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Methodology for Quality Assessment. Application Of Qualimetric Analysis.

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ABSTRACT: The article analyzes the main issues of quality assessment methodology and the application of qualimetric analysis. The stages and procedures for the qualimetric assessment of products and services are considered, the formation of the composition of the expert and working groups, which is considered one of the most important procedures that determine the reliability and accuracy of the qualimetric assessment of an object. A detailed description is given of the assessment of quality indicators of the object under study, which is of great importance when choosing the correct rating scale, i.e. qualimetric scales.

KEYWORDS: qualimetry, quality assessment, qualimetric analysis, quality examination, determination of the assessment situation, quality indicators, qualimetric scale.

I. INTRODUCTION

Improving quality is one of the most important economic and political tasks at the present stage of development of social production. An effective lever for solving this problem can be the introduction of methods for objective quality assessment.

Qualimetry is a new scientific field that studies and develops the principles and methods of quantitative assessment of quality. Numerous domestic and foreign quality assessment methods are based on general principles of qualimetry and contain similar stages and procedures for qualimetric assessment of products and services. There are usually four stages:

1. Organizational and preparatory stage;
2. Development of methodology, methods and procedures for assessment;
3. Quality examination;
4. Processing the results of the examination and drawing up an expert opinion.

Each of the listed stages contains a number of procedures, which in turn can be divided into specific operations. Let's consider the most common procedures inherent in each stage.

II. RELATED WORK

The organization of work, as a rule, begins with issuing a task to develop a methodology for assessing the quality of a specific object. The task is determined by the purpose of the assessment and is formed by the person (DM - decision maker), in whose practical activities the quality assessments obtained using the developed methodology will be used. This person may be a chief development engineer, a sales manager, or a representative of an organization that finances the development or commercialization of products [1].

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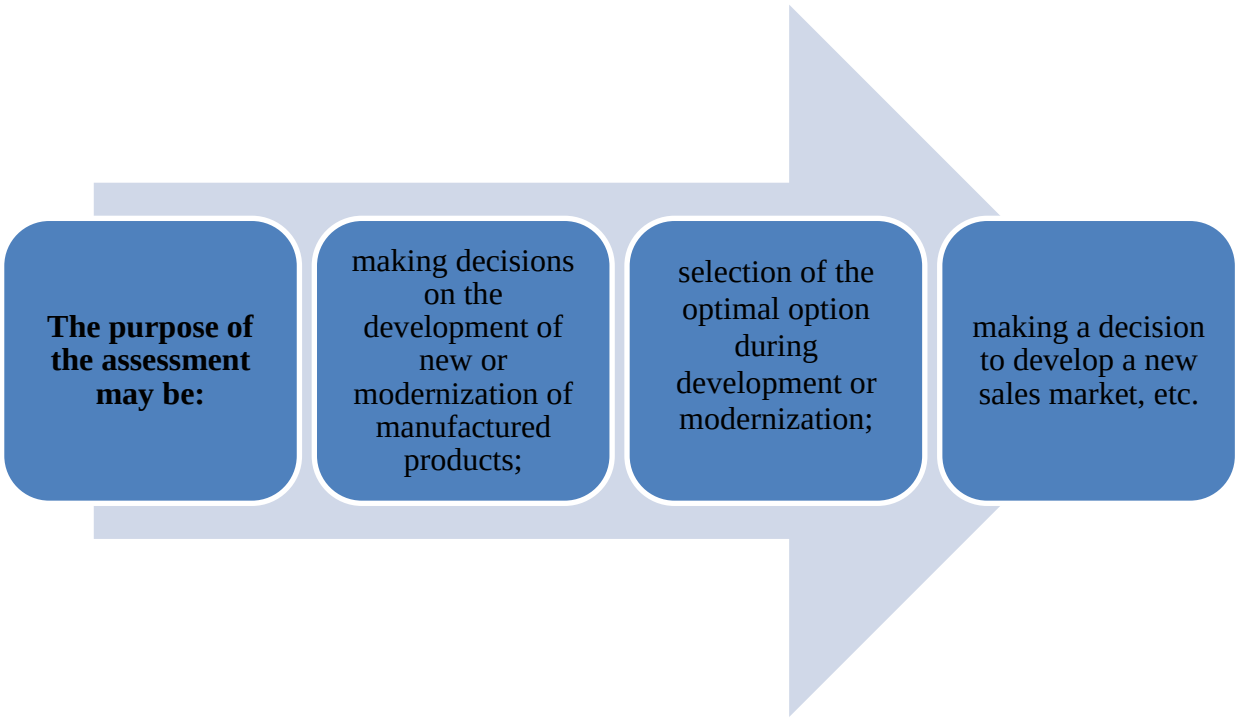

Fig.1. Assignment to develop a methodology for assessing the quality of a specific object.

