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ECONOMICS OF QUALITY IN ENTERPRISES OF WOODWORKING INDUSTRY

Abstract: Quality provision and quality improvement in enterprises is not only technical and organizational problem, but it is important economic question. On the ground of acquaintance with fundamental approaches in quality cost management we can expressly argue that economics of quality should be not-detachable and key part of quality management. Consequently we draw attention on determination of contents of economics of quality and signify possible approaches of its application in functional quality systems. In paper we answered fundamental questions of quality cost management concerning arguments for use quality cost monitoring in quality management, quality costs, practical approaches and methods for monitoring of quality costs, reduction of losses from poor quality, etc. It is the enterprise' option which model of quality cost management choose.

Key words: quality costs, models for monitoring quality costs, quality management, process

11.1. Introduction

Economy of quality and its application in the proposal of concept of quality controlling is one of the important principles of TQM. In addition to the economic prosperity and quality of production there are important: business engagement and communication with stakeholders, change of the view on the business and the way of profit generating and overall business prosperity. We are talking about fair business with customers, suppliers, about a pleasant working environment for employees, good services, tolerant and motivating working atmosphere, motivation, appreciation of employees and so on.

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Small and medium-sized enterprises apply business ethics at developing a code of ethics. All their employees are involved into its content and subsequent implementation. These enterprises also specify the form of assessment of application of code of ethics in practice. According to the research results, small and medium-sized enterprises with a code of ethics have better economic results than their competitors. The cost of ethics introducing in business are low. In Slovak circumstances, a pressure on the implementation of codes of ethics in the form of internal company directives is getting stronger, which can lead to the improvement of the business environment. In spite of this process, development of ethical approaches in companies in Slovakia is needed.

So far the concept of controlling has been applied only in some companies in Slovakia. Despite this fact, expanding of controlling concept, its importance and the need is growing especially with the increasing of competition, growing emphasis on quality, costs and return on equity (SEDLIAČIKOVÁ 2010). Because the economics is getting more important and the main goal of quality management is to achieve, that quality has become a measurable, programmable controllable variable, controlling concept appears in the field of quality management as well – under the name of quality controlling (ŠATANOVÁ 2002).

Following the above, the objective of this scientific paper is to propose a methodology for using of the quality controlling and its application and verification in the chosen company of furniture industry.

The paper is divided into three parts. In the first part of this paper, on the basis of domestic and foreign literature it is presented the current situation in the field of quality controlling as a part of the company controlling and supporting quality management focused on the cost essence of the concept of quality controlling and on formulation of own theoretical conclusions on the subject.

The second part presents practical situation of solved problems presented by the survey using questionnaire method, which aimed to determine the level of understanding, implementing of quality controlling in small and medium-sized manufacturing enterprises in Slovakia.

In the third part it is presented the proposal of a model of concept for quality controlling for small and medium-sized manufacturing enterprises.

In conclusion, we present, that the contribution of proposed model is in detection and identification of quality costs, in defining the possibilities of monitoring, and detecting of weaknesses in manufacturing. Successful handling of the issue becomes an important step to the identification, detection and subsequent elimination of the problems (deficiencies). This can lead to improving the quality of processes in enterprise, and thereby to increase their overall efficiency and performance.

11.2. Issue

The quality controlling is sub-system of company controlling and also support tool for quality management, aimed at supporting the management oriented to the future, relating to minimize costs, processes quality improvement and thus also the customer satisfaction.

The aim of quality controller is to minimize costs by maintaining required quality standards. Controller together with managers must be able to participate in all projects leading to enterprise quality improvement in all business fields and to inform management about achieved results through regular reports.

The essence of the quality controlling is monitoring the costs of quality and assessing using models (Table 11.1):

- Model PAF.
- Model COPQ.
- Process cost model.
- Model Life-cycle costs (NENADÁL 2001).

Table 11.1. - Basic differences of cost quality models

Model Cost group	Model PAF	Model COPQ	Process cost model	LCC model
Internal failure costs	*	*	*	*
External failure costs	*	*	*	*
Appraisal costs	*		*	*
Prevention costs	*		*	*
Opportunity costs		*	*	*
Environmental costs		*		
Customer costs				*

Source: Nenadál, 2011

The classic model for quality costs is called PAF model (abbreviation of English words - prevention, appraisal, failure). The translation is a system for prevention, assessment and elimination of losses from poor quality production. The classification of the four main groups of costs allows clearly see how the costs of prevention and assessment recover by decreasing of poor quality production. The model is often presented in foreign literature. It is considered as traditional understanding of quality costs.

