general costs of the organization. To keep records and track costs, organizations need to summarize costs and compare them with the appropriate measurement basis, such as net sales, costs of inputs, direct labor² ... Well-set system of separation and processing of data means that it will include customers, market research, development, preparation and monitoring of products in its use or expenditure, which also applies to services, in the case when talking about service organization.

After collection and separation of data, it is

necessary to systematically collected data to make understandable, applying an adequate way of displaying data³. Some of the tools that can be used to display data, known in the literature as a tool of quality, were presented the next picture.

The objectives of applying the basic tools of quality from the aspect of identifying and monitoring costs are:

- Monitoring the current levels of costs in the organization;
- Switching costs of identifying the prevention of occurrence of high costs in the organization and
- Systemic and systematic improvement of cost management and production planning, which could be realized "without error" and that would have a major impact on the costs of the organization, ie. their reduction.

¹ An examination of the relationship between conformance and quality-related costs, S.Thomas Foster Jr, International journal of quality&reliability management, 1996.

² Research on the trade-off relationship within quality costs:A case study, Qiang Su, Jing-Hua Shi, Sheng-Jie Lai, Total quality management, Routledge, 2009.

³ A research on the measurement of quality costs in the Turkish food manufacturing industry, Mine Omurgonulsen, Total quality management, Routledge, 2009.

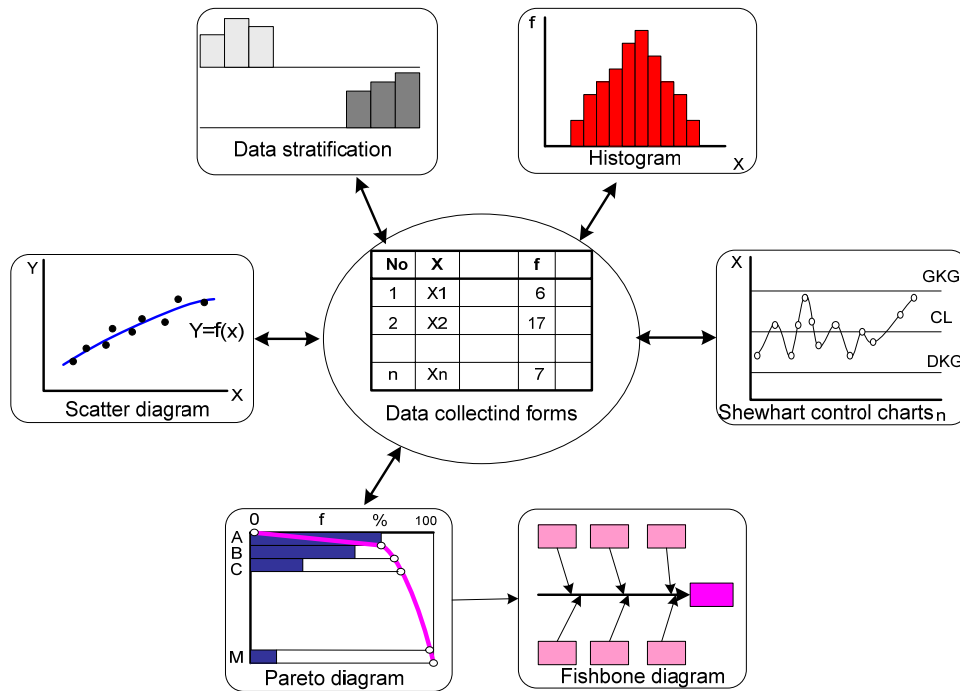


Image 1. – Basic Quality Tools [2]

2. FORMS FOR DATA COLLECTION

The data that is collected may come from different sources⁴. Data on costs can be collected from the following sources:

- Information on suppliers - suppliers cost estimation and cost control receiver supplied goods;
- Data from the work process - the costs associated with the work process;
- Data from the buyers - the required characteristics of products or services and the cost of reclamation.

Data on costs may occur in two forms:

1. Quantitative (numeric) - Data on the costs that can be precisely determined and related to measurable characteristics of products or services and
2. Qualitative (Attributes) - based on cost estimates electric power plant

⁴ Towards managing quality cost: A case study, S.B.Jaju, R.P. Mohanty, R.R. Lakhe, Total Quality Management, Routledge, 2009.

characteristics of products or services.⁵

3. HISTOGRAM

Histogram is best used when it has a large number of data to a simple and understandable way to show graphically the behavior and movement costs in the organization, ie. distribution of data that organizations possess. Histogram has a broad application, particularly suitable to display the results of tests conducted on a large number of samples, you should show the value of each sample.⁶

⁵ "TQM tools and techniques of quality," Professor. Dr. Miodrag Lazic, ppt perzentacija Production Mechanical Engineering Department, Faculty of Mechanical Engineering in Kragujevac, www.cqm.co.yu/ii/materijal/TQM/kolor/Tema2_tqm%20alati.pdf, 16/07/2009.

⁶ Presentation of the subject methods and techniques of quality management, I. Janicijevic, J.Omerbegović-Bijelović, Faculty of organizational science, 2008.

Histogram has a role to show data trends and values of certain variables, within the established categories. Categories (bars) is usually defined so that no overlapping intervals in the range variable and is determined to relate to one another. All intervals are usually the same size. The whole area which includes the histogram should be equal to the unit.⁷

For identifying and monitoring costs, histogram is used in the following cases:

- Display the value of targeted sampling variation, related to costs;
- Providing visual information about the behavior of costs in the organization and
- As one of the basis for deciding on the directions for improving the organization's costs.

