



## **Efficiency of Quality Management System's Application In The Enterprises of Light Industry**

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### **Abstract**

*The problems of assessment of quality management system's (QMS) application efficiency in the enterprises of light industry are considered in the thesis. Mutually related hierarchy of the processes is established on the basis of structural-functional analysis of quality management system. The opportunities of improvement of processes are indicated on the basis of assessment of importance of the expenses for processes. Efficiency of the application of quality management system in the enterprise has been approved.*

**Key Words:** *Quality management system, efficiency, importance, effectiveness, hierarchy, structural-functional analysis, quality costs.*

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Specialized private enterprise– Sumgayit Textile LLC equipped with modern equipment and technologies was chosen for realization of quality management system in the enterprises of light industry.

Products of this enterprise are meant for different consumers – from state orders for needs of Ministry of Defence to individual customers as well. Realization of studies in the practice is carried out according to the following sequence:

- 1. Establishment of QMS processes' hierarchy.** The hierarchy intends for establishing of functional SADT models of mutually related processes of structural divisions.
- 2. Defining expenses for implementation of processes.** Calculation and analysis of the expenses used for processes, as well as comparison of calculation results with technical-economic indicators of the sections are intended in this section.
- 3. Assessment of the importance of processes.** Establishment of double comparison matrix that defines the importance of processes, defining of the importance of these processes in the effectiveness of QMS and expert assessment of the results is carried out in this section.
- 4. Functional analysis of the processes.** A comparison of expenses and importance in the processes of departments is carried out, as well as which process is required to be improved is defined.
- 5. Selection of optimal variant for improvement of processes.** Drawing of morphological tables for solution of the problem of optimization of the process selected on the basis of FDA, selecting effective variant of improvement and to make recommendations about improving the process is intended here.
- 6. Tests of process software.** Checking of used algorithms in the practice, entry of initial data

and creation of database is carried out in this section. Process-functional process building, calculation of expenses for the processes and selecting of optimal decisions on the basis of forming morphological tables.

**7. Complex assessment of QMS efficiency**– is carried out through the examination of all special methods represented in the complex assessment.

Verification of the developed methods in the practice is the initial stage for establishing hierarchy of QMS processes. Establishing of the hierarchy of processes is carried out according to QMS structural-functional analysis method, principles of establishing hierarchy, as well as characteristics of production in the weaving factory.

Existing documentation system of QMS, structural scheme of the factory, QMS processes and mutual relations among processes of the sections are taken into account. Established hierarchy of QMS processes of weaving goods production factory is given in Figure 1. As it is seen, 3 levels of the hierarchy are analogical with the first 3 levels of principal hierarchy of QMS processes.

**Level 1**– purpose of the analysis:  $E_1^1$  – is considered the effectiveness of quality management system.

**Level 2**– criteria of QMS effectiveness:  $E_1^2$  – production of goods that satisfy the requirements of consumers;  $E_2^2$  – adequate demonstration of the ability to ensure product quality;  $E_3^2$  – economic efficiency and competitiveness of the enterprise.

**Level 3**– **Main** processes of QMS according to ISO 9001-2001 requirements:  $E_1^3$  - Management of QMS;  $E_2^3$  – ensuring management's responsibility;  $E_3^3$  – provision of resources management;  $E_4^3$  – management of product life-cycle processes;  $E_5^3$  – measurement, analysis and improvement.

Further structurization of hierarchy is carried out by taking into account functional characteristics of the processes which are implemented in the enterprise. 4th Level is presented as the processes of 1st and 2nd levels at the same time. A relevant structure selected from several processes corresponds for each main process of QMS indicated in the 3rd level of hierarchy.

Number of processes within QMS main processes is defined by enterprise standards (ES). Enterprise standards must meet the requirements of relevant sections of ISO 900-2001 and be developed according to the characteristics of weaving factory.

Thus, 6 processes for implementation of  $E_1^3$  (management of quality system) main process of QMS; 7 processes for  $E_2^3$  (ensuring management's responsibility); 9 processes for  $E_3^3$  (provision of resources management); 14 processes for  $E_4^3$  (management of product life-cycle processes); 9 processes for  $E_5^3$  (measurement, analysis and improvement) have been developed. Conventional signs of processes and list of ES have been worked out.

Processes implemented at the departments of weaving factory are represented in the 5th level of hierarchy. The processes of those departments are indicated on the basis of responsibility delegation matrix for QMS processes.