ISO standards and TQM concept presents process character of quality costs, thus a new understanding of these cost items, which represents a process cost model. This model observes process costs, i.e. the set of activities transforming inputs to outputs. This is an unconventional procedure, where it is not true, that the costs of prevention and appraisal cost by model PAF are the costs of conformity, and internal and external losses are the costs of non-conformity.

Next model in Table 11.1 is COPQ (from the English. costs of poor quality), which focuses on monitoring unproductive losses, and model of life-cycle costing is used to track costs by the user - the purchase, installation of the product during its entire lifetime.

11.3. Methodology

Based on the theoretical background of solved issues with a focus on cost essence of the concept of the quality controlling, for achieving the goal of paper, which is a proposal of methodology for the quality controlling, we used these methods:

- analysis of the current situation of the company,
- trend analysis,
- map of processes,
- model PAF and quality costs ratios,
- comparative method, allowing to detect variations in the quality costs, interaction and coherence of the investigated phenomena. This section presents the verification of the proposed methodology to the specific conditions of the furniture enterprise,
- synthesis, by which we evaluated the overall results, generalized the findings for business practice, and identified benefits for theory and practice.

11.4. Results and discussion

The paper presents a proposal of a methodology for implementation of the quality controlling in a furniture enterprise.

In the proposal of the structure of controlling managerial income, in the first step we obtained accounting data from general ledger and analysed translation device of managerial income, which the enterprise uses for monthly assessment of the results on the level of managers for individual departments and on top management. Default managerial income was categorized incrementally, starting from revenues through individual levels of cost to the profit. Total revenues are gradually deducted / adjusted by individual cost / benefit.

This current managerial income was adjusted by various corrections of costs and benefits, when divided the cost for variable and fixed costs. In relation to the quality, we proposed a new managerial income from controlling perspective.

In the next step of controlling application with a focus on quality, we defined the items of quality costs for specific accounts and documents, as they can be recorded. The aim was to observe the real costs and register them.

The following table shows the proposal of procedure, on which accounts it is possible to identify individual items of quality costs.

Table 11.2. The definition of quality costs according to the analytical accounts

Code	Quality costs item	No. account	Name of account	Responsible	Document
	Prevention costs				
P1	Selection, approval, evaluation of suppliers	512010	Travel costs to the limit	Purchasing manager	ID*
		512011	Travel costs to the limit - accomodation	Purchasing manager	ID
		521020	Indirect wages	Purchasing manager	ID
		524020	Social insurance - others	Purchasing manager	ID
P2	Internal audits	521020	Indirect wages	Quality manager	ID
		524020	Social insurance - others	Quality manager	ID
P3	External audits	518057	Other services - auditors	Quality manager	RI*
-	-	-	etc. to External failure costs	-	-

*Caption ID – internal document, RI – receipted invoice, etc.

Source: own study

The following Table 11.3 shows the interconnection of managerial income to the individual items of quality costs.

Table 11.3. Cost of quality in controlling income statement

No.	Item	Quality costs CQ
1.	Gross revenues - Swedwood company	
2.	Gross revenues - IKEA + domestic	
3.	Gross revenues - foreign	
4.	Gross revenues - all	
5.	Course losses, discounts	E1, E2
6.	Net revenues - all	
7.	Transport costs - sale	
8.	Direct material	I1, H4
9.	Direct wages - all	I1, I2
10.	Other direct costs	H1, H2, H3, H4, I1, I2, E3
11.	Transport costs - purchasing	
12.	Variable costs of sold products	
13.	Gross margin I.	
14.	Margin on material sales	
15.	Gross margin II.	
16.	Indirect material	E3
17.	Other personal costs	P1, P2, P4, H1, H2, H3, E1, E3
18.	Repair and maintenance	H6, E3
19.	Services	P1, P2, P3, P4, P5, P6, H5, E3
20.	Travel cost and representation	P1, E4
21.	Other operating costs	I4, E1
22.	Fixed costs	
23.	Other operating revenues	
24.	Activation of reserves, changes of reserves and correction	
25.	EBITDA	
26.	Depreciation	
27.	EBIT	
28.	Financial result	
29.	Extraordinary income and costs	
30.	EBT	

Caption:

Identification of cost items in managerial income sheet

Directly assignable costs to order

Indirectly assignable costs to order – by cost driver

I - Cost of Quality in the category "Costs of internal failures" identified by the serial number

E - Cost of Quality in the category "The cost of external failures" identified by the serial number

P - Cost of Quality in the category "The cost of prevention" identified by the serial number

H - Cost of Quality in the category "cost assessment" identified by the serial number

From the table above it is clear in which parts of managerial income are quality costs, i.e.:

- in variable costs, where they are mainly as the cost of internal failures associated with the consumption of direct material and direct wages,

- in fixed costs as well - indirect material consumption, general wages, travel costs, depreciation, and so on.

