# COST OF QUALITY, ISO 9001 AND ITS IMPACT ON CORPORATE PERFORMANCE: A LITERATURE REVIEW

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**ABSTRACT**

This paper aims to review the literatures in the area of cost quality and the implementation of ISO 9001 standard, as well as its impact on company performance. This literature study allows researcher to identify and analyze, first, the implementation of the ISO 9001 standard and its impact on company performance. Second, important information about the most widely type of quality cost used of by the company, the measurement of quality costs in company's business functions, the impact on company performance, and the research methods used are also provided. For this purpose, the researchers conducted a study and analysis of the literatures published from 1994 to 2016 on 11 important journals related to the topic of the impact of the implementation of ISO 9001 standard on the company performance. Such performance is then measured in terms of both financial and operational performance. The findings of study allows researchers to propose a future research agenda. Moreover this attainment make us possible to propose a conceptual framework that integrates a measurement model of quality costs on business processes in manufacturing companies that implement ISO 9001 standar, as well as how to measure the economic impact resulted from its implementation.

**Keywords:** ISO 9001, cost of quality, impact on company performance

## 1. INTRODUCTION

The definition of standard according to ISO / IEC Guide 2 2004, is a document established by a consensus and approved by competent authorities, provided to the public and for repeated use, guidelines or characteristics of activities or results aimed to achieve the optimum degree of order in a certain context (Eto et al., 2010). Standards may include management system standards, one of management system standards is the ISO 9001 standard, published in 1987, which is the result of the technical committee TC 176 (Aba, Badar, & Hayden, 2016). The ISO 9001 standard is about the requirements of a quality management system which is part of the quality management system certification (Aba et al., 2016). This standard is very famous in the world, because approximately 777 thousand companies in the world has been certified ISO 9001 in 2005 (Clougherty & Grajek, 2014).

Sampaio, Saraiva, & Monteiro (2012) analyzed the impact of the implementation of ISO 9001 standards and certification regarding company's performance, which the results divided into

three categories, which are companies that: (a) obtain a positive impact, (b) obtain a partial impact, and (c) does not obtain any impact. Researchers in various countries such as Leung, Chan, & Lee, 1999; Casadesús & Giménez, 2000; Gupta, 2000; Koc, 2007; Sampaio, Saraiva, & Rodrigues, 2011; Ilkay & Aslan, 2012; Terziovski & Guerrero, 2014; and Ochieng, Muturi, & Njihia, 2015 reveal that positive impact is resulted by the improvement of operational and financial performance of the company or internal external benefits. The improvement in operational performance such as: an organization's internal improvement; reduction of time to rework, scrap and waste, better handling of customer complaints; access to new markets, and on time delivery (Casadesús & Giménez, 2000); the use of technology management and quality control techniques (Gupta, 2000); positive effect of labor because it can reduce inefficiencies in the company's operations (Tzelepis, Tsekouras, Skuras, & Dimara, 2006); improved performance in the manufacturing parameters such as the performance of the design process, production planning, (Psomas, Fotopoulos, & Kafetzopoulos, 2011); improvements in the innovation process (Terziovski & Guerrero, 2014); improvement in the quality of products / services and operational processes (Psomas & Pantouvakis, 2015) are identified. In addition the improvement in the financial performance such as: an increase in financial performance and market (Psomas & Pantouvakis, 2015); Sales growth, operational results over asset, and operational results over sales (Sampaio et al., 2011); sales, average unit price, average production cost and QMS implementation and maintenance costs (Sampaio et al., 2012); increase in sales revenues, decrease in cost of goods sold/sales revenue and increase in the asset turnover ratios (Starke, Eunni, Fouto, & Angelo, 2012); net asset value (Ochieng et al., 2015) are also revealed.

Oppositely, for companies which were impacted partially, it was found that the acquisition of ISO 9001 certification was mearly to meet the demands of customers (Leung et al., 1999). Lastly, for companies that did not get any impact, the top management felt that there were internal improvement in the organization, but they do not know what is the contribution in the quantitative results of the implementation of that standards due to the company which is not serious in implementing ISO 9001 (Sampaio et al., 2011; Ilkay & Aslan, 2012)

Most of the methods used in measuring the impact of the implementation and certification of ISO 9001 is the qualitative research methodology with empirical survey method. Some research using case study method. Due to the limitations in applying quantitative methods, the ISO secretariat currently published a guidebook for measuring the economic benefits of the quantitative standards implementation based on case studies in various companies (ISO, 2012; ISO, 2013; ISO, 2014). In brief, the steps for measuring the impact of the implementation and certification of ISO 9001 are consist of 4 steps, first, to understand the company's business processes; second, the identification of the standards being used; third, analyzing the value drivers and main indicators; and lastly, quantitative calculation of the impact of the implementation of standards.