3.1. Calculation data

The first step in the calculation of data collecting and recording data on schedule in the form of measurement. It is necessary to calculate the range (R), which represents the largest difference (Xmax) and minimum (Xmin) shares the characteristics observed.

$$R = X_{max} - X_{min}$$

After determining the range, it is necessary to determine the class intervals. Number of class is calculated according to the following form, where n is the number of data:

$$k = 1 + 3,322 \log n$$

The width of the interval class (H) is calculated by the formula $H = R / k$. Compute the number of H should be rounded up or down to the same number of decimal places and how they have measured data, and always more. In determining the boundaries of the interval class, the lower limit of the first class (Gd1) adopts the minimum value Xmin. Determining the lower limit of other classes is done by adding a wide interval of H lower limit of the previous class:

$$Gd2 = Gd1 + H$$

$$Gd3 = Gd2 + H$$

.....

The upper limit of the interval have one decimal place more than the measured values and differ for the unit to the decimal place than the lower limits of the following intervals:

$$T = Gd2 + 0,01$$

$$Gg2 = Gd3 + 0,01$$

.....

Determination of the upper limits of the last class is done by adding a wide class of H to the lower border of the last class, which provides that the maximum measured value is within the last class. Center classes, where they b_i and b_{i+1} , the lower and upper bound of the i-interval, calculated using the following form:

$$X_{si} = (b_i + b_{i+1}) : 2$$

After performing the previous steps, followed by the formation of a table according to the frequency previously calculated data.

3.2. Drawing a histogram

On a sheet of paper is necessary to mark the horizontal axis with a scale. In this scale should correspond to units of measurement data, not the width of the interval. Before and after the last class left the area approximately equal width intervals.

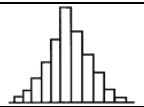
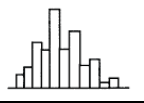
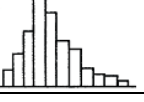
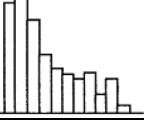
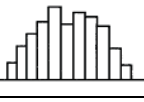
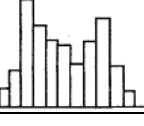
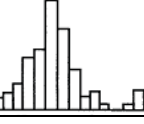
The left side indicates the vertical axis with a scale and frequency of application if necessary, the right line is the vertical axis with a scale of relative frequency (frequency divided by the total number of data). On the horizontal axis to indicate the limits of class. Using the class interval as the base line, draws a rectangle, whose height corresponds to frequency in the same class. The histogramu should draw a line that represents the average value and, if necessary, it is possible to prescribe limits for the measured size.

3.3. Histogram interpretation

3.3.1. Types of Histogram

Based on the histogram shape is possible to get useful information about the state of the observed phenomena. The following table are given various forms of histogram and their interpretation:

⁷ Web: en.wikipedia.org / wiki / Histogram, 17/07/2009.

General type	This is the form that usually occurs and is normal behavior in nonconformity observed phenomena.	
Histogram in the form of comb	This form occurs when the number of units of data involved in the class changes from class to class. This type of histogram shows discrepancies due to imbalances of the process.	
Positive or negative slant histogram	This type of histogram indicates the nonconformity as a result of normal deviations in one direction, which can be easily controlled and eliminated.	
Type Histogram with abyss on the left / right side	This type of histogram shows significant discrepancies in the process, which result in deviations whose causes should be seriously analyzed, which can be easily controlled and identified.	
Histogram forms a plateau	This type of histogram occurs as a result of mixing several distributions with different mean values, which is a consequence of nonconformities in the steady process.	
Histogram with peaks twins	This form occurs when the two mixed distribution with a large difference mean values. This form indicates the nonconformities in at least two sources causes (machine-tool, the machine-man, etc.).	
Type the isolated peak	This form may be due to the inclusion of data from different processes, data with different distribution, measurement error, as in the case of serious discrepancies in the process.	

3.3.2. Histogram to specification limit comparison

If the technical documentation set limits for measuring the size, they should be in the draw histogram for comparison.

When the histogram limits meets specifications: it is sufficient only to maintain the existing situation and the need to reduce the variations in the process of the lower level, given that the boundaries coincide with the given histogram.

When the histogram does not meet the specification limits: it is necessary to take measures to the mean value closer to the middle of the histogram given boundaries and requires the reduction of variation in the process.

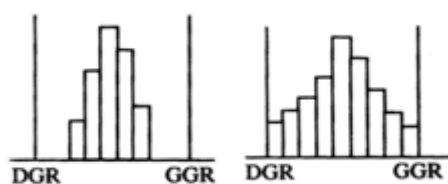
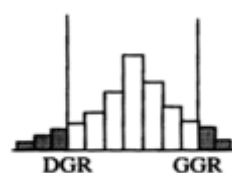
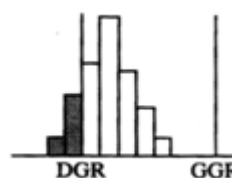


Image 2. – Histogram that meets the specification limits



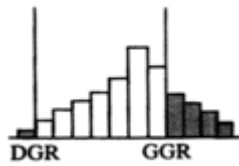


Image 3. - Histogram that does not meet the specification limits⁸

4. CONTROL CHARTS

Statistical process control (SPC) is a method for data collection and analysis process, in order to solve practical problems of control. The idea is to collect enough data so to gain knowledge about the process that follows. It is important to know limits of the process, because each process varies no matter how good a control. Variations of the process above the stipulated limit, and creates increased costs of the process. The process is under control if the parameters of product quality variation within the limits of natural fluctuations of the process. The main objective is to achieve the optimal course of the process, with optimal costs. If the process is under control then it works optimally, and no adjustment is necessary.