Identified costs are recorded at cost center "CQ" - the quality costs. If we want to know the costs of quality of the contract, these should be allocated from the Centre CQ to contract either:

- **directly** - i.e. there is a record that the costs were consumed on particular contract,

- **indirectly** – it is necessary to find a suitable key - cost-driver by Activity-Based-Costing when allocating fixed costs to activities (processes) and subsequently contracts

We quantified the quality costs according to defined methodology for period from 2007 to 2011. The results are documented in Fig. 11.1:

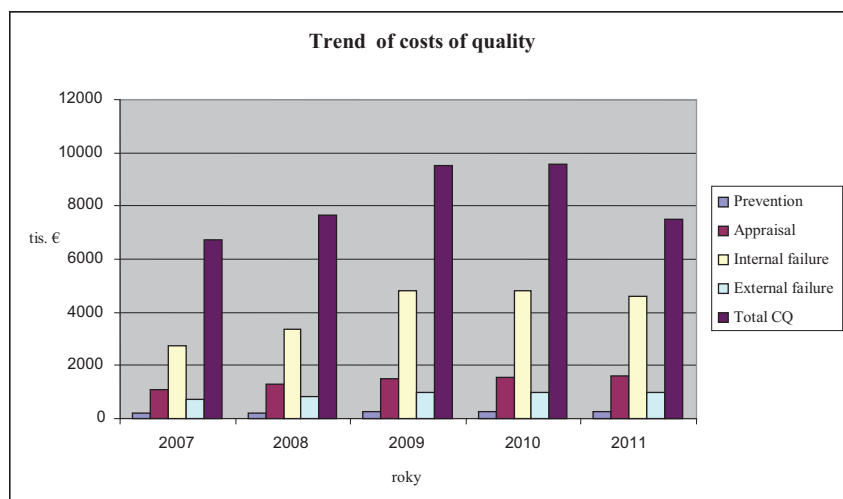


Fig. 11.1. Trend of costs of quality

Source: own study

Note: The data in Fig. 1 are shown in € (converted in accordance with the valid currency in the Slovak Republic at the time)

It follows, that over five years the quality costs have been increasing. The largest items are the costs of internal failures, the costs of evaluation and the cost of external failures. The costs of prevention are minimal. Quality costs were rising rapidly until 2009, when they stabilized. The growing trend was very significant by the costs of internal failures; we discovered them in the vast majority in direct material consumption – in the internal losses of low-quality production, which arise in production. Average structure of cost of quality in percentage is given in Fig. 11.2:

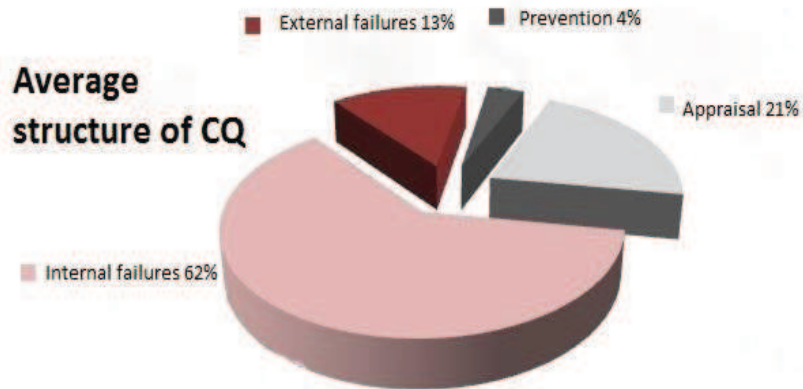


Fig. 11.2. Structure of costs of quality

Source: own study

The structure above shows that the costs of internal failures are an average of 62% of the total cost of quality. Together with costs of external failures they represent 75% of total cost of quality.

Appraisal costs are 21%, which is relatively high representation and it means that the company pays enough attention to quality and the quality is one of its strategic objectives. The quality objectives are based on the detecting of internal defects in processes, thus identifying the costs of internal failures reveals the areas where they need to be reduced. The costs for prevention are allocated only in the quality education, which is not entirely satisfactory, and representation of 4% in the structure of the quality costs is relatively low.

