

Dubravka Pekanov Starčević\*  
Ivo Mijoč\*\*  
Josipa Mijoč\*\*\*

UDK 336.717.16(497.5)  
JEL Classification M41, L15  
Review article

## QUANTIFICATION OF QUALITY COSTS: IMPACT ON THE QUALITY OF PRODUCTS

*Companies have increasingly focused their attention on quality costs because related activities use substantial resources, which directly affect business performance. Therefore, it is crucial to raise awareness of the quantification and rationalization of this group of expenses. The aim of the paper is to investigate if companies which pay more attention to quantifying quality costs produce products of higher quality compared to their competitors. Croatian companies whose securities are traded on a regulated market (Zagreb Stock Exchange) represent the framework of empirical research. The sample included 48 companies whose accounting/finance managers agreed to participate in the study. The results of the study have shown that companies that quantify quality costs achieve higher quality of products in terms of performance and reliability. In addition, the paper has shown that companies' characteristics differ depending on whether they quantify their quality costs or not. Reorganization and quality costs quantification are justified with possible financial benefits for companies. Therefore, companies should be encouraged to extract the quality costs from the total overhead costs in order to improve quality and consequently achieve better financial results.*

*Keywords: quality, quality costs quantification, cost management, statistical analysis, quality dimensions measurement.*

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\* D. Pekanov Starčević, Ph. D. (E-mail: dpekan@efos.hr)

\*\* I. Mijoč, Ph. D. (E-mail: imijoc@efos.hr)

\*\*\* J. Mijoč, Ph. D. (E-mail: jmijoc@efos.hr)

The authors are assistant professors at the J. J. Strossmayer University of Osijek, Faculty of Economics in Osijek.

The paper was received on Feb 2<sup>nd</sup> 2015, it was accepted for publication on June 10<sup>th</sup> 2015.

## 1. Introduction

In recent years, companies have been forced to review and control tightly their costs (Douglas, 2009). Rasamanie and Kanapathy (2011) emphasize that the highly competitive, globalised business environment of today has made quality costs a useful tool in monitoring and achieving cost reductions, in order to remain competitive. According to Chopra and Garg (2011) quality costs can help to quantify specific quality levels and ultimately improve productivity.

A number of studies have examined the measurement of quality costs and the quality level. In 1993 Juran and Gryna (1993) claimed that in production companies, the annual costs of poor quality amounted to approximately 15% of sales, and in service companies to approximately 30% of production costs. In 2001 Giakatis et al. stated that quality costs ranged from 5 to 30% of sales. Chiadamrong in 2003 estimated their proportion around 10% of production costs, while Kent (2005) stated that the total quality costs were 5-15% of turnover. The high proportion of quality costs in the structure of overall company costs confirms that the quantification of quality costs cannot be ignored and that it requires an interdisciplinary approach.

Quality costs include the costs incurred due to the repetition of certain procedures, testing, warranties and other similar activities related to a defective product or process. One of the reasons why measuring quality costs is justified lies in the fact that prevention is cheaper than fixing errors. The benefits of identification, quantification and monitoring of quality costs in companies are manifold.

According to Yang (2008) the benefits of an accurate measurement of quality costs include (1) focusing upon areas of poor performance that need improvement, (2) assisting in the overall control of quality, and (3) raising the firm's competitive advantage through higher quality and lower costs. Uyar (2008) found that after the quality cost system was adopted, there was a decrease in customer complaints, rework and scrap, warranty expenditures, and failure costs, and an increase in sales volume. Rasamanie and Kanapathy (2011) also concluded that the implementation of a quality cost reporting system definitely brings benefits to the organization. Quality costs should be quantified, as spending money on quality improvement programmes without quantifying quality costs leads to low or no impact on the financial result (Schiffauerova and Thomson, 2006). Rodchua (2006) stated that companies can lose money as they fail to use opportunities to reduce their quality costs.

The following chapters describe quality components, give the definition and classification of quality costs, and describe the benefits of quality costs quantification which are followed by a description of research methodology, presentation of research results leading to the conclusions and recommendations.