The advantages offered by implementing this guidebook are in the standard's impact identification especially on the company's business processes (primary processes and support processes), as well as the determination of value drivers and performance indicators related to the business processes. Such benefits will eventually enable the implementator to calculate the contribution of the implementation of standards. The standards can be standards from the association, national standards and international standards, standard of products and standards of management system. However, the guidebook does not identify the cost of quality incurred as a consequence to the implementation of these standards.

Cost of quality which was initiated by Feigenbaum in 1956 (Schiffauerova & Thomson, 2006a) is the specific costs associated with the success or failure of the qualified product/service. The quality cost component consists of the cost of prevention (Preventive), valuation (Appraisal) and internal and external failure (Failure), which is abbreviated as PAF quality cost. Beside the PAF

model, other models are also developed and discussed by researchers, such as CoC (Cost of Conformance) and CoNC (Cost of Non-Conformance) quality cost introduced by Crosby in 1979 (Schiffauerova & Thomson, 2006a).

A number of organizations use the analysis of quality cost as a tool in the quality improvement program to: (a) the initiative of TQM implementation in order to reduce the cost of quality improvement program (Laszlo, 1997), (b) conceptual framework for determining the quality cost of products which does not meet the standards (Czuchry, Yasin, & Little, 1999), (c) control of production process parameters (Weheba & Elshennawy, 2004), (d) determine the distribution of quality cost associated with the level of maturity of the quality system of the organization (Sower, Quarles, & Broussard, 2007), (e) determine the behavior of quality cost components in the prevention and assessment to reduce the cost of the failure of the internal and external (Omachonu, Suthummanon, & Einspruch, 2004; Kiani, Shirouyehzad, Khoshsaligheh Bafti, & Fouladgar, 2009; Chopra & Garg, 2011), ( f) a long term quality improvement programs evaluation tool, i.e., between quality cost investment and the revenue of a company (Waisarayutt & Wongwiwat, 2015), and (g) identification of areas which need corrective action by using procedure and form of quality cost measurement (Malik;, Khalid, Zurqanain, & Iqbal, 2016). A quality improvement program will be considered effective if it can answer the "high quality - low cost" phenomenon, and it will be considered ineffective if the phenomenon is "high quality-high cost" (Kim & Nakhai, 2008). However, the failure of quality cost initiative as a quality improvement program may occur when there is a misunderstanding with the term quality cost. Previous research reveals that the term quality cost is less understood in the middle and lower management level, but it is well understood by the top management (Roden & Dale, 2000). Therefore, the role of team leaders, leaders and operations manager in a manufacturing environment through activities associated with the cost of quality is important (Tiwari, Turner, & Sackett, 2007).

Most of the research methodology used in previous papers about cost of quality applied mathematical model approach. In addition some practical methods were utilized in the quality cost calculation occurred in a company. For the cost quality model, majority uses simulation model approach, which is used to: (a) examines the relationship between elements of PAF quality cost (Burgess, 1996); (b) analyzing the PAF quality cost and the relationship between quality and price in the market (Visawan & Tannock, 2004); (c) decisions making related to the costs incurred to reduce failure, waste and non-value added activities (Freeman, 2008), (d) calculating the contribution of quality cost prevention and assessment in reducing the cost of failure, and achieve the quality targets set by the customer (Kiani et al., 2009); (e) observing the behavior of PAF quality cost elements and the opportunity cost (set up, idle, waiting and inventory costs) (Omar & Murgan, 2014).

## 2. METHODOLOGY

The research methodology used in the study of the literature review consists of two steps. First, collecting materials related to the topics to be reviewed and restrictions specified. Second, identify a related paper, and make a descriptive analysis of papers to be used as input data in discussion stage.

### 2.1. Material Collection

Research in quality cost, and the impact of the implementation and certification of ISO 9001 has increased in recent years, but there is still a few number of publications with integration on both of the research topics. The basic definition of quality costs, and the standard of Quality Management System ISO 9001 have been presented in part 1. It is essential to determine the boundaries of this literature review. In this context, there are three highlights need to be considered, as follows:

a) Standard of management system, is the standard of quality management system ISO 9001, both versions 1994, 2000 and 2008,
b) The scope of quality cost components discussed are the Preventive-Appraisal-Failure (PAF), Cost of Conformance (CoC) and the Cost of Non-Conformance (CoNC),
c) The impact on the company's performance is the impact of operational and financial performance with respect to the investment costs or the implementation and certification of quality standards ISO 9001.