In SPC terminology, the normal limit variations are called statistical process control limits and they are determined based on measurements over a longer period of time. The sample in the SPC terminology means a set of one or more measurements and used to calculate the control points on a control chart. It is usually defined sample from 4 to 6 measurements, as well as a large enough sample for statistical process control, while the sample of 5 commonly used measurement. Sample size affects the sensitivity of control charts. Smaller samples give control charts that are less sensitive to changes in the process, while larger samples define the control charts that is too sensitive to small insignificant changes in the process.⁹

⁸ Presentation of the subject methods and techniques of quality management, I. Janicijevic, J.Omerbegović-Bijelović, Faculty of organizational science, 2008.

⁹ Web:
<http://bellsouthpwp2.net/e/v/evop/EVOPS/SPC.htm>, statistical process control, 17/07/2009.

Control chart is a graph of data obtained on samples periodically taken from the process and sequentially stored in the chart. Charted data, which may represent a single reading, or some statistical data, compared with the control limits. At the simplest level, the point is entered into the control card which falls outside the control limits indicates a possible change in the process, possibly due to a „systematic causes“. Apcisa this chart is the order of control, and the ordinate is entered parameter values that are controlled by a specific sample size. The conventional form of control chart data on the variables is called Shewhart chart.

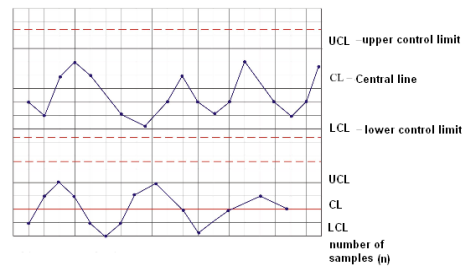


Image 4. – The appearance of the control chart

Control charts facilitate response to changes of the process, helping the user to clearly see random variations that are characteristic for a stable process in relation to changes that may be due to „systematic causes“. The role and value of the control charts in some activities related to the process are:

- **Managing the process** - to detect changes in the center of the process or the variability of the process and to trigger corrective action precisely in order to maintain or regain stability in the process.
- **Analysis capability** - if the process is in stable condition, data from the control charts can be used later for evaluation capability.
- **Analysis of measurement systems** - can show whether the measurement system is able to detect the variability of the process or product. Control charts can also be used to monitor the process of measurement.
- **Analysis of the causes and consequences** - the correlation between the events of the process and

shape control charts can help to make a conclusion about the causes and to plan effective measures.

- **Continuous improvement** - monitoring changes in the process and help to identify and determine the cause of change and are part of the permanent improvement.

As an example may be given a set of business rules, "Western Electric" process out of control:

1. One or more points outside the control limits;
2. Two of the three points from the same central line in the zone A (zone three Sigma- 3σ) or outside;
3. Four of the five points from the same central line in the zone B (zone two Sigma- 2σ) or outside;
4. Nine consecutive points on one side of the central line;
5. Six consecutive points of monotone increasing or monotone decreasing;
6. Fourteen points in a row move up and down and
7. Fifteen points in a row in Zone C (area of a Sigma- σ), above and below the central line.¹⁰

When you interpret control charts, there is a danger of "false alarms" (danger to conclude that the change occurred when it was not the case). There is also a risk that can not detect changes that occurred. These risks can be reduced, but can never eliminated.¹¹

Control charts are applied to achieve the following objectives:

- Monitoring the quality of materials, parts and products, which affect the costs of the organization;
- Determine capability and production equipment to keep costs at a given level.

Results of application of control charts include the following:

- Maintenance of the process in a state of control;

- Restoration process in the state control after the disturbance;
- The certification of the achieved level of quality and costs;
- Preventing nonconformity products and increase costs;
- Prevention quality.

5. ISHIKAWA (CAUSE AND EFFECT, FISHBONE) DIAGRAM

5.1. General characteristics

Ishikawa diagrams was first applied Kaoru Ishikawa, who is considered the founder of process quality management in Kawasaki factory, and over time became one of the founders of modern management directions.

This tool was first applied to 1960. and represented one of the seven basic tools of quality management, in addition to histogram, Pareto diagrams, forms for collecting data, control charts, diagrams and flow Scatter diagrams. Cause and effect diagram appears in the literature under the name "fishbone diagram, because it looks reminiscent of the skeletons of fish. Chart cause and effect is the result of a general analysis of the impacts (causes) that cause the appearance of high costs in the organization. Mazda Motors is known for using Ishikawa diagrams during development Miata sports car. Each factor is identified by chart was included in the final design.¹²

Fishbone chart, diagram or cause and effect, is used for the review and view the relationship between consequences and its potential causes.¹³

The objectives of application:

- Identify all the causes of occurrence of certain conditions, outcomes or results and
- Analysis and identification of causal-consequential link cause and outcome.
- Basic features of this tool are:

¹⁰ Web:
<http://bellsouthpwp2.net/e/v/evop/EVOPS/SPC.htm>, statistical process control, 17/07/2009.