## 2. Literature review

### 2.1. Quality and the components of quality

Companies have come to realize that improving the quality of products and services is a necessity in today's business. The reason for this is the high cost associated with failing to meet the quality standards as well as benefits obtained from customers perceiving the company as a manufacturer of premium quality. Cooper (1995) argues that a combination of three elements is a key to product market success. They include the product costs, the product quality and the time required for its development. Kato (1998) states that quality is the most important characteristic of a product and that it is crucial to avoid reducing the costs which reduce the quality of a product from the customer's perspective. It can therefore be concluded that the main goal of improving the quality of products and services is to meet customer needs.

According to Juran and Gryna (1993) quality means "fitness for use" or "customer satisfaction". Customer satisfaction is achieved through the properties of a product (they affect sales revenue) and lack of incompleteness (reduces costs). According to Garvin (1987) the quality of the product or service is made up of eight dimensions listed in Table 1.

Table 1.

#### GARVIN'S QUALITY DIMENSIONS

Quality dimension	Description of the quality dimension
Performance	A product's primary operating characteristics
Features	Characteristics which enhance the appeal of the product or service to the user
Reliability	Likelihood that a product will not fail within a specific time period
Conformance	The precision with which the product or service meets the specified standards
Durability	The length of a product's life
Serviceability	The speed with which the product can be put into service when it breaks down
Aesthetics	The subjective dimension indicating the kind of response a user has to a product
Perceived Quality	The quality attributed to a good or service based on indirect measures

Source: Garvin, D. (1987), "Competing on the Eight Dimensions of Quality", Harvard Business Review, Vol. 65, No. 6, pp.: 104.

Any serious attempt to deal with quality issues must take into account the costs associated with quality (Yakup and Sevil, 2012).

## *2.2. Quality costs - definition and classification*

Quality cost information is an important input to management decision making (Hansen and Mowen, 2009). Traditionally, quality costs have been limited to the costs of inspection and testing of finished products. Other costs of poor quality were usually classified as overhead costs and have not been treated as quality costs. Blocher et al. (2002) introduced the concept of “hidden factory” which refers to the use of facilities and resources for the purpose of repairs, re-testing, re-making and other remedial activities related to the poor quality of a product. They are hidden because they are often included in the total manufacturing overhead costs that are allocated to all products.

Chiadamrong (2003) defined “hidden quality costs” as the costs of handling the quality problems that go beyond the visible costs of activities. Krishnan et al. (2000) define the quality costs as “costs that are incurred to prevent a shortfall in quality and a failure to meet customer requirements, as well as costs incurred when quality does in fact fail to meet customer requirements”. According to Shim and Siegel (1999), quality costs are the total costs incurred due to: (1) investments in the prevention of non-conformance with requirements, (2) assessment of product and/or service conformance with the requirements and (3) failures in achieving conformance with the requirements.

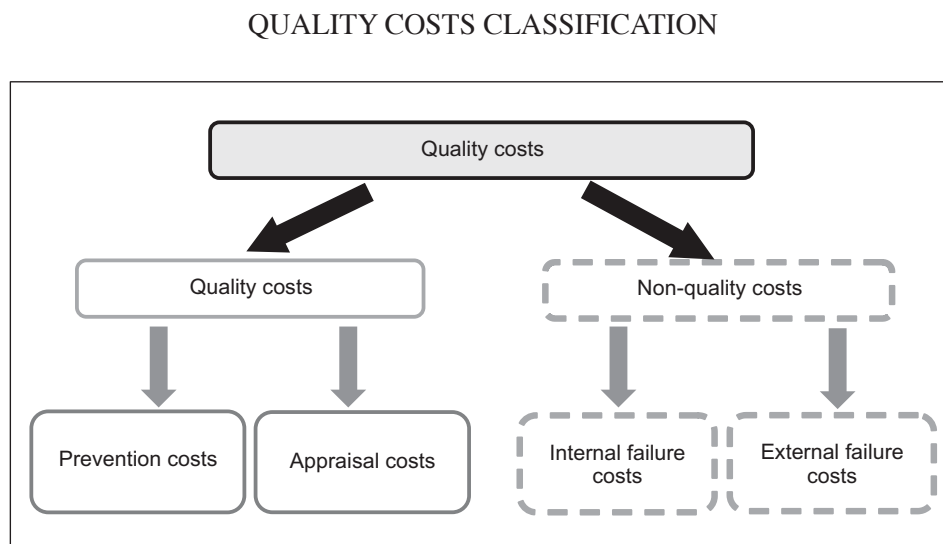
Consequently, the mentioned authors classify quality costs into three categories: (1) prevention costs - costs incurred in preventing defects, i.e., costs of preventing production of poor quality products; the costs incurred in this stage minimize the costs of appraisal and costs of failure, (2) appraisal costs - costs incurred during supervision or inspection; they occur because of failures that had not been corrected through prevention and (3) failure costs.