If the previous analysis had explanatory power and could be interpreted in terms of importance for the enterprise, it is necessary to supplement them with a calculation of quality indicators.

Indicators of quality costs are ratios that reflect the interrelations between monitored items and have an important explanatory power for any managerial review.

Table 11.4. Data available to calculate the costs of quality indicators

No.	Input data in thousands. €	2007	2008	2009	2010	2011	Average *
1.	CQ total	4744,20	5653,80	7517,10	7567,60	7505,50	6597,64
2.	Prevention (P)	193,40	213,10	253,10	244,30	278,20	236,42
3.	Appraisal (A)	1075,40	1285,60	1504,50	1546,40	1626,60	1407,70
4.	Internal failure (I)	2755,00	3348,90	4801,50	4808,60	4614,70	4065,74
5.	Internal failure VC (I _{VC})	2725,40	3313,30	4758,90	4757,40	4563,50	4023,70
6.	External failure(E)	720,40	806,40	957,90	968,40	986,00	887,82
7.	I + E overall	3475,40	4155,20	5759,50	5776,90	5600,70	4953,54
8.	Gross revenues*	43518,40	51670,30	64219,70	67315,30	65930,50	58530,84
9.	Overall costs	37070,00	42022,70	48739,90	52471,50	55821,30	47225,08
10.	Operating costs	33335,80	37653,40	44279,50	48376,43	51823,40	43093,71
11.	Variable costs	30131,70	34369,90	40082,00	44836,50	48251,70	39534,36
12.	External failure (E _D)	315,00	326,30	355,90	375,90	382,80	351,18

Table 11.5. Indicators of costs of quality

	Indicators						
1.	%CQ/TC	12,80%	13,45%	15,42%	14,42%	13,45%	13,97%
2.	%CQ/OC*	14,23%	15,02%	16,98%	15,64%	14,48%	15,31%
3.	%(I+E)/OC	10,43%	11,04%	13,01%	11,94%	10,81%	11,49%
4.	% I/OC	8,26%	8,89%	10,84%	9,94%	8,90%	9,43%
5.	% A/OC	3,23%	3,41%	3,40%	3,20%	3,14%	3,27%
6.	% P/OC	0,58%	0,57%	0,57%	0,50%	0,54%	0,55%
7.	% E/OC	2,16%	2,14%	2,16%	2,00%	1,90%	2,06%
8.	% I _{VC} /VC	9,04%	9,64%	11,66%	10,61%	9,46%	10,14%
9.	% QC/GR*	10,90%	10,94%	11,71%	11,24%	11,38%	11,27%
10.	% E/GR	1,66%	1,56%	1,49%	1,44%	1,50%	1,52%
11.	%E _D /GR	0,72%	0,63%	0,55%	0,56%	0,58%	0,60%

* *Caption: Average represents the mean value in 5 years*

Source: own study

Gross revenues* - for the purpose of evaluating CQ is necessary to use gross revenues adjusted for foreign exchange losses occurring in the sale. We start from the gross revenues, because from these are deducted the costs of external errors (601xxx-claim-credits)

OC-operating costs - consisting of variable + fixed costs + sold material (542xxx account)

VN-variable costs

I_{VC} - costs of internal failures of variable nature - it is a direct material + direct labour – there is an assumption, that with increasing production they may rise (I1 non-productive costs - labour, energy, I2 cost of extra work to repair repairable non-conforming products).

E_D - external failures - these are bonds issued due to complaints of non-conforming products for customers in overall price + discounts on prices due to reduced quality.

Evaluation in terms of cost

The total cost of quality for period of five years, in fact, reached an average of 6597.64 thousand €, which represents 14% from the total cost of the company (total costs are an average of five years 47 225.08 47. €). Because the quality costs are operating costs, it is interesting to compare these two items, i.e. average total costs of quality for period of five years are 15.3% from the average operating costs (operating costs excluding depreciation are an average of 43 093.71 thousand €).

Evaluation in terms of revenues

The total costs of quality and quality costs related to the external business environment (cost of external failures) were compared with revenues of the company.

The total costs of quality in relation to gross revenues excluding foreign exchange losses are 11%, averaged over a period of five years, (overall CQ = 597.64 6 thousand €, total gross revenues = 58 530.84 IST. €). The variable costs of external failures compared to revenues stands at an average of 1.5%, while complaints handled through credit notes are only 0.6%.