¹¹ ISO / TR 10017:2007 - Guidelines on statistical techniques for ISO 9001:2000, Serbian Institute for Standardization, 2007.

¹² Web:
http://en.wikipedia.org/wiki/Fishbone_diagram, fishbone diagram, 16/07/2009.

¹³ Presentation of the subject methods and techniques of quality management, I. Janicijevic, J.Omerbegović-Bijelović, Faculty of organizational science, 2008.

- A clear visual representation of the possible causes of high costs in the organization and the consequences of their actions.
- Provides the possibility of analysis of interaction between individual effects-causes, their importance and impact on the costs of the organization and place in the overall structure of possible causes (a cause may occur in several places in the diagram, the different groups of causes).
- Links cause high costs are qualitative and hypothetical character and serve as the basis for efficient troubleshooting another method.

Individuals or working groups using cause and effect diagram to perform the analysis, monitoring and insight into the relationships between causes and high costs, which arise as a consequence of (problem) that arises effect causes. Using diagrams cause and effect makes it easier to find solutions for eliminating the causes, and as this diagram, in combination with other statistical methods and theories, the basis for creating more complex statistical methods.

5.2. Steps in implementation

When it comes to cost in the organization, cause and effect diagram is used to the emergence of high costs in the organization defines the problem that leads to them - poor quality products, the emergence of state failure in the long cycle time of production ... or many other similar problems. Then it is necessary to identify the causes of high costs as a consequence.

Possible is the situation that defines the costs and the (desired) effect. In this case, requires the identification of conditions that lead the realization of the effect of such consequences. Result (a problem or effects) must be defined on the basis of objective data in the form completely clear. In the process of defining helps Brainstorming-analysis methods for gathering ideas.

The graphic is specified by the withdrawing arrows from left to right and at the end of the arrow in a rectangle, write the problem that is analyzed (high cost), leaving the left side of the chart the future space for

data entry. Identifying the causes that lead to high costs lies in the examination of all possible causes of high costs and the classification of causes on characteristics, performance or similar features. General groups of causes is entered by pulling the appropriate lines on the line of action of causes in the diagram, where you get the basic structure of the diagram. Each defined the cause is added to the line of main groups of causes. Above or below the arrow entered the main causes of high costs: methods, materials, machinery, measuring methods, working environment ... Each entered the causes should be merged with the main arrow.

In relation to the categories in which samples are classified the following types of systems:

- **4M - 5M - 6M** (equipment, labor, method, material, maintenance, environment)
- **4P** (business policies, procedures, people, office space).¹⁴

Each individual group forms a cause of its branches. The process of spreading a diagram is made of linked causes, in several stages, until exhausted view all identified samples. For each of these branches are saved factors that may be considered as causes. For each of branches entered the more detailed factor.

When entering the chart at a certain level of exhaustion of all identified causes and check each of the branches be located, access to the analysis, which consists in identifying the causes probably (3-5) high costs and their labeling in the diagram. Presented procedure, in addition to directing the primary causes, allows finding the line of critical cause, which is certainly one of the most important results of this tool.

Worked chart cause and effect is particularly analyzed, and then compare the data collected from specific process, with diagrams and thus determines the most influential reason which causes high costs in the monitored process or seen at the level of organization.

¹⁴ Web:

http://en.wikipedia.org/wiki/Fishbone_diagram, fishbone diagram, 16/07/2009.

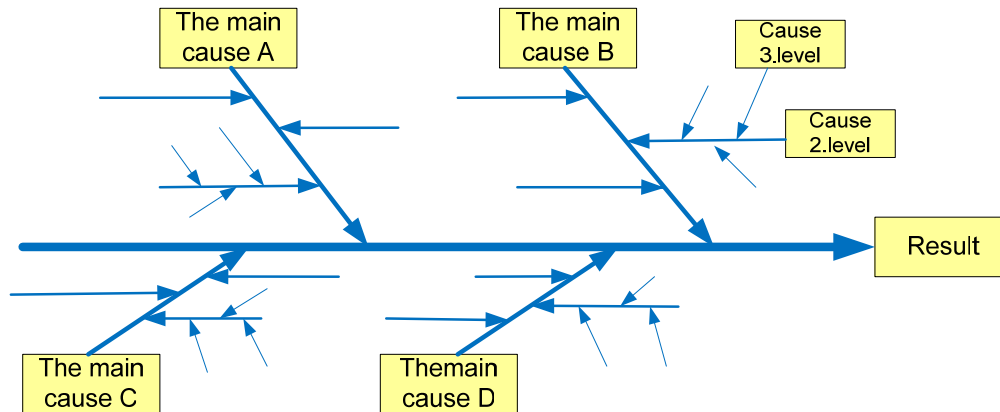


Image 5. – Structure Ishikawa diagram

Based on the established causes of the most influential defined corrective actions should be conducted to determine the most important cause of eliminating the high costs, and proposed corrective actions.

6. PARETO (ABC) DIAGRAM

6.1. General characteristics

Pareto analysis enables the detection of the most frequent cause of poor quality, which results in high costs in the organization. Applies when you need to establish the main causes of defect and priority activities to improve quality. This method helps to:

- Facilitates priority targets for improvement;
- Select key programs improve quality and reduce costs;
- Works and the main causes of defects and marginal and
- Extract key elements for improving customer satisfaction.