The same approach is advocated by Juran (1985) and Juran and Gryna (1993), the only difference being that they divide the failure costs into internal and external failure costs. The costs of internal failures include costs of repairing poor quality products before they leave the factory, while the external failure costs include costs of poor quality that had not been detected before the product left the factory.

The most severe form of external failure is associated with extremely low quality, which leads to a reduction in a company’s market share that is taken over by the competition which consequently leads to the loss of market or the loss of

image, and a long-term negative operating result (Peršić and Janković, 2006). The first two categories of costs have a positive impact on the level of quality – the more a company invests in prevention and appraisal, the higher the level of quality. In contrast, the last two categories have a negative impact on the level of quality, which means the lower the product quality, the higher the failure costs, regardless when they were detected. The quality costs classification is shown in Figure 1.

Figure 1.



Source: Adapted from Juran and Gryna (1993), Shim and Siegel (1999) and Juran (1985)

Quality costs, according to Crosby (1979) include costs of conformance and costs of non-conformance. The above classification is similar to PAF (prevention-appraisal-failure) model. Costs of conformance include costs incurred in order to do something well the first time, and they include costs of prevention and appraisal, while the costs of non-conformance are incurred when a product does not meet customer requirements; these relate to failure costs.

Table 2.

## QUALITY COSTS MODELS AND COST CATEGORIES

Quality costs model	Category of quality costs
PAF model ( <i>prevention – appraisal - failure</i> )	prevention + appraisal + failure
Crosby's model	costs of conformance + costs of non-conformance
Opportunity cost model	prevention + appraisal + failure + opportunity costs

Source: Adapted from: Schiffauerova, A., Thomson, V. (2006), "A review of research on cost of quality models and best practices", *International Journal of Quality & Reliability Management*, Vol. 23, No. 6, pp.: 650.

Sandoval-Chavez and Beruvides (1998) connected opportunity costs to the traditional PAF model. Opportunity costs can be divided into three categories: insufficient capacity utilization, inadequate materials handling and poor service. They express the total quality costs through the revenue lost and profit unearned. Table 2 summarizes the models of quality costs and the associated costs for each model.

### 2.3. Quality costs quantification

According to Omurgonulsen (2009), quality costs alone do not improve quality. The implementation of quality costs provides input and feedback to the quality systems that are responsible for quality improvement (Tsai and Hsu, 2010). Pires et al. (2013) found that the majority of Portuguese companies with ISO certified systems do not explicitly and separately identify quality related costs in the management report and therefore they are unable to manage improvements. Quality cost measurement should be part of a firm's quality management programme (Tye et al., 2011). It is necessary to present the quality costs in the form of financial language, so that members of the top management can communicate the benefits derived clearly and effectively (Yang, 2008).

However, Sansalvador and Brotons (2013) state that one of the main problems with quality cost estimation is the existence of hidden quality costs, whose quantification is uncertain and subjective. Some authors also suggest that the costs of quality should be used as a measure of organisational performance (for example,

Lari and Asslani, 2013, Omurgonulsen, 2009). Tye, Halim and Ramayah (2011) showed that implementation of quality costs improved the bottom line of manufacturing firms in Malaysia.