### 2.2. Search for Related Papers

Searching is conducted on scientific publications with a theoretical construction and conceptual, empirical survey, practical approach, case studies and action research. Searched articles are limited to English-language cost of quality journal articles, with the publication period from 1994 until 2016, and for the impact of the implementation and certification of ISO 9001 standards, starting the period from 1999 to 2016, which the company obtained ISO 9001 is likely to increase annually (ISO, 2015). The articles database used to search this article, is a database provided by major publishers such as Elsevier (www.sciencedirect.com) with journals such as: International Journal of Production Economics, Journal of Materials Processing Technology, and Emerald (www.emeraldinsight.com) with journals such as: International Journal of Quality & Reliability Management, The TQM Magazine, The TQM Journal, Leadership in Health Services Management Research Review, Industrial Management & Data Systems, Managerial Auditing Journal, Industrial Management & Data Systems, International Journal of Health Care Quality Assurance, International Journal of Operations & Production Management.

With a total number of 11 journals selected, it can be said to be highly relevant to the topic being studied, such as: the International Journal of Quality & Reliability Management, The TQM Magazine, and The TQM Journal which are examined and explored, including all other international journals with research topics in the quality cost and the impact of the implementation and certification of ISO 9001. Total relevant articles reviewed are 50 articles.

## 3. RESULTS

### 3.1. Descriptive Analysis

This literature study uses descriptive analysis to classify documents descriptively based on the main topics (Seuring & Gold, 2012). Firstly, how the distribution of related articles in the publication in the period of time specified; secondly, in what journal those article were published; and lastly, the research methodology used.

The distribution of the article's publication within the period 1994 - 2016, is shown in **Figure 1**. The search is started in 1994, with the first article about cost of quality. There are several articles published prior to 1994, but those were not included in the calculation. A relatively high number of articles related to the topic of quality costs and the implementation and certification of ISO 9001 are published in the period of 2011 and 2012 in the International Journal of Quality & Reliability Management, The TQM Journal, and The TQM Magazine. This may indicate that in 2011 and 2012, researches related to both topics were pretty much discussed, and it seems that most of the researchers published the results in such three journals (**Figure 2**).