Pareto analysis indicates the most common causes of quality problems, and thus high costs, which should be directed to greatly reduce the appearance of defects. Based on practice confirmed Pareto principle, that the greatest number of defects arises only under the influence of several causes (This principle is also known as 80/20 - 80% of the problem is caused by the effects of 20% of causes).

This technique was initially named after the Italian economist who concluded that about 90% of wealth in the country has about 10% of the population. Pareto analysis, one of the basic tools of quality, is used when the required information What percentage of the discrepancies can be eliminated if they solve the main causes of the observed discrepancies, which comes to cost reduction. It is important to remove the irrelevant cause, that further corrective action concentrated on the vital causes.

Primary data are obtained from the process in the enterprise. Basic data collected through the records of defects, for example. nonconformity track materials, record complaints, records of defects with a check ... In the recording of defect must accurately record the cause of their creation. Defects arising from various causes may not be expressed in the form of a data. The data is further processed by grouping the causes for a specific time period. Collected appearance of defect is calculated as a percentage in relation to the total number of occurrences of any defect, (the total amount or total value). When the data thus processed, the draft can be Pareto diagram.

Pareto diagram is shown as a histogram, where the rectangles represent the most common causes of a certain percentage of representation in relation to the total number of occurrences of problems. The X-axis diagram is applied categories of causes of problems, and the ordinate (y-axis) is applied in the percentage representation of the cause. In

addition to representation in the form of percentage of occurrence on the y-axis can show the amount of quantity or cost. The rule is that the histogram display in descending sequence, in order of appearance representation.

The diagram can also show the cumulative curve representation. It is determined by adding the representation of certain causes. The intersection of the cumulative curve with the desired level of avoidance of defects (70%) is the turning point. It separates the vital causes of trivial causes whose elimination would not significantly reduce the appearance of defects. The Pareto diagram can also show analysis of the causes of representation in two different time intervals, based on what can be seen improvements after implementation of corrective measures.

The level of significance of elements from the set of problems is determined by the diagram observed three separate areas:

- **area A** - the area most important, influential, elements from the set of problems is the region since the beginning of the horizontal axis to the intersection with the horizontal axis line A. In this area there is usually a very small number of elements from the set of problems and they are priorities for improving quality.
- **area B** - the area of significant, influential, elements from the set of problems is an area on a horizontal axis between the points of intersection of lines A and B with the horizontal axis. In this area is usually a small number of elements from the set of problems.
- **area C** - area meaningless elements from the set of problems is the area of intersection of the horizontal axis with the line B to the end of the horizontal axis. In this area usually is the largest number of elements from the set of problems.

In addition to application on a particular model, ABC or Pareto diagram is used as an unavoidable, often starting or final stage of a large number of other methods and techniques for improving the quality of business - virtually

all occasions when you need the size ranking of various types according to previously defined criteria.

6.2. Example of application Pareto chart

Below shows the example of Pareto chart of the company Stark. Data collection was done by monitoring the production process of manufacturing biscuits. Defined seven types of defects that can occur in the production process:

1. Biscuits crushed when filling
2. Baked biscuits damaged bar
3. Broken biscuits in 100g Packaging Machine
4. Broken biscuits in 150g Packaging Machine
5. Broken biscuits in 200g Packaging Machine
6. Broken biscuits at 2500g Packaging Machine
7. Biscuits crushed 50g on Packaging Machine

After collecting and grouping data from the production of defects and their causes, was obtained in the following table with the data, based on the Pareto diagram was drawn:

Cause	Quantity (kg)	Spiolage (%)	Participation (%)
2	1197	0.57	67.67
1	490	2.05	27.70
5	39	0.08	2.20
6	30	0.05	1.70
4	7	0.01	0.40
3	6	0.09	0.34
7	0	0.00	0.00
TOTAL:	1769		100

In particular Pareto diagram can be seen that the main cause of defects in the process of manufacturing biscuits baked biscuits that damage to the bar, and biscuits, which was broken when filling. Determined action on the main causes, comes to improving the production process biscuits, which directly result reducing the cost of the production process.

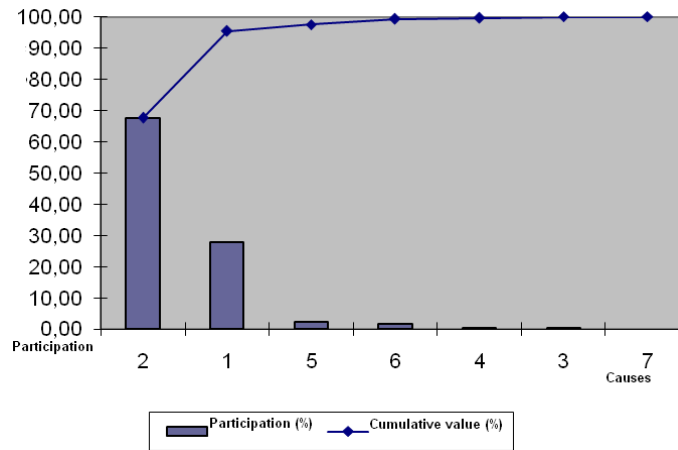


Image 6. – Table data and Pareto diagram

7. SCATTERING CHART

Chart scattering is used to determine the relationship between two variables. This diagram is a graphical representation of relations between the related variables, due to recognition of the connection between their values. From it you can see how changing the independent variable X changes the dependent variable Y.