A mandatory procedure at the first preparatory stage is "Defining the assessment situation." The essence of this procedure is that the immediate supervisor of quality assessment work (LRO - the person developing the assessment), having received from the customer (DM) a task to conduct a qualimetric assessment, clarifies all issues related to this task. This is necessary so that the developer has sufficient information:

- about the process of using the assessed object;
- about properties to be included in the list of evaluated ones;
- about the process of using the values of quality indicators that will be obtained as a result of qualimetric analysis.

III. EXPERIMENTAL RESULTS

Forming the composition of expert and working groups is one of the most important procedures that determines the reliability and accuracy of the qualimetric assessment of an object. *The expert group is a collection of qualified specialists who have the necessary knowledge and practical experience relating to the object being assessed, and are organized for expert assessment of the quality of this object. The working group is a collection of specialists under the leadership of the LRO, organizing the activities of the expert group and processing expert judgments about the quality of the object.*

The formation of an expert group consists of determining its structure (for example, there may be several subgroups specializing in assessing various groups of indicators), professional composition, number of experts and selection of experts.

The professional staff of specialists must provide a comprehensive analysis of the problem being solved. When selecting experts, an analysis of their compliance with the requirements must be carried out. Experts must equally understand the goals and objectives of assessing the quality of an object, satisfy the requirements of competence, interest, efficiency and objectivity [1,2].

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Expert competence implies good knowledge of the object being assessed (professional competence) and assessment methodology (qualimetric competence). Interest is determined by the possibility of using the results of work in the expert commission in one's practical activities. Efficiency means composure, efficiency in work, validity of judgments. Objectivity is determined by the ability to make unbiased judgments

At the second stage of qualimetric analysis, the selection of methods, methods and assessment procedures is carried out. It is carried out by a working group, which must take into account the characteristics of the object being assessed, the established deadlines for completing the work, its complexity, and areas of possible use of the results obtained. Based on the purposes of the assessment, available information, selected methods, methods and assessment procedures, a list of operations that must be performed by experts is determined.

Survey methods are used to obtain expert opinions. A survey is a way to identify expert judgments on the quality of an object. Survey methods are divided into group (the entire group is surveyed) and individual (each expert is surveyed separately). Survey procedures include interviewing, questionnaires, and mixed surveys. When interviewing, the expert's judgment is revealed during the conversation within the framework of a certain plan.

The third stage of work is carried out by an expert group, whose members express their judgments in accordance with the methods, methods and procedures established at the second stage [3]. At the fourth stage, expert judgments are processed, absolute, relative and complex quality indicators are determined, and a conclusion is drawn up on assessing the quality of the object.

When assessing the quality indicators of the object under study, the correct choice of the rating scale is of great importance. In qualimetry, the concept of scale is used in a mathematical sense, i.e. as a method for assessing and comparing the properties of various objects.

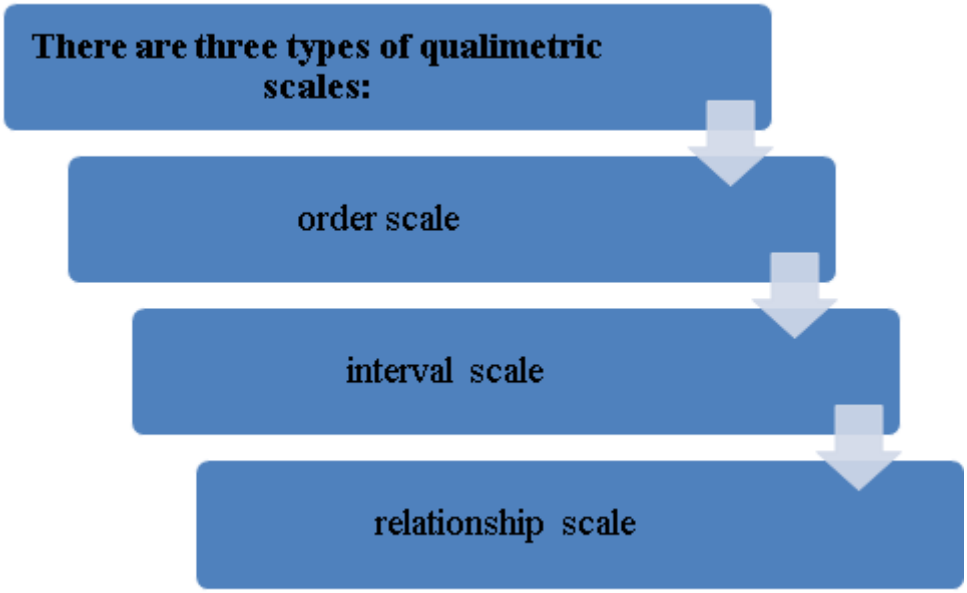

Fig.2. Main types of qualimetric scales.

