Determinants Influencing the Design and Development of Quality Cost System: The Case of Nam Dinh Seafood Firms

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Abstract
This research was conducted for investigating the impacts of determinants on the establishment (design) and development of the quality cost system in Nam Dinh seafood firms. The data was collected from 69 Nam Dinh seafood firms via questionnaires. The research employs qualitative research method to identify affecting determinants and quantitative research method to analyze the degree to which determinants affect the design and development of the quality cost system. The results show that there are four determinants influencing the establishment and development of the quality cost system, i.e., the accounting system efficiency, firm size, business assets and business cycle (the ratio of profit divided by turnover); among which the accounting system efficiency is the strongest. Hence, this study recommends Nam Dinh seafood firms focus on the accounting system to improve the efficiency of the quality cost system in order to control the quality cost and improve the business performance.

Keywords: Quality cost system, seafood firms, Nam Dinh

1. Introduction
Success in today's competitive market depends on many determinants. An important determinant is a continuous improvement in the quality. In general, quality means conforming to standards that have been established from the beginning. Organizations should gradually change from qualitative to quantitative assessments for getting their goals. When quality is determined by numbers, the cost of quality (COQ) is more accurately measured.

The previous studies have shown that quality enhancement is not the only determinant that satisfies customers because other determinants such as price reduction and cost reduction also play an important role (Emami, 2007). The seafood industry in Vietnam is increasingly expanding into international markets. However, according to statistics of Vietnam Association of Seafood Exporters and Producers, seafood firms still face many problems in the quality of seafood products when exporting to international markets.

Due to the causes leading to the failure of the product quality, COQ is recognized as an important determinant. As producers want to maintain and improve quality, the product will incur costs in the process (Gholozade and Poorbakhsh, 2010). The major difficulty in achieving efficiency in product quality is the cost. In order to understand the true relationship between cost and quality, it is important to understand the determinants involved in the cost of quality.

Offering a product or service that gives satisfaction to customers cannot afford the high cost. In practice, the responsibility of managers is to balance product quality and cost (Ardeli and Raeesi, 2004). Implementing the quality cost system is a tool for improving product quality and business performance of an entity.

Applying better COQ system with the use of available resources of the business enables investors to provide backup for meeting customers’ demand and reducing costs associated with failure (Tazeshar, 2002).

In general, COQ refers to all costs associated with production to achieve high-quality products. There are three types of COQ, i.e. cost of waste prevention, assessment costs and costs of failure (Tazeshar, 2002). According to Emami (2007), costs are defined as (i) Cost of internal failure: costs include the assessment, improvement and/or replacement of the product before it reaches the consumer; (ii) Cost of external failure: costs include the assessment, improvement and/or replacement of a product after it has reached the consumer; (iii) Cost of assessment: costs include the assessment or control of products or services to ensure quality standards; (iv) Costs of waste prevention: costs are used to prevent the waste of goods or low-quality products.

Normally, organizations do not calculate COQ accurately because these costs are not necessary for the preparation of financial position statement or comprehensive income statement, although these
determinants may have a significant impact on the profit of the entity. Without a COQ assessment system, organizations will not be able to derive the source of these costs or determine the method of controlling them. In addition, organizations collecting and reporting COQs have no legal obligation, but they are only meaningful in corporate management.

Although managers believe that COQ often costs a lot of money. In many firms, this cost accounts for 20% of sales and about 25-40% of operating costs (Ardeli and Raeesi, 2004). Therefore, in order to achieve the objective of this research, the study should answer the question: What are the determinants involved in the design and implementation of a COQ system in Nam Dinh seafood firms to control the cost of quality costs in these firms?

The COQ system has been widely applied in the world and has brought about remarkable results, but in Vietnam, this topic is still quite new. During the survey of Nam Dinh seafood firms, the authors find that Nam Dinh seafood firms have great potential to develop and increase their competitiveness and bring about great socio-economic benefits when improving product quality. Owing to the objective of enhancing socio-economic benefits for Nam Dinh seafood firms in particular and for the economy in general, we study the reasons to improve the quality of seafood products including COQ control, which has been studied extensively in developed countries. Thus, investigating the determinants influencing the design and development of COQ system to control COQ and improve product quality and business performance of Nam Dinh seafood firms is necessary.

2. Literature Review

Cost of quality was first introduced in 1950 by Baum, who expanded and developed the concept at General Electric in the United States. Thus, COQ was first used in industry. Today, industrialized countries are more likely to use COQ in business, public sector, service, transportation and distribution (Ardeli and Raeesi, 2004).