Diagrams are defined:

- Regression - dependency of two variables (two sets of variables) $Y = f(X)$, when the independent variable X (the cause) and condition affect the dependent variable Y (a consequence, the goal).
- Correlation - the interdependence or connections of two variables (two sets of variables) X and Y when it examines the strength of connections between variables through correlation coefficients.

Cases in which it is used:

- When you need to find a potential problem;
- When you have identified all the causes and consequences and using a fishbone diagram came to the conclusion that the cause preceded the consequences and
- When it is necessary to determine which of the two causes that have the

same result should be affected to avoid occurrence of problems.¹⁵

The objectives of application:

- Establish the relationship between costs and other parameters of organization and
- Evaluate the intensity of interdependence.

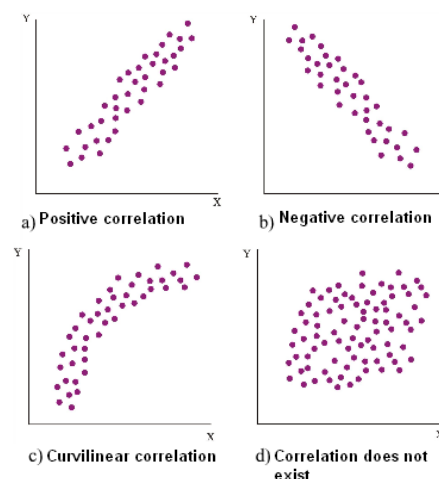


Image 7. – Correlation diagrams

¹⁵ Presentation of the subject methods and techniques of quality management, I. Janicijevic, J.Omerbegović-Bijelović, Faculty of organizational science, 2008.

7.1. The process of application

Before you start drawing a diagram, it is necessary to collect data for the variables that should be linked as cause and consequence. After that, all the values of variables are drawn in the graph, where the ordinate represent one, and abscissa another variable.

After drawing the points, it is necessary to observe the position drawn points on the graph. If the item ordered, so that through them can retreat rights, then the application of this tool is finished, because the relationship between cause and effect linear. If not, transfers to the next step.

This step begins by graph divided into four

<p>A = number of points in Quadrant 1 + the number of points in quadrant 3 B = number of points in Quadrant 2 + number of points in quadrant 4 Q = minimum between A and B N = A + B After observing the value of N in the table, it is possible to determine the border. Q < border => no connection between variables Q > limit => links cause of the consequence of the coincidence</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 12.5%;">N</th> <th style="width: 12.5%;">Limit</th> <th style="width: 12.5%;">N</th> <th style="width: 12.5%;">Limit</th> </tr> </thead> <tbody> <tr><td>1-8</td><td>0</td><td>51-53</td><td>18</td></tr> <tr><td>9-11</td><td>1</td><td>54-55</td><td>19</td></tr> <tr><td>12-14</td><td>2</td><td>56-57</td><td>20</td></tr> <tr><td>15-16</td><td>3</td><td>58-60</td><td>21</td></tr> <tr><td>17-19</td><td>4</td><td>61-62</td><td>22</td></tr> <tr><td>20-22</td><td>5</td><td>63-64</td><td>23</td></tr> <tr><td>23-24</td><td>6</td><td>65-66</td><td>24</td></tr> <tr><td>25-27</td><td>7</td><td>67-69</td><td>25</td></tr> <tr><td>28-29</td><td>8</td><td>70-71</td><td>26</td></tr> <tr><td>30-32</td><td>9</td><td>72-73</td><td>27</td></tr> <tr><td>33-34</td><td>10</td><td>74-76</td><td>28</td></tr> <tr><td>35-36</td><td>11</td><td>77-78</td><td>29</td></tr> <tr><td>37-39</td><td>12</td><td>79-80</td><td>30</td></tr> <tr><td>40-41</td><td>13</td><td>81-82</td><td>31</td></tr> <tr><td>42-43</td><td>14</td><td>83-85</td><td>32</td></tr> <tr><td>44-46</td><td>15</td><td>86-87</td><td>33</td></tr> <tr><td>47-48</td><td>16</td><td>88-89</td><td>34</td></tr> <tr><td>49-50</td><td>17</td><td>90</td><td>35</td></tr> </tbody> </table>	N	Limit	N	Limit	1-8	0	51-53	18	9-11	1	54-55	19	12-14	2	56-57	20	15-16	3	58-60	21	17-19	4	61-62	22	20-22	5	63-64	23	23-24	6	65-66	24	25-27	7	67-69	25	28-29	8	70-71	26	30-32	9	72-73	27	33-34	10	74-76	28	35-36	11	77-78	29	37-39	12	79-80	30	40-41	13	81-82	31	42-43	14	83-85	32	44-46	15	86-87	33	47-48	16	88-89	34	49-50	17	90	35
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quadrants, as follows:

- If there is a diagram of points x, calculate $x / 2$ points from top to bottom and draw a horizontal line.
- Compute $x / 2$ points from left to right and draw a vertical line.
- If an odd number of points, draw a line through the central point.
- The upper right quadrant is quadrant 1 and the other in order to mark the opposite direction of movement clockwise.

The following is counting how many points in any quadrant is, but should not count those points that are on the lines that restrict quadrant.