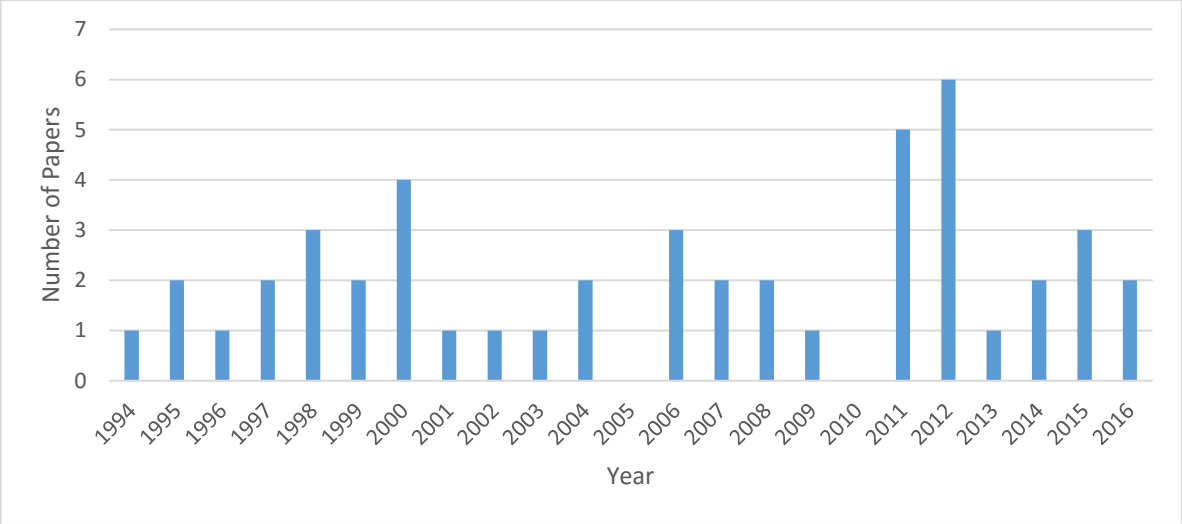


**Figure 1.** Allocation of the Articles across the Analyzed Period 1994-2016

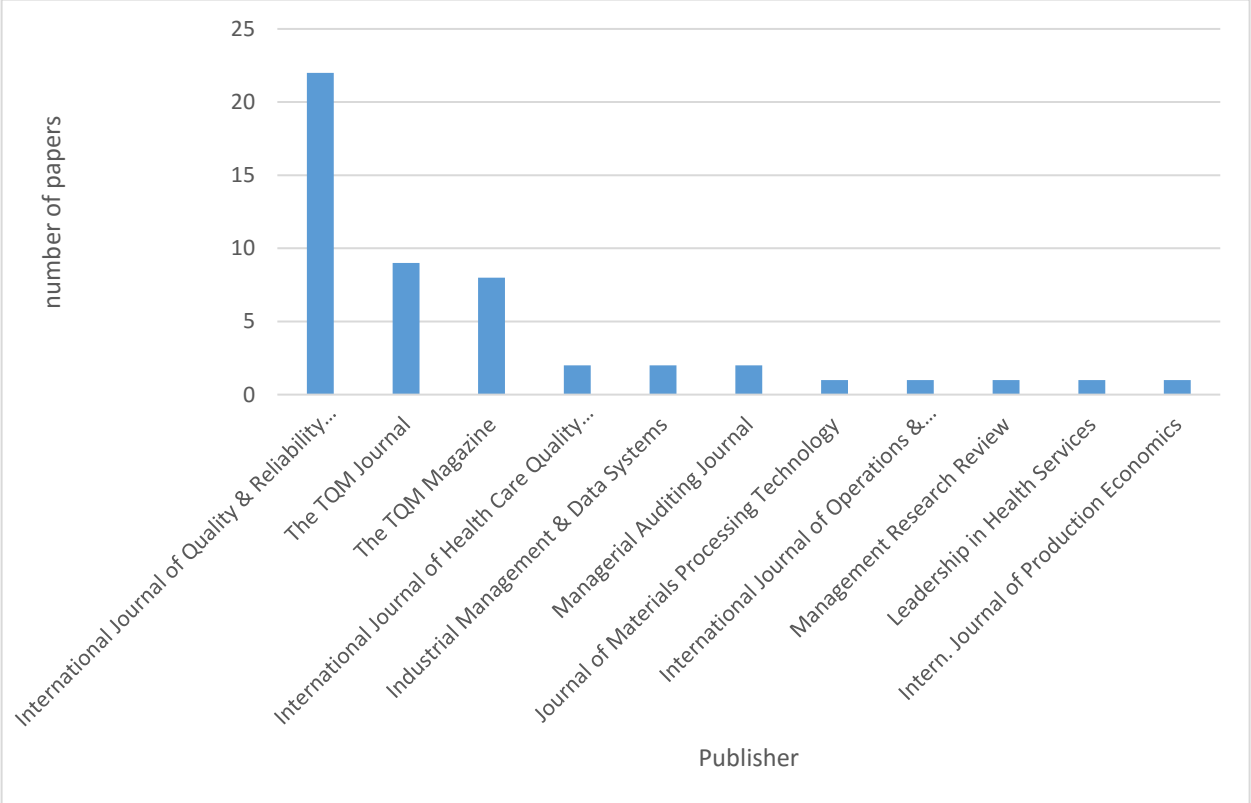


**Figure 2.** Publisher in the Papers

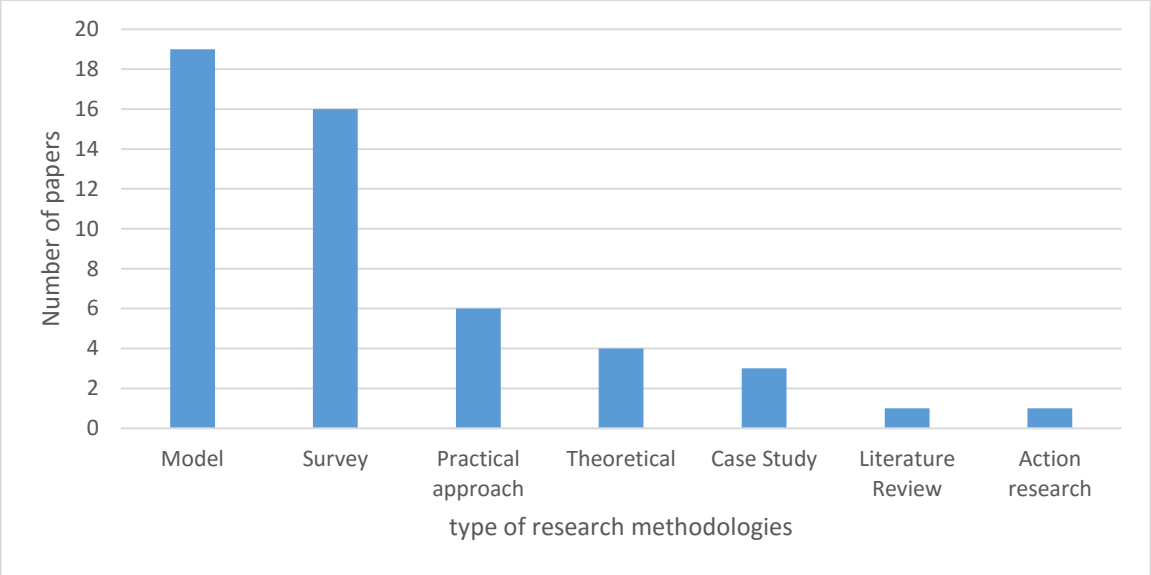


**Figure 3.** Research Methodologies Applied in the Papers

Besides, there are seven research methodological approach used in this study, which are the methods of research: case studies, models, empirical survey, practical approach, theoretical and conceptual, literature review, and action research (**Figure 3**). The majority of research methods undertaken by the researchers is using a construction of mathematical model approach or simulation (total 19 articles) with quality cost topic. Meanwhile the approach of empirical survey methods (some 16 articles) majority using empirical survey method with questionnaires and using statistical analysis for the implementation and certification of ISO 9001 topics. The practical approach is used by the researchers to measure the cost of quality without using mathematical model approach or simulation as a research method. In addition, research with conceptual construction or theory is also carried out by researchers in the quality cost by developing existing theory of quality cost of previous studies.

### 3.2. Discussion

In general, the results of the literature review on 50 articles, can be categorized into 3 areas, which are: cost of quality, the impact of the implementation and certification of ISO 9001, and the integration of cost of quality measurement in the company that implement ISO 9001 (**Figure 4**). These three categories gave an insight how the papers were evolved which initially identified into two main