A number of studies have been conducted on COQ. The components of the COQ system were introduced by two researchers from Victoria Industry University in 1999. The researchers, Oliver and Que (1990) split COQ into different components: costs of waste prevention, assessment costs, and costs of failure. Lovea and Iranib (2003), in a study of project management quality in the information system for the civil engineering industry, described the COQ system as including costs of waste prevention and assessment costs. Briggs et al. (2007), in a study on the quality of service provided by hotels in Scotland, find that organization size (firm size), quality standards, and motivation of employees engaged are determinants influencing the development of COQs.

Reed et al. (2000) show some determinants that affect the COQ system. Determinants that Reed mentions include employee training and education, commitment from leaders (leadership), and organizational culture. In a study on COQ systems in the pharmaceutical industry, Mobini (1998) identified a number of constraints in setting up COQ systems, including the complexity of measuring costs, the lack of training and the inadequate accounting system efficiency to provide information.

Tazeshar (2002) conducted a study on obstacles to the implementation of COQ in the automobile industry. The results of the study showed that major obstacles to the implementation of COQ systems are that leaders are unaware of COQ’s importance due to the inadequate training, the lack of accepted standards, the complexity of measuring the cost of quality and the lack of information provision in the accounting information system.

Nikdel (1998) explained the relationship between the total quality management and the COQ by studying the COQ design model in an industrial unit. After introducing theoretical concepts, the model was applied to the forging industry. The results of this application have been recognized in such areas as manufacturing, molding, quality, and finance; all the COQs are recognized. After identifying the cost variables in each of the major sectors and incorporating these variables into the various activities within the company, the data was collected, and the data collection system was established. After this period, the COQ reports and the COQ structure were defined as a common basis for investigating each COQ element. Finally, after the system was implemented, the results were observed, and recommendations were made to improve product quality and reduce costs (Nikdel, 1998).

Employing the open approach, Dehdar (2009) studied the obstacles to developing COQ systems in consumer goods firms in Tehran Stock Exchange. The results show that determinants such as motivation of
employees involved in the operation, organizational culture, continuous training of staff and manager perception influenced the design of COQ systems in the sample firms.

In conclusion, on the basis of previous studies on the cost of quality, the determinants that influence the design and development of a COQ system are discussed and assessed from a variety of perspectives and from different types of firms. Overall, the determinants that influence the implementation of quality costs include the ability of staff, organizational culture, continuous training of employees, organization size, the commitment of the manager, the accounting system efficiency, quality standards, business assets, employee motivation and sales cycle (sales divided by profit).

In Vietnam, studies on the cost of quality are still new. Previous studies have just given rise to the importance of adopting COQ systems in firms. Pham (2013), Tran (2017) concluded the important role of controlling the cost of quality management directly influencing the profit of the business. Nguyen (2013) identified quality management costs in cattle feed producing firms. Studies in Vietnam have not evaluated the determinants that influence the design and development of COQ system.

Thus, based on different views from previous studies on determinants affecting the design and development of the system of quality costs in general, as well as to have a basis for improving the quality of production. We know that the study of determinants influencing the design and development of a COQ system is necessary and the implementation of this topic will fill the gap that other studies in Vietnam have not been done. The results of this study will enrich the theoretical and practical knowledge of the COQ system and the determinants involved in the actual context in Vietnam.

3. Data Collection and Research Methodology

3.1. Data Collection

In order to collect the research data, the questionnaire was developed and sent to experts in the quality field of universities and experts in Nam Dinh Department of Fisheries. The pilot survey was sent to Lenger Seafood Company Vietnam, modified and then sent to research samples.

The research sample was Nam Dinh seafood firms which were exploited from the statistics of Nam Dinh Department of Fisheries, including 69 seafood firms (seafood processing firms, aquaculture firms, and fishery firms).

After identifying the sample and completing the questionnaire, 205 questionnaires were sent to 69 Nam Dinh seafood firms including different positions in the enterprise such as managers, accountants, quality staff, production staff via mail, email, or directly. 158 questionnaires were collected. The research team tested the validity of the questionnaire and filtered out the 8 questionnaires with errors. 150 questionnaires were prepared for analysis on the SPSS 22.

3.2. Research Hypotheses

Based on the previous findings, combined with the context of Nam Dinh seafood firms, we selected through interviews with quality experts from universities, experts in Nam Dinh Department of Fisheries. We selected four determinants that influence the design and development of a COQ system, including the accounting system efficiency, firm size, firm assets and sales cycle (the rate of sales divided by profit) - developed the model of Fahimied (2013), an intermediary is the type of firms: seafood processing firms, aquaculture firms, and fishery firms.

