# Application of the Quality Management Methods and Tools in the Operation of Electrical Equipment

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***Abstract*—The basic quality management methods and tools widely accepted in various types of international organizations are considered. These methods can be successfully used in today's environment in domestic organizations during the electrical equipment operation and the other product life cycle stages. Recommendations on the use of various management and engineering quality tools are presented.**

***Keywords—quality management; quality management methods and tools; quality management and engineering methods***

## I. INTRODUCTION

The import substitution industrialization processes implemented by the Government of the Russian Federation provide the domestic electrical enterprises opportunity for rapid development. In this context, quality management tools should be actively used in Russian electrical industry enterprises to achieve strategic goals and increase their competitiveness.

Quality management is being increasingly implemented not only at domestic production plants but also in the other organizations of various fields. In Russia, the concept of quality traditionally comes down to product quality as one of its important components. However, understanding the quality in relation to the organization processes (quality management, production quality, etc.) is much more complicated and wider. Ideas for developing quality management solutions that require improving the production plants activities, processes, product quality and quality systems were actively developed by E. Deming, J. Juran, A. Feigenbaum, F. Crosby, K Ishikawa, G. Taguchi and other well-known specialists. Sustainable organization development is impossible without continuous improvement of management, processes, resources optimization, as well as without constant organization's personnel training quality management methods and tools. Russian enterprises lag behind their foreign competitors in implementing advanced quality management tools and methods, although this issue in our country has its own history, huge potential and has been developing since the beginning of the twentieth century.

## II. MAIN PART

The current development of quality management means and methods in international practice demonstrates many concepts, methodologies and tools. There are various approaches in the literature to their classification. In any case, in this amount, as in any systematics, one can single out a specific upper level of quality management tools and methods, which includes so-called concepts (methodologies, philosophies, theories) and models, among which, as the most famous examples, we can list following [1]:

- The philosophy of "Total Quality Management" (TQM);
- Toyota Production System – TPS;
- The concept of "Lean Production" (LP);
- "Theory of Constraint" by Goldratt (TOC);
- KAIZEN concept;
- The concept of Six Sigma (SS);
- Problem Solving Methodology (Global 8D);
- Balanced Scorecard (BSC);
- Benchmarking;
- Business Process Reengineering ( BPR);
- Models of quality systems based on international standards, including industry standards.

It's hard to argue with the number of expert's opinion [2, 3] that the trend on reengineering has now passed. Today, it has evolved from destructive power into one of the ways to organization restructuration.

Organizations successfully using various methods of quality engineering (engineering methods to improve quality) [4]:

- Statistical quality control, (SQC), including SPC – Statistical process control (GOST R 50779.40 and others); Selective statistical control (GOST R 50779.30 and others);
- Process capability;
- Risk management;
- Hazard analysis and risk assessment;
- Failure Mode and Effect Analysis – (FMEA);
- Methods of Geniti Taguchi;

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- Quality Function Deployment – (QFD);
- Failure Trees Analysis (FTA);
- IDEF, ARIS and other methods of process modelling;
- Q7. Seven “simple” quality tools (Ishikawa diagram, checklist, stratification, histogram, Pareto diagram, scatter (dispersion) diagram, control charts);
- N7. Seven “new” quality tools (program implementation process diagram, affinity diagram, tree diagram, matrix diagram, matrix data analysis, relationship diagram, arrow diagram);
- Brainstorming;
- SWOT analysis and many other tools.

In our opinion, the most suitable tools for electrical equipment operations are Q7, N7 and SQC.

An important factor for the effective application of management and quality engineering methods is the correct tools selection depending on the product life cycle stage.

With the increasing knowledge-intensive production and the transition to the creation of the project-oriented product, the products cannot be usually delivered without providing related services. It is not only about warranty service, but also about the other product operation stages where being serviced and repaired, and which is of the greatest importance among the life cycle the stages, both in terms of duration and cost.

Therefore, a high personnel competence in matters of selection, development and using of management and quality engineering methods is required. In accordance with this, managers and quality specialists should be well versed in the above methods of management and quality engineering. Each manager (and the quality manager too) must understand (must be competent) in basic statistical methods:

- Process algorithms (flowcharts);
- Ishikawa diagrams;
- Checklists;
- Histograms;
- Pareto diagrams;
- Dispersion diagrams;
- Control cards;
- Factorial experiment design, etc.

He should also be able to describe, maintain and improve the quality management system, diagnose it and decide:

- what variations are recognized as special and require actions from the higher level of management;
- what variations are recognized as common and require action from the senior management level,
- as well as lead teams with different educational levels, etc.

At the same time, it had to be recognized that there are problems in the domestic electrical industry with enterprise management associated with an ineffective organizational structure. Insufficient attention is paid to statistical quality management (SQC), statistical process control (SPC), experiment planning (DOE, design of experiment) and quality function structuring (QFD).

## III. Conclusion

As already noted, the considered quality management and engineering methods can be successfully used in different combinations at each stage of the full product life cycle.

It should be emphasized that many of the above quality engineering methods and tools can be used in the enterprise's management system of any industry. However, some enterprises try to use quite sophisticated quality management and engineering methods, such as Six Sigma, Kobayashi's 20 Key Management, Taguchi methods, and to face with difficulties in implementing and supporting methods, and problems with finding significant resources.

If the enterprise’s resources are limited, for continuous improvement the management system processes, managers should first use the simplest, but effective quality management and engineering methods, such as: streamlining “5S”, seven “simple” quality tools, Kipling's method, Five Why? method, etc. Implementation of sophisticated management and quality engineering methods quickly leads to staff frustration and stop using these methods.

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