areas, those are the cost of quality (model and measurement of quality cost), and the implementation and certification of ISO 9001 (impact on organizational performance). Then, it progressed to the studies that measure the costs of quality in companies that implement ISO 9001. The development of this research, provide a basis for subsequent research in the areas of modelling construction research for quality cost measurement in companies that implement ISO 9001 standards, and the impact on company performance.

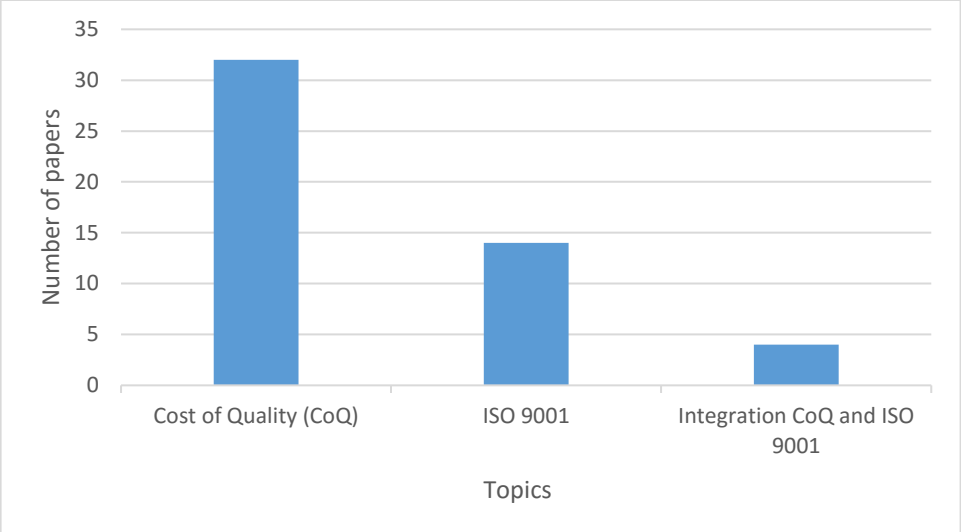


**Figure 4.** Category Selection in the Papers

Each category of literature review results are discussed as follows:

1. **Cost of Quality**: The papers which examined and explored are specifically on the model and the measurement of quality costs on the company's performance. 20 papers discuss the PAF quality cost component, CoC and CoNC as a quality improvement program in achieving the company's performance, and 12 papers discuss the behavior of quality cost components itself, such as the behavior of the Preventive cost component and Appraisal or Cost of Conformance in the reduction of failure costs component (internal and external) cost of Non-Conformity. Research using PAF quality cost component approach are more numerous than the CoC and CoNC quality cost approach (**Table 1**). Hereafter, studies using approach in cost of quality calculation is more numerous than the approach using simulation method. Furthermore, the simulation method approach is very rare performed for CoC and CoNC quality cost (**Table 2**). It shows that there's more opportunity approach to use the simulation methods in researching the behavior of CoC and CoNC cost components.