Even if the scattering diagram shows the dependence between two variables, does not necessarily mean that one causes the other consequences, but that both are caused by third variables. The position of the points closely a straight line, the dependence between variables is stronger. If the scattering diagram shows that there is no relationship between variables, should be applied layering tool.

8. STRATIFICATION DATA

With this technique the data is classified so that their meaning can be seen. It is used when the collected data came from multiple sources, such as different shifts, days of the week,

different suppliers, different parts of the equipment ... causing increased costs in the organization.

The principles of stratification:

- Separately collect data on costs for different conditions, causes, location, series (materials, products, machines, jobs, shifts, lines, processes, ...);
- Establish a system of identifying the cost of parts and products from the receiving warehouse to warehouse finished products;
- Establish a system of traceability in the security organization to be known carriers of the cost.

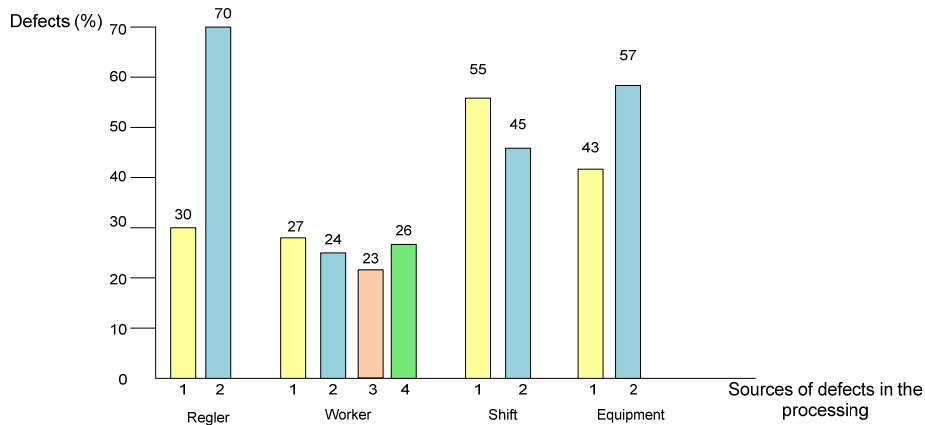


Image 8. – Sample stratification data [2]

9. SIGNIFICANT ISSUES ARISING WHEN MEASURING AND MONITORING COSTS

Costs, particularly costs of quality are becoming increasingly important for modern organizations, which seek continuous improvement of operations¹⁶. Measuring the cost is the basis for reporting costs¹⁷.

In traditional manufacturing companies costs are measured in relation to production, including, for example, spoilage, processing, appeals, inspection and testing. Costs that appear in other parts of companies, which are mostly dominated by office workers were measured only up to certain limits, or in many cases are not measured.

In modern manufacturing enterprises are the dominant share of transfers from the processing of materials, the preparation of the production, design, construction, setting a number of production machines, more management and control further. Errors in the production of these companies can predict and prevent various types of computer simulation, prompt electronic controls and the like. So that the dominant costs are in production, but in the "office" part of the company. The ratio of

technical and technological tasks of preparation and direct production significantly changed. Now the cost of technical and technological preparations hugely greater amounts of effort and costs of the organization. Services company could be viewed as a modern production company.

The companies have not decided in advance that will be used when measuring data measurement, and as a consequence, neither the methods of measurement are not relevant custom¹⁸. One gets the impression that the primary goal is to publish regular reports, instead of using the information in them, to achieve improvement. In modern companies, seeks to apply the principle of decision-making based on facts, in order to avoid this error.

Some costs are visible by themselves, while others are greatly disputed¹⁹. Company whose activities are usually successful measurements decide on these issues very quickly and then continue to start work. Less successful companies are continuing discussions and weak progress with measurements.

The question of how to decide who really caused the costs usually leads to difficulties. Generally, companies that are successful usually choose a simple method to decide who should be "blamed" for measured cost, while

¹⁶ Improving the definition and quantification of quality costs, Ching-Chow Yang, Total quality management, Routledge, 2008.

¹⁷ Quality costs measurement under activity-based costing, Wen-Hsien Tsai, Internatioanl Journal of Quality & Reliability management, 1998.

¹⁸ Cost of quality usage and its relationship to quality system maturity, V.Sower, R.Quarles, E.Broussard, Internatioanl Journal of Quality & Reliability management, 2007.

¹⁹ Increasing the visibility of hidden failure costs, S.K.Krishnan, Measuring business excellence, 2006.

not so successful companies postpone this discussion. This error is largely removed well-defined competencies and responsibilities in the organization.

Companies generally choose to measure the cost of construction of measuring system in which employees should report problems and errors (autocontrol, self-evaluation). In some cases, developed new systems of measurement, whether the forms are filled, any such computer programs, specialized for measuring costs. Often appearing and problems such as unclear reporting procedures, not-training of users and the existence of many opportunities to be wrong. The use of special systems is often difficult, because the extra work users look overweight.

One of the most important reason why often does not work expense reporting is the lack of commitment and interest in information disclosed in the management company. In many cases, executives do not use the information to be performed measurements and to improve. This reduces the motivation for reporting errors and problems among employees.

Employees generally considered reporting costs as additional work and are unable to see what can be achieved by measuring their good²⁰. Employees are often embarrassed to report on the costs of their workplace, because it can be interpreted as their personal fault. Companies that were most successful were addressed great attention to training its employees to ensure their clear understanding, a feeling of participation in decisions and create a clearer picture of the importance of the system, assurance that management requires information and respond quickly to problems and failures.