These variables have been recognized in various studies as determinants affecting the COQ system, so the model used in this study will be illustrated as follows:

![Figure 1: The Conceptual Model of the Research (Saraee et al., 2013)](http://www.ijmsbr.com)
Cost of quality (COQ): includes costs of waste prevention, assessment costs and costs of failure (Gholizadeh and Poorbakhsh, 2010). The cost of waste prevention is measured as the costs incurred before the product is manufactured, which may include research and development costs such as wages, materials, machinery, etc. The assessment cost is the cost of testing, controlling the implementation of the production process and inspecting the product quality. The cost of failure includes the cost of internal failures and the cost of external failures. The cost of internal failures consists of costs of inadequate products before reaching customers, and the cost of external failures comprises the cost of failures after the product reaches customers.

The accounting system efficiency (AE): regularly collect, measure and analyze information related to transactions, financial activities and administrative events to provide information in reports to managers inside and outside firms. In fact, the accounting system collects information available in an organization, preparing different information for decision making (Gholizadeh & Poorbakhsh, 2010). The accounting system efficiency in providing information relates to the extent to which the accounting system is capable of gathering and presenting the information needed for the COQ system (Mobini, 1998). The accounting system efficiency classifies, measures and reports COQ to serve the decision-making of executives.

Organization size (OS): Organization size (firm size) refers to a variable for all employees of an organization in 80% of studies conducted (Robins, 1987). This variable is measured by the number of employees in the enterprise and is categorized into micro firms, small and medium firms, large firms and corporations.

Business assets (BS): The assets of an enterprise are economic resources with development prospects (Nowravesh and Karami, 2007). Assets are rights to future economic benefits or other legitimate means to obtain benefits arising from transactions or other events under the control of the entity. Assets in accounting refer to all monetary assets and rights. The assets of a unit can be a tangible entity such as land, buildings, or cash, or maybe intangible financial rights. Normally, assets are divided into different groups on the balance sheet. Two of the groups that are widely used are mobile and fixed assets. The asset is a financial concept related to rights and assets can be converted into cash, arising from transactions, events, and is owned by an entity. The asset is one of the accounting elements showing the financial condition of a non-governmental entity (Honrngrren et al., 2001). The value of the variable is on the balance sheet of Nam Dinh seafood firms.

Sales cycle (SC): is profit divided by sales

After reviewing the relevant studies, the hypotheses for this study are as follows:

(i) There is a positive relationship between the accounting system efficiency in providing information for the COQ system and the design and development of a COQ system.

(ii) There is a positive relationship between the size of the organization and the design and development of a COQ system.

(iii) There is a positive relationship between the level of business assets and the design and development of a COQ system.

(iv) There is a positive relationship between the sales cycle and the design and development of a COQ system.

(v) There is a relationship between the accounting system efficiency, the organizational size, the business assets, the sales cycle and the development and establishment of the COQ system through the type of firms: seafood processing firms, aquacultural firms, and fishery firms.

3.3. Data Processing

We use the Cronbach's Alpha coefficient to evaluate the quality of the developed scale. The scale is rated good when: (i) The overall Cronbach's Alpha coefficient is greater than 0.6; and (ii) Corrected Item-Total Correlation is greater than 0.3 (Nguyen, 2013; Dinh, 2014). Regarding the development and design of the COQ system, the coefficient of observation was 83.6, and the value of the accounting system efficiency was found to be 80.3. As a result, the questionnaire is reliable. The data were collected and analyzed in SPSS, and the regression test was employed to test the hypothesis. Hypotheses are studied with pairs of hypotheses:

Hypothesis 1: There is a positive relationship between the accounting system efficiency in providing information for the COQ system and the design and development of a COQ system.
H0: There is no relationship between the accounting system efficiency in providing information for the COQ system and the design and development of a COQ system.

H1: There is a relationship between the accounting system efficiency in providing information for the COQ system and the design and development of a COQ system.

**Hypothesis 2:** There is a positive relationship between the size of the organization and the design and development of a COQ system.

H0: There is no relationship between the size of the organization and the design and development of a COQ system.

H1: There is a relationship between the size of the organization and the design and development of a COQ system.

**Hypothesis 3:** There is a positive relationship between the level of business assets and the design and development of a COQ system.

H0: There is no relationship between the level of business assets and the design and development of a COQ system.

H1: There is a relationship between the level of business assets and the design and development of a COQ system.

**Hypothesis 4:** There is a positive relationship between the sales cycle and the design and development of a COQ system.

H0: There is no relationship between the sales cycle and the design and development of a COQ system.

H1: There is a relationship between the sales cycle and the design and development of a COQ system.