Since 2008 it has been seen slight increase in revenues in development of outcomes. In 2009, due to the global economic crisis, revenues decreased by 2%. Despite the costs of external failures maintained on the previous level and it was expected, that by the end of 2009 would still grow. If the company managed the rise of costs of

external failures, what was result of reduced quality, enterprise would spare by 351.18 thousand €, which represents 0.6% of gross revenues.

One of the activities of controlling is modelling the impact of inputs on earnings before interest and taxes (EBIT), what is the backbone of corporate management and modelling scenarios of results. In this context, here is an example in relation to the costs of quality, i.e. situation of "what happens if ...".

Table 6 shows what would happen if we could eliminate some of the costs of quality, what is the objective of the company. We used the average data for period of 5 years.

The results can be summarized:

If we removed the costs of internal failures and external failures, which averaged over period of five years was 4 935.55 thousand €, nearly 12% of operating costs, positive impact on EBIT would be up by 37% (Table 11.6).

Table 11.6. Impacts of costs of quality on EBIT by average real values during the period of 5 years

S.n.	Item in thousand €	average 5 years	saving	model	impact in €/Δ%	impact in %
1.	Gross revenues overall	58 597,70		58 597,70		
2.	Exchange losses	66,80		66,80		
3.	Gross revenues*	58 530,90		58 530,90		
4.	External failures (E _D)	351,18	-351,18			
5.	Claims-recognized	157,48				
6.	Discounts for reason of lower quality	193,70				
7.	Net revenues overall	58 179,72		58 530,90	351,18	
8.					
9.	Internal failures overall	4065,74	-4 065,74			
10.	Internal failures of var. character (I _{VC})	4 023,70				
11.	Other external failures	536,63	-536,63			
12.					
13.	EBIT	13 508,97			4 953,55	37%
14.	% EBIT	23%		32%	8%	
	Total changes		-4 953,55		4 953,55	37%

Source: own study

At the end we would like to explain the sequence of steps that we proposed and implemented:

1. Identification of the company's quality objectives, from which it is derived, what the objectives of quality controlling should be.

2. The identification of processes on the basis of drawing up of process map.

3. Proposal for classification of quality costs, as they were available to monitor appropriately and feasibly in terms of accessibility of information in the enterprise. (Nenadál, 2001).

4. In order to complexly perceiving of concept of quality controlling and cost of quality throughout the company management, current managerial income in its vertical structure was predefined.

5. Identification of quality costs by analytical accounts and resources of information. To identify the quality costs we determined sources of information, from which we can get them, as specific analytical accounts and the accounting documents. Some accounting evidence was not sufficient; therefore we had to extract data from other registers.

6. Collecting data on the costs of quality, i.e. definition of "workflow" (flow of documents, information, and labour). This step is the most important in any proposal of concept, because it is important to determine how it is possible and if it is necessary to obtain information in the company. Therefore, we reviewed the content of each selected item in the costs of quality in terms of classification by elements of cost (materials, labour, energy, services, etc.) and we found a way, how controller can obtain the information, from whom, where and when. In this part, we proposed the general definition and the steps to obtain the information that can be used in other manufacturing companies – defining classifiers of the costs of quality, classifiers of processes, activities.

7. Identification of quality costs in managerial income with detail to the analytical account.

8. Verification of proposed concept of quality controlling in the selected furniture enterprise.

11.5. Summary

Quality is currently perceived as the economic category, which can be measured. Here arises a tool that helps to make quality become measurable, transparent and predictable. Controlling brings all this; which promotes in quality assurance and improvement. In the foreign literature it is known as quality controlling, representing the economic concept of quality.

Its role is to bring relevant information concerning the quality for quality management for the purpose to achieve goals, detect weaknesses and deficiencies arising in the processes (ŠATANOVÁ 2001). Presented article deals with this new concept and outlines a simple way of applications of quality controlling in the enterprise. We consider the proposal of concrete steps for the application of the concept of quality controlling in terms of the furniture business, by identifying quality objectives, processes, quality costs, through data collection and definition of information sources to its final conversion into controlling reports. Further propose indicators of quality costs and their importance to the enterprise and practical modelling changes in the cost and quantifying the potential impacts to profit are the practical benefits of paper.

Manufacturing companies should accentuate on the prevention of low quality production losses and they should focus on the identification and subsequent optimization. In process management and allocating costs to contracts respectively products it is appropriate to use the methodology Activity Based Costing, just where the highest are costs of non-conforming (failures) (ŠATANOVÁ 2003). Also the evaluation of the costs of failures should be done. These costs need to be analyzed to ensure adequate prevention of their occurrence.

In connection with the issue of the quality controlling, the proposed methodology is original.

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