An order scale is an assessment method in which assessment objects are arranged in order of increasing or decreasing the value of a parameter or properties of an object, and the method of determining the order of arrangement is not related to any numerical characteristic of the objects. A classic example is the assessment of mineral hardness based on the Mohs scale.

The Mohs scale of relative hardness of minerals consists of 10 hardness standards: talc -1; gypsum - 2; calcite - 3; fluorite - 4; apatite - 5; ortho-eye - 6; quartz - 7; topaz - 8; corundum - 9; diamond - 10. Relative hardness is determined by scratching the surface of the test object with a standard. Typically, an order scale is used when there is no method that allows assessment in established units of measurement. Another example is the organoleptic

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assessment of product quality indicators (taste of a food product, fabric color, font legibility, fashionability) using a point rating scale.

Point scale – serves to assign quantitative characteristics to the assessed property, which are a measure of this property. The main characteristic of the point scale is the range - the number of gradations that the scale includes, that is, the number of evaluation points. At the same time, the scale, that is, the difference between the scores corresponding to two adjacent gradations, does not matter.

For example, a scale with a top score of 5 points with gradations of 0.5 points has the same range as a scale with a top score of 10 points with gradations of 1 point or a scale with a top score of 100 points with gradations of 10 points. All listed scales are 10-point (provided that a score of 0 is not used).

The number of gradations of the applied scale is determined based on the nature of the problem being solved, taking into account experience in assessing the quality of similar products, the number of experts participating in the work, the required accuracy of the result and the possibilities of qualitative description of quantitative gradations. For expert assessment of quality, as a rule, scales with an odd number of gradations are used, in which there is an average level [4]. The most preferable are scales with five and seven gradations of quality according to the property being assessed, and the number of gradations may coincide (option 1) or not coincide (option 2) with the number of points (*Table 1.*).

Table 1.

Gradation	**Points**	**Option №1** **Qualitative assessment** **Option №2** **Very high quality**
Option №1		
5	5	Great quality
4	4	Good quality
3	3	Medium quality
2	2	Poor quality
1	1	Very bad quality
Option №2		
7	100	Very high quality
6	85	High quality
5	70	Above average quality
4	55	Medium quality
3	40	Below average quality
2	25	Low quality
1	10	Very low quality

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An interval scale is an assessment method in which the essential characteristic is the difference between the values of the evaluated parameters, which can be expressed by the number of units established in this scale. In this case, the starting point can be set arbitrarily. An example of an interval scale is the Celsius temperature scale.

In the Celsius scale, the temperature at which ice melts is taken as the starting point. The interval between the melting temperature of ice and the boiling temperature of water is divided into 100 equal intervals - degrees. With this unit, the entire Celsius scale is divided into degrees in the positive and negative directions.

The interval scale is used to characterize such product properties that are associated with temperature conditions, for example, the minimum operating temperature and operating temperature range of cryoinstruments, frost resistance of artificial leather, and the minimum temperature of the freezer.

A ratio scale is an assessment method in which a unit of measurement is used and, therefore, the value of the parameter being assessed can be represented as:

$$Q = q * N ,$$

where, Q is the value of the estimated parameter,

q - unit of measurement,

N is a positive number, which is a quantitative characteristic of this parameter.

IV. CONCLUSION

With the right approach at an enterprise to assessing the quality of manufactured products, the role of a qualimeter engineer in ensuring its quality and competitiveness can become enormous. He must correctly identify consumer requirements and forecast their changes for a sufficiently long period of time necessary to restructure production. In the order scale, logical operations are possible, but arithmetic operations are not possible. If the value of a product parameter measured on an order scale is greater for the first type than for the second, and greater for the third than for the first, then we can conclude that the value of this parameter for the third type is greater than for the second. However, in both cases it is impossible to say how much more [5,6]. This can be done by using an interval scale. On a graduated scale, the difference between any two parameter values can be determined. Therefore, it is impossible to determine how many times the value of one parameter is greater than the value of another. This can only be done using a ratio scale. In this sense, the ratio scale is the most perfect and allows any arithmetic operations. The ratio scale is applicable to most parameters that are physical quantities: size, weight, density, force, tension, frequency, etc.

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