**Mentioned processes are indicated with the following conventional signs:**  $E_1^5$  – processes of Logistics Department (LD);  $E_2^5$  – processes of production management department (PMD);  $E_3^5$  – processes of accounting records department (ARD);  $E_4^5$  – processes of energy-mechanical center (EMC);  $E_5^5$  – processes of engineering center (EC);  $E_6^5$  – processes of scientific and technical committee (STC);  $E_7^5$  – processes of personnel management department (PMD);  $E_8^5$  – processes of information technologies department (ITD);  $E_9^5$  – processes of economics and marketing department

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 (EMD); E<sub>16</sub><sup>5</sup> – processes of technical control department (TCD); E<sub>17</sub><sup>5</sup> – processes of factor laboratory (FL).

<b>The goal</b> - effectiveness of quality management system
<b>Criteria</b> - production of goods that meet the requirements of consumers: - adequate demonstration of the ability to ensure product quality; - improvement of economic efficiency and competitiveness of the factory
<b>Main QMS processes</b> Quality Management System (QMS) (Section 4); – ensuring management's responsibility (Section 5); – provision of resources management (Section 6); – management of product life-cycle processes (Section 7); – measurement, analysis and improvement (Section 8).
<b>1st and 2nd Level QMS processes</b>
<b>Processes of structural divisions</b>

**Figure 1.** Hierarchy of processes in textile factory: According to the requirements of ISO 9001-2001 standard process-functional model of QMS is presented as the models of mutually related processes (Section 3.1). Similar model network of the processes operating within the departments of textile factory is established [1-3].

**Resources spent for QMS processes:** For calculation of expenses incurred for the processes of structural divisions of a textile factory FDA analysis of processes should firstly be conducted. Expenses for implementation of processes in the divisions should be defined and then degree of importance of these processes should be compared.

Using the method of calculation of expenses for the processes, initial data of the enterprise was gathered, calculations of the expenses spent for the processes was done, relevant analysis was carried out and the results were compared with technical-economic indicators of divisions' performance.

Quality service of the enterprise have organized all divisions' process executives' filling in the tables according to the data collection scheme. Trainings were carried out and instructions developed for all responsible executives for explaining the characteristics of the expenses incurred for the processes and filling in the tables.

The tables filled in with introductory information on all the processes as per each department of the enterprise are compiled. Introductory information of 124 processes' expenses over the whole enterprise have been defined. According to the information filled in the tables, for implementation of processes of the structural divisions all necessary calculations have been done by using formulas of cost determination method and the results have been indicated in the tables of expenses of the processes carried out in the departments.

It was determined that expression of quality costs by an absolute price for unambiguous assessment is inappropriate. That is why it is advisable to measure quality costs assessment criteria by a relative quantity. For example, the following relative quantities may be used during the analysis of spinning department's processes:

- ratio of quality cost groups;
- ratio of quality costs actual cost of the workshop;
- ratio of non-compliance costs to compliance costs.

The structure of expenses incurred for the processes in the textile factories is given in Table 1 as a sample.

The analysis showed that, quality costs forms 22,95% of the whole expenses incurred for the processes of spinning department. Quality costs have increased 85,83% in comparison to the previous period. The largest increase (+146,24%) in relative share of expenses incurred to the processes is observed in inspection and testing costs, and they have led to increase of quality costs as a whole.

Comparison of quality costs showed that, costs of preventive measures has the largest share (41,1%), costs for internal losses have a share close to this (38,94%) (Table 2), (Figure 2).

**Table-1: The structure of costs incurred for the processes in a textile factory, Manat**

Category of costs	March, 2014		November, 2014		Increase (+), decrease (-), %
	manat	%	manat	%	
Normal activities	989809.27	87.65	1208899.56	77.04	-12.10
Preventive measures	66029.01	5.85	148042.81	9.44	+61.34
Inspection and tests	21047.89	1.86	71877.73	4.58	+146.24
Internal losses	52415.39	4.64	140229.56	8.94	+92.67
External losses	0	0.00	0	0.00	0
Costs for processes	1129301.56	100	1569049.66	100	
All quality costs	139492.29	12.35	360150.10	22.95	+ 85.83

**Table-2: The structure of quality costs in a textile factory, %**

Category of costs	March, 014	November, 2014	increase (+), decrease (-)
Preventive measures	47.34	41.10	-13.16
Inspections and tests	15.09	19.96	+32.53
Internal losses	37.57	38.94	+3.51
External losses	0	0	0
Quality costs	100	100	