**Hypothesis 5:** There is a relationship between the accounting system efficiency, the firm size, firm assets, sales cycle and the development and design of the COQ system through the type of firms: seafood processing firms, aquacultural firms, and fishery firms.

4. Results and Discussion

* Analysis of factor correlation – Pearson correlation

The objective of this test is to examine whether the independent variable correlates significantly with the dependent variable (each independent variable is considered). When the significance level (Significance, Sig.) of the partial regression coefficient is 95% or greater (Sig. <.05), it can be concluded that the correlation between the independent variable and the dependent variable is statistically significant (Nguyen, 2013; Dinh, 2014).

**Correlations**

<table>
<thead>
<tr>
<th></th>
<th>Design and development of the system</th>
<th>Accounting system efficiency</th>
<th>Organization size</th>
<th>Business assets</th>
<th>Sales cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design and development of the system</td>
<td>Pearson Correlation</td>
<td>1</td>
<td>.523(*)</td>
<td>.401(*)</td>
<td>.268(*)</td>
</tr>
<tr>
<td></td>
<td>Sig.(2-tailed)</td>
<td></td>
<td>.000</td>
<td>.000</td>
<td>.001</td>
</tr>
<tr>
<td></td>
<td>n</td>
<td></td>
<td>150</td>
<td>150</td>
<td>150</td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.01 level (2-tailed).

Analysis of correlations with the Pearson correlation between the four independent variables with one dependent variable is the willingness to set up and develop the COQ system showing that all four independent variables are highly correlated; the lowest independent variable is the sales cycle with 0.182 and the highest is the variable of the accounting system efficiency (.515). With the critical index \( \alpha \) of 0.01 (1%) for statistical significance, all variables have Sig. (2-tailed) less than 0.01, so they are all statistically significant. Thus, all four independent variables can be included in multivariate regression analysis.

* Multivariate regression analysis:

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.857a</td>
<td>.796</td>
<td>.696</td>
<td>.654</td>
</tr>
</tbody>
</table>

a Predictors: (Constant)

Adjusted R2 is 0.696 indicates that 69.60% of the readiness to establish and develop a COQ system is explained by the regression analysis of four independent variables.
**Analysis of Variances**

This test is conducted to examine the linear relationship between independent variables and dependent variables. The model is considered inappropriate when all regression coefficients are zero, and the model is considered appropriate when at least one regression coefficient is not zero.

Analysis of Variance (ANOVA) is employed to test the appropriateness of a model. If the assurance level is at least 95% (Sig. <0.05), the model is considered appropriate (Nguyen, 2013; Dinh, 2014).

With a degree of freedom of 4, the regression analysis gives F the value of 66,895 and the statistical significance less than the critical index α, (.000 <0.05), rejecting the hypothesis H0 theory (homogeneous determinants) and it can be concluded that there is a statistically significant difference in the relation of the dependent variable on COQ system development and independent variables.

### ANOVA(b)

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Regression</td>
<td>141.005</td>
<td>4</td>
<td>28.201</td>
<td>66.895</td>
</tr>
<tr>
<td></td>
<td>Residual</td>
<td>61.535</td>
<td>144</td>
<td>.427</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>202.540</td>
<td>149</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*a Predictors: (Constant)*

### *Regression Coefficients*

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
<th>Collinearity Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std.Error</td>
<td>Beta (β)</td>
<td></td>
<td>Tolerance</td>
</tr>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>3.420</td>
<td>.053</td>
<td>64.075</td>
<td>.000</td>
</tr>
<tr>
<td></td>
<td>REGR factor score</td>
<td>Accounting</td>
<td>.612</td>
<td>.054</td>
<td>.523</td>
</tr>
<tr>
<td></td>
<td>REGR factor score</td>
<td>Organization size</td>
<td>.456</td>
<td>.054</td>
<td>.401</td>
</tr>
<tr>
<td></td>
<td>REGR factor score</td>
<td>Assets</td>
<td>.305</td>
<td>.054</td>
<td>.268</td>
</tr>
<tr>
<td></td>
<td>REGR factor score</td>
<td>Sales cycle</td>
<td>.314</td>
<td>.054</td>
<td>.182</td>
</tr>
<tr>
<td></td>
<td>a Dependent Variable: COQ design and development</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All determinants are beta (β)> 0; most of the distributions of the set of values of each determinant are from the mean score downwards. All values of the statistical significance of determinants < the critical value α (Sig. Column) show that all statistics eliminate H0 (null hypothesis) and are statistically significant.