Sedevich Fons (2012) states that despite the fact that company directors usually resort to quality cost and accounting systems to support decision-making processes, these management control tools are often used separately, thereby promoting ineffectiveness and inefficiency. Yang (2008), Chiadamrong (2003) and Cheah (2011) asserted that the traditional accounting/costing system is inadequate to meet the need of tracking quality costs.

Peršić and Janković (2006) state that quality cost management should be based on the assumption that in the short-term, costs of non-quality need to be reduced and in the long-term, they should be eliminated because the customer is not willing to pay more. At the same time, it must be taken into account that low quality products which come to the market threaten the company's long-term business success as well as its survival in the increasingly competitive environment. Therefore, the company's management has to introduce quality programmes in order to improve the quality of products and business processes, while cost accounting needs to provide the methodological basis and tools for managing quality costs. The same authors state that the results of successful implementation and quality control of quality programmes are based on reliable data concerning the amount, structure and character of all categories of quality costs. As there are no special accounts for recording the quality costs, it is important to ensure a system that would extract those costs from existing accounts, where they are hidden and are caused by activities connected with the quality introduction programme.

The normative basis for monitoring and managing quality costs are international standards such as ISO 9000, ISO 9000:2008, ISO 9001:2009, ISO 9004:2010<sup>1</sup>. However, reporting on the quality costs is not subject to accounting standards, which is why quality cost models differ among companies.

The above depends on the company's informatization level and methods of classification of expenditure items. These costs are reported in financial accounting (class 4) in the aggregated form in the category of expenses by nature (Malmi et al., 2004). This means that the quality costs are shown in total, not taking into account the criterion of separation of related costs. Therefore, the structure of expenditures should be presented as expenses by their nature or by the function that they have in the profit and loss account (for example, the cost of materials, the cost of other services, provisions for future costs and risks, the cost of depreciation

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<sup>1</sup> Croatian Standards Institute, available at <http://www.hzn.hr/default.aspx?id=43> (13 April 2015)

of fixed assets, personnel costs, financing expenses, other operating expenses and losses). The aforementioned approach raises the quality of financial statements to a higher level.

After they are taken out from the total costs of the organization, quality costs are categorized. It is only after their breakdown that the data obtained can be processed, analyzed, and finally put in a report according to internal users' requests (Rogošić, 2009). Alternatively, quality costs can be presented as a separate record kept as quality cost accounting, which is a part of managerial accounting (Habek, 2003). Habek (2003) further states that this procedure poses particular requirements in terms of multi-layered accounting practices, as well as the problem of including in the current expenditure, or possibly the transfer to future periods when conditions for such a transfer have been met. Companies should therefore put additional effort into continuous training of all employees, particularly those in managerial positions, with regard to the ISO 9000ff series of standards. Employees should learn how to implement the quality management system and the sub-system of monitoring the quality costs, which are in the function of enhancing competitiveness on the world market (Lazibat, Matić, 2000).

Based on the above theoretical assumptions, the following research propositions have been developed:

- *RP1: Croatian companies that quantify quality costs produce products of higher quality/provide services of higher quality compared to competitors*
- *RP2: Characteristics of Croatian companies that quantify quality costs are different compared to companies that do not quantify quality costs*
  - *RP2a: (company size) Large companies quantify quality costs to a greater extent than small and medium-sized companies (SMEs)*
  - *RP2b: (overhead cost allocation) The criteria for allocating overhead costs varies depending on whether companies quantify quality costs or not*
  - *RP2c: (business activities) Manufacturing companies quantify quality costs to a greater extent than non-manufacturing companies*
  - *RP2d: (business segment) Multinational companies quantify quality costs to a greater extent than domestic companies*
  - *RP2e: (market orientation) Export-oriented companies quantify quality costs to a greater extent than companies that are focused exclusively on the domestic market.*



### 3. Methodology

#### 3.1. Sample description

According to the Croatian Financial Services Supervisory Agency (HANFA) 197 companies whose securities are traded on the Zagreb Stock Exchange (ZSE) were operating in Croatia in 2011. The scope of research did not include banks, investment funds, insurance companies, cities and companies in bankruptcy. The target population comprised of 172 companies.