Table 1. Generic Quality Cost Model and its Categories

| Model | Cost of Quality Categories | Related Publications |
|---|---|---|
| *PAF model* | *Prevention, Appraisal, Failure* (PAF) | Johnson (1995); Burgess (1996); Laszlo (1997); Roden & Dale (2000); Superville & Gupta (2001); Schiffauerova & Thomson, (2006b); Sower, et al., (2007); Freeman (2008); Kim & Nakhai (2008); Kiani, et al., (2009); Chopra & Garg (2012); Fons (2012); Omar & Murgan (2014) |
| *Process cost models* | *Conformance and non-conformance* | Bland et al. (1998); Øvretveit (2000); Weheba & Elshennawy (2004) |

Table 2. Methods of Measuring PAF Quality Cost and Process Models

| Model | Approach Method | |
|---|---|---|
| | Calculation / Measurement of the quality cost (empirical study) | Simulation |

| | | |
|---|---|---|
| *PAF model* | Goulden & Rawlins (1995); (Johnson, 1995); (Goulden & Rawlins (1997); Miguel & Pontel (2004); Omachonu, et al. (2004); Bamford, et al. (2006); Chopra & Garg (2012); Fons (2012); Fons (2013); Waisarayutt & Wongwiwat (2015) | Burgess (1996); Visawan & Tannock (2004); Freeman (2008); Kiani, et al. (2009); Omar & Murgan (2014) |
| *Process cost models* | Bland et al. (1998); Weheba & Elshennawy (2004); | - |

2. **Implementation and certification of ISO 9001**: Some papers were examined and analyzed on the impact of the implementation and certification of ISO 9001. Of the 14 articles, there are three categories of impact on the company due to the implementation and certification of ISO 9001, namely: positive impact (9 articles), partially impact (3 articles), and no impact (2 articles). Although there are contradictions among researchers, however the majority of the authors stated that the implementation and certification of ISO 9001 has a positive impact on the operational and financial performance of the company. The impact of the implementation and certification of ISO 9001 has been discussed in Chapter 1.
3. **The integration of quality cost measurement on companies that implemented ISO 9001 standards**: Of some papers that have been examined and analyzed, only a few papers discusses the measurement of quality cost on a company that implemented ISO 9001 as well as its impact on the company's performance. Of 4 articles, there is one study discusses the identification and analysis of quality cost on the companies that implement ISO 9001 standards, by using empirical survey method (qualitative research) and questionnaires to several companies (Halis & Oztas, 2002). Then there is another study discusses the impact of having a quality management system through the integration of the use of quality management theory, traditional accounting, quality cost measurement (PAF) and the balanced scorecard to measure net income of the implementation of ISO 9001 (Fons, 2011). There is one study that pretty well in discussing the measurement of the cost of quality (conformance costs, direct non-conformance costs and indirect non-conformance costs) on the companies that implemented ISO 9001 and its impacts. Unfortunately, the study was limited to the conceptual framework that is done on a health services (healthcare) and an implementation of quality cost case study (Fons, 2013), therefore it needs to be verified and validated by actual research data. And lastly, there are one study discusses the incompatibility term differences in ISO 9001 associated with the cost of poor quality in the industry to reduce the total cost of poor quality such as cost planner, and rework (Chiarini, 2015). By this research, there is an opportunity for conducting a systematical and well-structured research, for integrating the measurement of quality cost occurred in the business processes of companies that implemented ISO 9001 standards, and measure the impact on the company through the establishment of value drivers and performance indicators (**Figure 5**) using the approach steps as written in the ISO guidance (ISO, 2013; ISO, 2014).

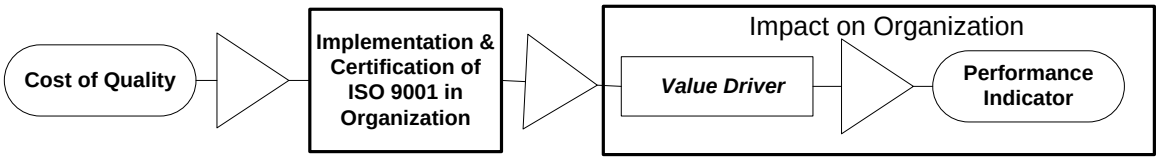


**Figure 5**. Integration of Cost of Quality, Implementation and Certification of ISO 9001 and its Impact on the Company Performance.

## 4. PROVISIONAL RESULTS

This literature review was conducted to identify research gaps, and after the review it come to some provisional results as follows:

- Research on the quality cost have been numerous performed by researchers, from the measurement of PAF or CoC and CoNC quality cost components and the behavior of each those cost component respectively, the development of quality cost model by using simulation methods to predict the effect of the cost of quality in the performance of the company (Burgess, 1996; Visawan & Tannock, 2004; Freeman, 2008; Kiani, et al., 2009; Omar & Murgan, 2014). In addition, PAF quality cost model is the most widely used by researchers to calculate the cost of quality occurred (Goulden & Rawlins, 1995; Johnson, 1995; Goulden & Rawlins, 1997; Miguel & Pontel, 2004; Omachonu, et al., 2004; Bamford, et al., 2006; Chopra & Garg, 2012; Fons, 2012; Fons, 2013; Waisarayutt & Wongwiwat, 2015).
- Research on the ISO 9001 standardization is mainly focused on the implementation, certification and its impacts on the company performance. However the measurement of the impacts are still in qualitative only due to the majority of the research conducted is empirical survey studies (Lee, et al., 1999; Casadesús & Giménez, 2000; Gupta, 2000; Koc, 2007; Sampaio, Saraiva, & Rodrigues, 2011; Ilkay & Aslan, 2012; Terziovski & Guerrero, 2014; and Ochieng, Muturi, & Njihia, 2015), it did not directly measure the impact in the unit of money (quantitative). ISO secretariat has published a book on measuring the economic benefits of the implementation of standards in the company (ISO, 2013; ISO, 2014). The guidebook provides steps on how to measure the contribution of the implementation of standards. However, this guide has not integrated the investment of quality cost incurred in measuring the impact of the adoption of the standard.
- There is an opportunity to integrate both research topics of quality costs and the impact of the implementation of ISO 9001 standards on the corporate performance. Although there has been some research done (Halis & Oztas, 2002; Fons, 2011; Fons, 2013; Chiarini, 2015), however there still not enough basis to build the theoretical and conceptual research related to the integration of these two topics. Future research needs to consider this.

## REFERENCES

Aba, E. K., Badar, M. A., & Hayden, M. A. (2016). Impact of ISO 9001 certification on firms financial operating performance. *International Journal of Quality & Reliability Management*, *33*(1), 78–89.

Bamford, D. R., & Land, N. (2006). The application and use of the PAF quality costing model within a footwear company. *International Journal of Quality & Reliability Managemen*, *23*(3), 265–278.

Bland, F. M., Maynard, J., & Herbert, D. W. (1998). Case Study: Quality costing of an administrative process. *The TQM Magazine*, *10*(5), 367–377.

Burgess, T. F. (1996). Modelling quality-cost. *International Journal of Quality & Reliability Management Modelling*, *13*(3), 8–26.

Casadesús, M., & Giménez, G. (2000). The benefits of the implementation of the ISO 9000 standard: empirical research in 288 Spanish companies. *The TQM Magazine*, *12*(6), 432–441.

Chiarini, A. (2015). Effect of ISO 9001 non-conformity process on cost of poor quality in capital- intensive sectors. *International Journal of Quality & Reliability Management*, *32*(2), 144–155.

Chopra, A., & Garg, D. (2011). Behavior patterns of quality cost categories. *The TQM Journal*, *23*(5), 510–515.

Chopra, A., & Garg, D. (2012). Introducing models for implementing cost of quality system. *The TQM Journal*, *24*(6), 498–504.

Clougherty, J. a., & Grajek, M. (2014). International standards and international trade: Empirical evidence from ISO 9000 diffusion. *International Journal of Industrial Organization*, *36*, 70–82.

Czuchry, A. J., Yasin, M. M., & Little, G. S. (1999). A practical , systematic approach to understanding