The result of multivariate regression analysis between the dependent variable - the design and development of a COQ system (DD) and four independent variables - the accounting system efficiency (AE), organization size (OS), business assets (BS) and sales cycle (SC) show that all of these determinants have a positive correlation with willingness to invest. The multicollinearity between these determinants does not occur with the variance inflation determinants of all four determinants being equal to 1, and the tolerance is relatively high (being equal to 1).

Thus the research model needs to be reset to the level of standardization β as follows: The accounting system efficiency with standardized coefficients b is .523; the organization size with normalization factor b is .401; the business assets with normalization coefficient b of .268; the sales cycle with normalization coefficient b is .182. From the results of the above analysis, the regression equation is expressed as follows:

\[
DD.COQ = .523 \text{ AE} + .401 \text{ OS} + .268 \text{ BS} + .182 \text{ SC}
\]

**Testing the difference of design and development of the COQ system according to type of firms (aqua-cultural firms, fishery firms, and seafood processing firms)**

- Type of firms
  - H0 (null hypothesis) means there is a difference between types of firms and the design and development of the COQ system.
Test of Homogeneity of Variances

<table>
<thead>
<tr>
<th>Dependent Variable: DD.COQ</th>
<th>Levene Statistic</th>
<th>df1</th>
<th>df2</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.623</td>
<td>2</td>
<td>147</td>
<td>.165</td>
</tr>
</tbody>
</table>

Test of Homogeneity of Variances shows the statistical significance Sig = .165 ≥ 0.05, so the variance in the data is not statistically different.

**ANOVA**

<table>
<thead>
<tr>
<th>Dependent Variable: DD.COQ</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>1.594</td>
<td>2</td>
<td>.797</td>
<td>.573</td>
<td>.583</td>
</tr>
<tr>
<td>Within Groups</td>
<td>200.946</td>
<td>147</td>
<td>1.367</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>202.540</td>
<td>149</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ANOVA result also shows that there is no difference in the establishment and development of the COQ system of surveyed firms according to types of firms with the statistical significance up to .583

**Robust Tests of Equality of Means**

<table>
<thead>
<tr>
<th>Dependent Variable: DD.COQ</th>
<th>Statistic(a)</th>
<th>df1</th>
<th>df2</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welch</td>
<td>.590</td>
<td>2</td>
<td>73.068</td>
<td>.568</td>
</tr>
<tr>
<td>Brown-Forsythe</td>
<td>.588</td>
<td>2</td>
<td>112.355</td>
<td>.568</td>
</tr>
</tbody>
</table>

an Asymptotically F distributed.

Welch testing gives the statistical significance of .568, and the similar value is given by Brown-Forsythe method. Therefore the willingness of the design and development of the COQ system is not different among types of firms.

Analyzing the impact of determinants on the design and development of the COQ system in Nam Dinh seafood firms through regression shows that:

First, the accounting system is the biggest obstacle to the design and development of the COQ system. In order to be able to control the cost of quality management, it is required that the accounting system continually provides continuous the COQ management costs in accordance with the four types described above, from which the evaluation is assessed whether there is a problematic section and an appropriate solution is come up with.

Second, organization size also affects the design and development of the COQ system. If the organization size is large with the high degree of specialization, it is easier to identify and classify the cost of quality management than the small business which does not clearly define the responsibilities of each department.

Third, business assets show the strength of prestige as well as the ability to liquidate when establishing the COQ system. If the company has a high proportion of equity, good liquidity will facilitate the design and development of a COQ system.

Finally, sales cycle, the rate of profit divided by sales. The sales include the cost of goods, so if the rate of profit divided by sales is large, that business is profitable, and the equity and liquidity will increase, which will actively support the establishment and development of the COQ system.

5. **Recommendations**

Based on the results of this study, there is a relationship between the accounting system efficiency and the design, development of a COQ system. The study may provide the following suggestions as (i) Firms should strengthen their accounting system; (ii) Firms should form an accounting team with the participation of COQ experts participate; (iii) Firms should use advanced software to present information in time for management. Using smart programs can be considered useful as they can facilitate data collection and reporting.

The accounting system has a positive influence on the establishment, implementation, and development of the COQ system. Therefore, the following suggestions were made to strengthen the accounting system efficiency to manage the COQ of Nam Dinh seafood firms. Specifically: (i) Firms should improve their accounting system efficiency to provide information relating to COQs; (ii) Firms should properly store information in order to access their information in the event of an unexpected incident and, if necessary, contact the accounting system or automatic document distribution; (iii) Firms should control the
quality of raw materials and components; (iv) Firms should implement a management system that maintains, compensates, describes and measures the role of costs in activities.

References