The questionnaire was sent to all 172 companies, and the survey ultimately included 48 companies (33 questionnaires were sent back by post and further 15 via e-mail). The effective rate of returned questionnaires was 28%, which is considered satisfactory. Using a sample of 48 Croatian companies whose securities are traded on a regulated market, the paper investigates the extent to which the listed Croatian companies quantify quality cost categories, and whether this quantification is linked with the quality of products and services. Table 3 gives an overview of the main characteristics of the studied companies.

Table 3.

SAMPLE DESCRIPTION ACCORDING TO THE COMPANIES' CHARACTERISTICS

Companies' characteristics	Variable	Companies	%
Companies' headquarters according to NUTS II classification	North-West Croatia (NWC)	18	37.5
	Pannonian Croatia (PC)	9	18.8
	Adriatic Croatia (AC)	21	43.8
Company size	Small and medium	22	45.8
	Large	26	54.2
Business activities	Production	24	50.0
	Service	22	45.8
	Trading	2	4.2
Business segment	Multinational business	6	12.5
	Domestic business	42	87.5
Market orientation	Domestic	22	45.8
	Foreign	26	54.2

The research included mainly those companies whose headquarters (NUTS II classification) were in the Adriatic Croatia (43.8%), followed by the North-West Croatia (37.5%). Least represented were companies based in the Pannonian Croatia (18.8%). Most of the companies in the sample are large companies (54%), while small and medium-sized companies account for 46% of the sample.

Half of the companies (50%) are production companies in terms of the business segment; we can distinguish between companies with multinational business operations (12.5%) and companies with domestic business operations (87.5%). In addition, 54.2% of companies covered by this survey are oriented both towards domestic and foreign markets, while 45.8% of companies are oriented only towards the domestic market. Accounting department staff (35.4%) accounted for the majority of respondents, followed by controlling department staff (31.3%) and chief financial officers (12.5%).

### 3.2. *Research instrument*

In the empirical part of the paper, the product quality was observed through three of Garvin's quality dimensions: performance, reliability and durability. In order to test the quantification of quality costs, the respondents were asked to rate the characteristics of their most important product compared to competitive products in the same industry. Three characteristics of the product were measured on a five-point Likert scale (Table 4).

Table 4.

#### QUALITY DIMENSIONS AND THE LEVEL OF MEASUREMENT

in industry	1	2	3	4	5
	the worst	average		the best	
Performance of the most important product	1	2	3	4	5
Reliability of the most important product	1	2	3	4	5
Durability of the most important product	1	2	3	4	5

For the purpose of this paper, the variable 'business activities' has been modified by integrating two modalities, i.e. service and trading companies were de-

scribed as non-manufacturing companies. The survey tested the effect of quantifying quality costs, depending on the size of the company (1 = small and medium, 2 = large companies), business segment (1 = multinational, 2 = domestic business) and market orientation (1 = domestic, 2 = foreign). The variable used to measure the type of overhead cost allocation was also described (Table 5).

*Table 5.*

METHOD OF ALLOCATING OVERHEAD COSTS IN SURVEYED COMPANIES

Calculation and allocation of overhead costs using	Companies	%
One overhead rate	7	14.9
Multiple overhead rates by business segments	35	74.5
Multiple overhead rates by business activities	5	10.6
Total	47	100.0

Custom variables concerning the calculation and allocation of overhead costs were made with an aim to test the impact of quantifying quality costs, depending on the approach to overhead cost allocation. In addition, the paper examined the differences between the main characteristics of companies (organisational structure and business activity), depending on whether they quantify quality costs or not.

**3.3. Statistical methods**

In order to test the research proposition several statistical methods were used. One of the applied methods was the *t test* procedure for independent samples. The *t test* was deployed to test the differences in the characteristics of the products depending on the corporate decision to quantify (or not to quantify) quality costs. The Chi-square test was used to test the differences between companies that quantify and those that do not quantify quality costs considering their size, i.e. to identify the characteristics of Croatian companies in which they differ depending on whether they quantify their quality costs or not.