In many cases, the leadership feels that the results of measurements are unreliable and inaccurate information²¹. Results are then considered to be poor basis for making decisions and are not used actively. Many successful companies have tried to avoid this problem is starting work on the measurement of

²⁰ A review of research on cost of quality models and best practices, A.Schiffauerova, V.Thomas, International journal of quality/reliability management, 2006.

²¹ Understanding the language of quality costing, S.Roden, B.G.Dale, The TQM magazine, 2000.

the small scale measures in order to build experience and develop the ability to create an appropriate system of measurement later.

The best opportunity for introducing the system of measuring the very start. Companies that have had unsuccessful attempts often encounter serious problems when trying to begin again with new methods, because employees are not convinced in advance of what can be achieved. This means that the introduction of measuring costs should be well planned and prepared.

Companies which are mainly production oriented usually reveal that their costs are higher than those in the service-oriented businesses. This probably can be explained by the fact that it is easier and more acceptable measure these costs in production. The highest costs are usually reported in those companies that have developed the best methods of measurement. This indicates that the costs should be used for comparison between different companies, only if it can be used to identify identical methods of data collection.²²

10. CONCLUSION

Costs are significant areas of interest the company, not only in times of crisis, what is today but always. Profits are realized only if the income from the sale of goods or services exceeds the amount of production costs that should be expended in the production thereof²³. Knowledge of functions and how changes in the cost of present and future is an important factor in pricing, product profitability, but also when forming the company strategy, which says one of Porter's strategies for achieving sustainable competitive advantage, where the main setting that the costs are lower than cost competition.

However, for many companies cost represents a significant difficulty, due to the lack of an adequate monitoring system, lack of

²² „Some of difficulites in measuring the cost of poor quality“, A.Kokic-Arsic, O.Jankovic, the Festival of quality, Kragujevac, 2005.

²³ The direct and indirect impact of product quality on financial performance: A causal model, Lassaad Lakhil, Faderiko Pasin, Total quality management, Routledge, 2008.

motivation of staff for this kind of business or simply lack of knowledge, business and other cultures.

Monitoring costs and their objective measurement sets new challenges in terms of questioning whether an act, whether it is decided based on the facts and whether the analysis conducted, and whether, in accordance with the conclusions of the analysis run and implement appropriate action.

In modern businesses require most related to the identification and tracking of costs, in a certain way, but observed and applied to some extent, however, correctly sizing problems and timely implementation of appropriate procedures is the basis on which to distinguish successful from those who are to a lesser extent.

REFERENCES:

- [1] A. Kokic Arsic, O. Jankovic , "Some of the difficulties in measuring the cost of poor quality," , Festival of quality, Kragujevac, 2005.
- [2] Dr. Miodrag Lazic , "TQM tools and techniques of quality," , Production Mechanical Engineering Department, Faculty of Mechanical Engineering in Kragujevac, www.cqm.co.yu/ii/materijal/TQM/kolor/Tema2_tqm%20alati.pdf
- [3] Mine Omurgonulsen, A research on the measurement of quality costs in the Turkish food manufacturing industry, Total quality management, Routledge, 2009.
- [4] A.Schiffauerova, V.Thomas, A review of research on cost of quality models and best practices, International journal of quality/reliability management, 2006.
- [5] S.Thomas Foster Jr., An examination of the relationship between conformance and quality-related costs, International journal of quality&reliability management, 1996.
- [6] V.Sower, R.Quarles, E.Broussard,, Cost of quality usage and its relationship to quality system maturity, Internatioanl Journal of Quality & Reliability management, 2007.
- [7] Ching-Chow Yang, Improving the definition and quantification of quality costs, Total quality management, Routledge, 2008.
- [8] S.K.Krishnan, Increasing the visibility of hidden failure costs, Measuring business excellence, 2006.
- [9] ISO / TR 10017:2007 - Guidelines on statistical techniques for ISO 9001:2000, Serbian Institute for Standardization, 2007.
- [10] Ilija Nikolic Case with Reliability, electronic script, Faculty of organizataion science, 2005.
- [11] I. Janicijevic, J.Omerbegović-Bijelović, Presentation of the subject methods and techniques of quality management, Faculty of organizataional science, 2008.
- [12] Wen-Hsien Tsai, Quality costs measurement under activity-based costing, Internatioanl Journal of Quality & Reliability management, 1998.
- [13] Qiang Su, Jing-Hua Shi, Sheng-Jie Lai, Research on the trade-off relationship within quality costs: A case study, Total quality management, Routledge, 2009.
- [14] Lassaad Lakhel, Faderiko Pasin, The direct and indirect impact of product quality on financial performance: A causal model, Total quality management, Routledge, 2008.
- [15] S.B.JAju, R.P. Mohanty, R.R. Lakhe, Towards managing quality cost: A case study, Total Quality Management, Routledge, 2009.
- [16] S.Roden, B.G.Dale, Understanding the language of quality costing, The TQM magazine, 2000.
- [17] Web: [en.wikipedia.org / wiki / histogram](http://en.wikipedia.org/wiki/histogram),
- [18] Web: http://en.wikipedia.org/wiki/Fishbone_diagram, fishbone diagram,