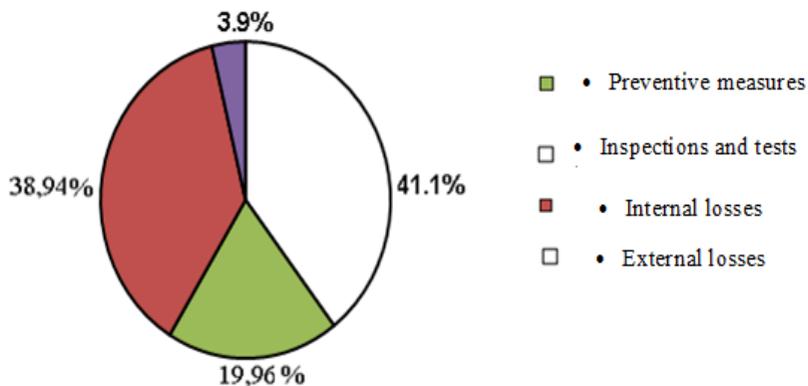


Figure-2. The scheme of quality costs for November, 2014 in textile factory

Thus, the analysis shows that it is necessary to try decrease internal losses by increasing

preventive measures, in other words to turn the direction of costs on reduction of internal losses. The structure of quality costs of each process was analysed in a similar way in the sections. Compared to the previous period, a slight increase in the costs for inspection and tests, as well as in internal losses was observed (Figure 3).

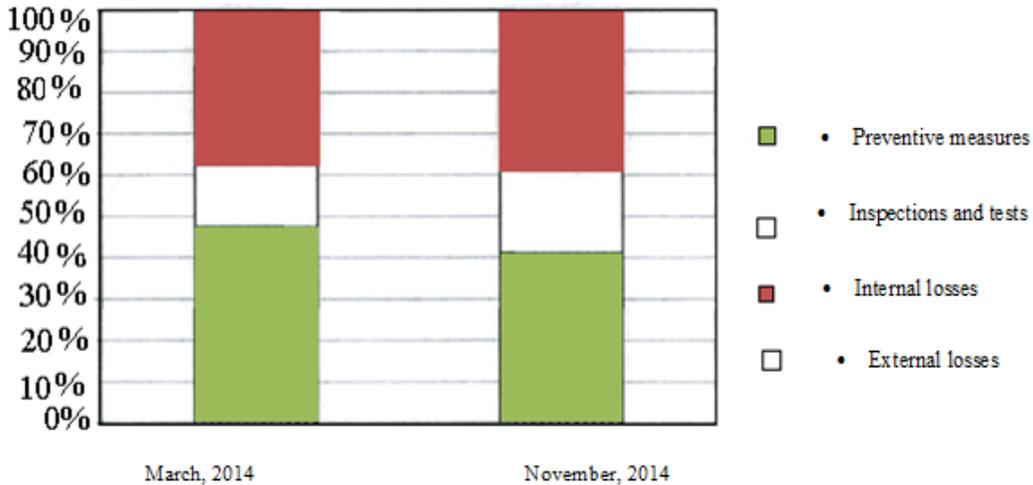


Figure-3. Comparative scheme of quality costs in the textile factory

It should be noted that increase of costs for internal losses is in fact an alarming problem, but this increase is related with intensifying control over the processes and defining more discrepancies. In the period of application of quality cost records system internal losses may have larger share in comparison to other cost parameters, but over time its downward trend is more important.

In order to compare quality costs with business performance of the spinning department, quality costs are divided into the actual value:  $(\text{costs})/(\text{actual value}) = C_k / C_f \times 100 \%$  ;

Here  $C_k$  – quality costs in the period of analysis, manat;  $C_f$  – actual value for the period of analysis, manat;  $(\text{costs})/(\text{actual value}) = 360150,10 / 1554302,77 \times 100 \% = 23.2\%$ .

Thus, total amount of quality costs in the textile enterprises comprises 23,2% of the product's actual value for November, 2014. According to the opinion of quality experts [4-6], quality costs in the weaving factories in Azerbaijan may have up to 30% share of gross production expenses. Therefore the enterprise must study quality costs (especially internal and external losses) more seriously. Ensuring continuous performance of the equipment (50% of quality costs) and product warehouse storage processes (52,63%) have the largest share of quality costs.

It is necessary to make a balance of quality compliance and non-compliance costs in the textile factory in order to get more reasonable recommendations. The results of such an analysis are given in Table 3 and Table 4. It was defined that, the largest quality non-compliance costs are observed in the process of fabric production and minimal costs in the processes of ensuring equipment performance.

Thus, defining costs for the processes allows to find out the trend of quality costs generally and as per separate cost groups, as well as the areas that require improvement.