#### 4. Results

With the aim of testing the formulated proposition, the research variables were operationalized and analysed. This paper looks into the impact of quantification of quality costs on product characteristics, i.e., whether these improve if the observed companies quantify quality costs.

The quantification of quality costs was observed on a nominal measuring scale. The results show that 71.7% of companies quantify their quality costs, while 28.3% of companies do not. This result was unexpected having in mind previous research showing that most Croatian companies (management and employees) are not familiar with quality costs, and thus it was expected that they did not quantify them.<sup>2</sup> The results are at the same time encouraging considering that the companies have shown significant progress in quantifying quality costs. In order to test the first research proposition, the *t test* procedure was applied. The results of the *t test* used to test the existence of statistically significant differences in the characteristics of the products depending on the corporate decision to quantify (or not to quantify) the costs of quality are shown in Table 6.

According to the results presented in Table 6, there is a statistically significant difference in the quality of products in terms of performance and reliability of the most important products of the company (compared to competitors in the industry), depending on whether the company quantifies its quality costs ( $p < 0.05$ ). By comparing these two groups of companies and their grades, it is evident that companies that quantify the quality costs gave a significantly higher average rate to performance ( $\bar{x} = 4.34$ ,  $\sigma = 0.602$ ,  $\sigma_{\bar{x}} = 0.106$ ) than those that do not quantify quality costs ( $\bar{x} = 3.85$ ,  $\sigma = 0.801$ ,  $\sigma_{\bar{x}} = 0.222$ ).

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<sup>2</sup> For example, research on quality costs models certified according to ISO 9001 and 9002 carried out in 1999 in Croatia showed that in 27% of the surveyed certified companies the management were not familiar or were familiar with quality costs only to a certain extent. In 73% of the companies, employees were not familiar with this category of costs, or they were only partly familiar with these costs. Costs of quality were not, or not entirely, determined in 70% of the surveyed certified companies in Croatia (Drljača, 2005)

Table 6.

T TEST BY QUANTIFYING QUALITY COSTS BY PRODUCT QUALITY DIMENSIONS

	Quantification of quality costs	n	Mean	$\sigma$	$\sigma_x$	t test	p-value
Performance	Yes	32	4.34	.602	.106	2.281	.028**
	No	13	3.85	.801	.222		
Reliability	Yes	32	4.50	.568	.100	2.256	.029**
	No	12	4.00	.853	.246		
Durability	Yes	31	4.45	.506	.091	1.332	.190
	No	11	4.18	.751	.226		

\*\* the difference is statistically significant at the significance level of 0.05

Similar results were produced in the case of quality of products in term of reliability as the companies that quantify quality costs gave a significantly higher average rate to this dimension. In general, it can be concluded that companies that quantify quality costs produce products of higher quality, i.e., provide services of higher quality compared to competitors that do not quantify their quality costs. The research proposition 2a states that *large companies quantify quality costs to a greater extent than small and medium-sized companies*. As large companies have more resources than small and medium-sized companies, it is assumed that they will largely quantify quality costs. The Chi-square test was used to test the differences among companies that quantify and those that do not quantify quality costs (Table 7).

Table 7.

THE CHI-SQUARE TEST RESULTS FOR RELATION OF QUANTIFYING  
QUALITY COSTS AND THE COMPANY'S SIZE

	SMEs	Large	Total	Chi-square statistics
Quantifying quality costs	11 (33.3%)	22 (66.7%)	33 (100.0%)	$\chi^2 = 4.890$ $p = 0.027^{**}$
Not quantifying quality costs	9 (69.2%)	4 (30.8%)	13 (100.0%)	
Total	20 (43.5%)	26 (56.5%)	46 (100.0%)	

\*\* the difference is statistically significant at the significance level of 0.05

The Chi-square test shows some interesting results. In the total number of companies that quantify quality costs, 69.2% are small and medium-sized while 30.8% are large companies. Therefore, research proposition 2a is not rejected ( $p < 0.05$ ). However, as these responses were not expected, the question is whether respondents in the category of small and medium companies understand the meaning and definition of quality costs. Furthermore, the paper examined the differences between the two groups of companies (those that quantify and those that do not quantify quality costs) and between business segments to which the companies from the sample belong, their business activities, market orientation, as well as the differences in the method of calculation and allocation of overhead costs. The question is whether it is likely that companies that quantify quality costs use multiple overhead rates in the allocation of overhead costs to the products. Given that the quality costs for companies that do not quantify them are usually included in the total overhead costs, it is expected that companies that quantify quality costs apply more overhead rates for allocation of overheads to the products.

Table 8.

COMPARISON OF COMPANIES THAT (DO NOT) QUANTIFY QUALITY COSTS BY OVERHEAD COSTS ALLOCATION

	Allocation of overheads using			Chi-square statistics
	One overhead rate	Multiple overhead rates by business segments	Multiple overhead rates by business activities	
Quantifying quality costs	6.2%	81.2%	12.5%	$\chi^2 = 4.836$ $p = 0.89^*$
Not quantifying quality costs	30.8%	61.5%	7.7%	
Total	13.3%	75.6%	11.1%	

\* the difference is statistically significant at the significance level of 0.1

Previous research has shown that companies that use multiple overhead rates easily quantify quality costs because they are more visible. For example, the calculation of costs on the basis of activities (use of multiple overhead rates by company activities) agrees with the concept of quality costs (Anderson and Sedatole, 1998; Tsai, 1998). The analysis was conducted using the Chi-square test, and the results of the analysis can be found in Table 8.

The conducted Chi-square test for comparison of the relation between different approaches to the allocation of overheads to products and (non) quantifying quality costs showed a statistically significant difference ( $\chi^2 = 4,836$ ;  $p < 0.1$ ). Thus, it can be concluded that companies that quantify quality costs allocate overhead costs using multiple overhead rates in comparison to companies using one overhead rate (RP2b). Finally, Chi-square tests the difference between companies that (do not) quantify quality costs and their business activities (RP2c), the business segments to which they belong (RP2d) and their market orientation (RP2e).

Table 9 provides an overview of tests related to research proposition about differences between the *Croatian companies' characteristics* and their decision on quantifying quality costs (RP2c-e). According to the results, manufacturing companies quantify quality cost to a greater extent than non-manufacturing companies ( $p < 0.05$ ).

Table 9.

**COMPARISON OF COMPANIES' CHARACTERISTICS  
AND QUANTIFICATION OF QUALITY COSTS**

Yes		Quantification of quality costs		Chi-square statistics
		No		
Business activity	Manufacturing	19 (86.4%)	3 (13.6%)	$\chi^2 = 4.890$ $p = 0.027^{**}$
	Non-manufacturing	14 (58.3%)	10 (41.7%)	
Business segment	Multinational	6 (100.0%)	0 (0.0%)	$\chi^2 = 2.718$ $p = 0.990^*$
	Domestic	27 (67.5%)	13 (32.5%)	
Market orientation	Foreign	17 (68.0%)	8 (32.0%)	$\chi^2 = 0.378$ $p = 0.539$
	Domestic	16 (76.2%)	5 (28.8%)	

\*\* the difference is statistically significant at the significance level of 0.05\* the difference is statistically significant at the significance level of 0.1

In addition, all multinational companies in the sample quantify quality costs. Furthermore, it is evident that 81.8% of the total number of companies that quantify quality costs are oriented towards the domestic business segment, while 18.2% are oriented towards the multinational business segment. This difference is statistically significant at a significance level of 10% ( $\chi^2 = 2.718$ ,  $p < 0.1$ ). With regard to market orientation, sample data do not show any differences between companies that quantify their quality costs and those that do not ( $p > 0.05$ ).