**Table-3: Quality compliance and non-compliance costs in the textile factory**

Name of the process	Compliance costs		Non-compliance costs	
	manat	share in quality costs, %	manat	share in quality costs, %
1.Spinning process (1st process)	38270,46	70,26	16202,01	29,74
2.Weaving process (2nd process)	23448,91	43,77	30127,19	56,23
3.Dyeing process (3rd process)	15914,12	17,43	75364,52	82,57
4.Enterprise management process (4th process)	9980,28	66,67	4990,14	33,33
5.Organization of labour process (5th process)	2226,02	66,67	1113,01	33,33
6.Production planning process (6th process)	925,5	75,00	308,5	25,00
7. Process of technological preparation of the production (7th process)	7518,72	66,67	3759,36	33,33
8.Process of operational preparation of the production (8th process)	4620,12	75,00	1540,04	25,00
9.Process of equipment's work provision (9th process)	108196,17	99,13	944,63	0,87
10.Process of product storage (10th process)	8820,24	60,00	5880,16	40,00
Total	219920,54	61,06	140229,56	38,94

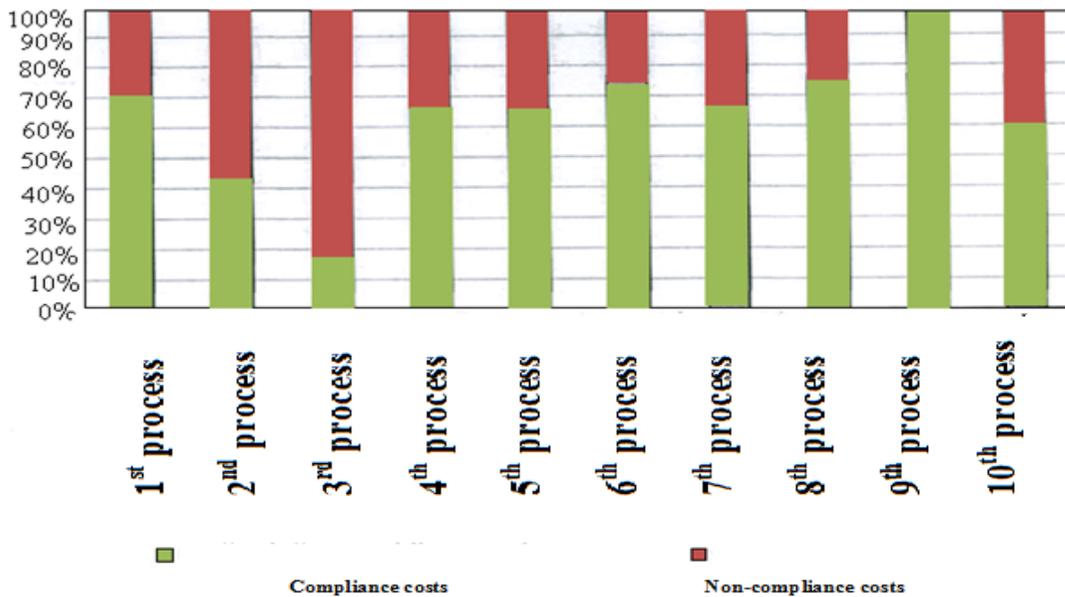


Figure-4. Balance of quality compliance and non compliance costs in the textile factory

Results of total expenses incurred for textile factory processes, calculated on the basis of application of the proposed method are compared with technical-economic parameters acquired through traditional accounting records: costs for the processes of spinning workshop were 1569049,66 manats; indicator of actual value of the workshop was 1554302,77 manats. The proximity of results got in both methods of costs' calculation proves that there were no mistakes in application of the method proposed for defining costs incurred for the processes.

All the processes of structural divisions of textile products manufacturing enterprise were analysed in the same way and all enterprise-wide data were generalized. It was defined that, the processes of Logistics Department (LD) and Economics– Marketing Department (EMD) have the largest share of quality costs. The costs of Technical Control Department (TCD) and central factory laboratory (CFL) should also be considered quality costs in full amount.

It was determined that losses arising from quality non-compliance all over the enterprise is 1232113,54 manats in total. This figure is a part of the enterprise's profit (gross profit 6%). Logistics Department and spinning processes have the largest share in quality non-compliance costs. **Result.** The network and hierarchy of mutually related models of QMS and processes of structural divisions were established in the factory on the basis of structural-functional analysis of Quality Management System. This hierarchy allows to connect the processes implemented in the structural divisions of the enterprise with QMS's functional performance processes that meet the requirements of ISO 9001-2001 standard.

The opportunities of the method of defining the expenses spent for implementation of the processes of structural divisions are have been showed in the example of a weaving factory. This method allows to make analysis of the quality costs incurred for the processes on the basis of calculations and define the processes to be improved, to follow the dynamics of quality costs and to compare quality costs with economic parameters.

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