## 5. Conclusion

Quality and quality management have gained considerable attention in recent years. As costs related to quality consume a significant portion of the company's resources (Juran and Gryna, 1993) it is necessary to quantify these costs so that the company could more easily identify quality-related problems and improve its performance. In order to investigate whether Croatian companies quantify their



quality costs, the above research was conducted. The authors have concluded that Croatian companies largely quantify their quality costs. Namely, Croatian companies are becoming increasingly aware of the importance of quantifying quality costs.

Furthermore, the aim of this paper was to investigate the link between the quantifying of quality costs and the quality of products and services. The results of the study have shown that companies that quantify quality costs give statistically significant higher rates to the quality of products in terms of performance and reliability of their products when compared to competitors in the same industry. It can therefore be concluded that companies which pay more attention to quantifying quality costs produce products of higher quality, i.e., provide services of higher quality compared to their competitors. Companies that have not been quantifying quality costs might take this activity into consideration as a step in their efforts to improve the overall quality of their products and services.

By analysing the difference in the characteristics of Croatian companies depending on whether they quantify their quality costs or not (RP2a-e), it was observed that they differ in size, allocation of overheads, business activity and business segment to which they belong. As stated above, large companies mostly quantified quality costs. This was expected considering the fact that large companies have greater resources than small and medium-sized companies. As for the allocation of overhead costs, this research has shown that companies that quantify quality costs use multiple overhead rates compared to those companies that do not quantify quality costs. The use of multiple overhead rates results in more accurate product costs of those companies. Manufacturing companies quantify quality costs to a greater extent than non-manufacturing companies. The results of this study also suggest that there is justification and potential benefit from reorganization and introduction of the quantification of quality costs.

Consequently, the recommendations based on this paper include:

1. splitting quality costs, that is, extracting quality costs from the total overhead costs in order to increase the efficiency of recording business events,
2. presentation and recording of quality costs in separate accounts which distinguishes a percentage of certain types of expenses, which allows a more realistic and objective level of financial reporting,
3. encouraging and facilitating the development of a harmonized system of recording and presenting quality costs, in terms of accounting, in the form of a separate accounting standard, i.e., IAS/IFRS system as mandatory, or optional at the level of the Guidelines (Directive),
4. advocating quantifying quality costs to a larger extent than so far in large companies, but also, in general, encouraging companies to do so regardless of their size and activity.

Future empirical research should examine the relationship between the application of contemporary methods of cost management and quantification of quality costs and measure their impact on financial performance indicators.

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## KVANTIFIKACIJA TROŠKOVA KVALITETE: UTJECAJ NA KVALITETU PROIZVODA

### Sažetak

Poslovni subjekti su sve više usmjereni na troškove kvalitete, jer srodne djelatnosti koriste značajna sredstva koja izravno utječu na poslovne rezultate. Dakle, ključno je podizanje svijesti o kvantificiranju i racionalizaciji skupina troškova. Cilj rada istražiti je one subjekte koji usmjeravanjem veće pozornosti kvantificiranju troškova kvalitete proizvode outpute veće kvalitete u usporedbi prema svojim konkurentima. Hrvatski subjekti čijim se vrijednosnim papirima trguje na uređenom tržištu (Zagrebačka burza) predstavljaju okvir empirijskog istraživanja. Uzorak uključuje 48 poslovnih subjekata čiji su menadžeri računovodstva/financija pristali sudjelovati u istraživanju. Rezultati istraživanja pokazali su kako subjekti koji kvantificiraju troškove kvalitete postižu veću kvalitetu proizvoda u pogledu performansi i pouzdanosti. Osim toga, u radu se prikazuju različita obilježja subjekata ovisno o tome kvantificiraju li troškove kvalitete ili ne. Reorganizacija i kvantifikacija troškova kvalitete opravdava se mogućnošću postizanja financijske prednosti poslovnih subjekata. Dakle, subjekte treba poticati na izdvajanje troškova kvalitete iz ukupnih troškova s ciljem poboljšanja kvalitete, a time i postizanja boljih financijskih rezultata.

Ključne riječi: kvaliteta, kvantifikacija troškova kvalitete, upravljanje troškovima, statistička analiza, mjerenje dimenzija kvalitete.