cost of quality : a field study. *Industrial Management & Data Systems*, *99*(8), 362–366.
Eto, M., Song, M., Henry, J., Lee, H., Yang, H.-D., & Lee, H. (2010). *Standardization: Fundamentals, Impact and Business Strategy*. APEC Secretariat.
Fons, L. A. S. (2011). Measuring economic effects of quality management systems. *The TQM Journal*, *23*(4), 458–474.
Fons, L. S. (2012). Integration of quality cost and accounting practices. *The TQM Journal*, *24*(4), 338–351.
Fons, L. S. (2013). Healthcare quality costs based on an ISO 9000 model. *Leadership in Health Services*, *26*(3), 184–195.
Freeman, J. M. (2008). The case for quality costing simulation. *The TQM Journal*, *20*(5), 476–487.
Goulden, C., & Rawlins, L. (1995). A hybrid model for process quality costing. *International Journal of Quality & Reliability Management*, *12*(8), 32–47.
Goulden, C., & Rawlins, L. (1997). Quality costing: the application of the process model within a manufacturing environment. *International Journal of Operations & Production Management*, *17*(2), 199–210.
Gupta, A. (2000). Quality management practices of ISO vs non-ISO companies: a case of Indian industry. *Industrial Management & Data Systems*, *100*(9), 451–455.
Halis, M., & Oztas, A. (2002). Quality cost analysis in IS0-9000-certified Turkish companies. *Managerial Auditing Journal*, *17*(1/2), 101–104.
Ilkay, M. S., & Aslan, E. (2012). The effect of the ISO 9001 quality management system on the performance of SMEs. *International Journal of Quality & Reliability Management*, *29*(7), 753–778.
ISO. (2012). *Economic Benefits of Standards: Internastional Case Studies* (Vol. 2). ISO Central Secretariat.
ISO. (2013). *Economic Benefits of Standards- ISO Methodology 2.0*.
ISO. (2014). *Economic Benefits of Standards*.
ISO. (2015). *ISO Survey 2015*.
Johnson, M. A. (1995). The development of measures of the cost of quality for an engineering unit. *International Journal of Quality & Reliability Management*, *12*(2), 86–100.
Kiani, B., Shirouyehzad, H., Khoshsaligheh Bafti, F., & Fouladgar, H. (2009). System dynamics approach to analysing the cost factors effects on cost of quality. *International Journal of Quality & Reliability Management*, *26*(7), 685–698.
Kim, S., & Nakhai, B. (2008). The dynamics of quality costs in continuous improvement. *International Journal of Quality & Reliability Management*, *25*(8), 842–859.
Koc, T. (2007). The impact of ISO 9000 quality management systems on manufacturing. *Journal of Materials Processing Technology*, *186*, 207–213.
Laszlo, G. P. (1997). The role of quality cost in TQM. *The TQM Magazine*, *9*(6), 410–413.
Lee, H. K. N. L. K. C. C. C. T. Y. (1999). Costs and benefits of ISO 9000 series : a practical study. *International Journal of Quality & Reliability Managemen*, *16*(7), 675–681.
Leung, H. K. N., Chan, K. C. C., & Lee, T. Y. (1999). Costs and benefits of ISO 9000 series: a practical study. *International Journal of Quality & Reliability Management*, *16*(7), 675–691.
Malik;, T. M., Khalid, R., Zurqanain, A., & Iqbal, S. A. (2016). Cost of Quality: Findings of wood products'manufacturer. *The TQM Journal*, *28*(1), 2–20.
Miguel, P. A. C., & Pontel, S. (2004). Assessing quality costs of external failures (warranty claims). *International Journal of Quality & Reliability Management*, *21*(3), 309–318.
Ochieng, J., Muturi, D., & Njihia, S. N. (2015). The impact of ISO 9001 implementation on organizational performance in Kenya. *The TQM Journal*, *27*(6), 761–771.
Omachonu, V. K., Suthummanon, S., & Einspruch, N. G. (2004). The relationship between quality and quality cost for a manufacturing company. *International Journal of Quality & Reliability Management*, *21*(3), 277–290.
Omar, M. K., & Murgan, S. (2014). An improved model for the cost of quality. *International Journal of Quality & Reliability Management*, *31*(4), 395–418.
Øvretveit, J. (2000). The economics of quality – a practical approach. *International Journal of Health Care*

*Quality Assurance*, *13*(5), 200–207.
Psomas, E. L., Fotopoulos, C. V., & Kafetzopoulos, D. P. (2011). Core process management practices , quality tools and quality improvement in ISO 9001 certified manufacturing companies. *Business Process Management Journal*, *17*(3), 437–460.
Psomas, E., & Pantouvakis, A. (2015). ISO 9001 overall performance dimensions: an exploratory study. *The TQM Journal*, *27*(5), 519–531.
Roden, S., & Dale, B. G. (2000). Understanding the language of quality costing. *The TQM Magazine*, *12*(3), 179–185.
Sampaio, P., Saraiva, P., & Monteiro, A. (2012). ISO 9001 certification pay-off: myth versus reality. *International Journal of Quality & Reliability Management*, *29*(8), 891–914.
Sampaio, P., Saraiva, P., & Rodrigues, A. G. (2011). The economic impact of quality management systems in Portuguese certified companies. *International Journal of Quality & Reliability Management*, *28*(9), 929–950.
Schiffauerova, A., & Thomson, V. (2006a). A review of research on cost of quality models and best practices. *International Journal of Quality & Reliability Management*, *23*(6), 647–669.
Schiffauerova, A., & Thomson, V. (2006b). Managing cost of quality: insight into industry practice. *The TQM Magazine*, *18*(5), 542–550.
Seuring, S., & Gold, S. (2012). Conducting content-analysis based literature reviews in supply chain management. *Supply Chain Management: An International Journal*, *17*(5), 544–555.
Sower, V. E., Quarles, R., & Broussard, E. (2007). Cost of quality usage and its relationship to quality system maturity. *International Journal of Quality & Reliability Management*, *24*(2), 121–140.
Starke, F., Eunni, R. V., Fouto, N. M. M. D., & Angelo, C. F. de. (2012). Impact of ISO 9000 certification on firm performance: evidence from Brazil. *Management Research Review*, *35*(10), 974–997.
Superville, C. R., & Gupta, S. (2001). Techniques Issues in modeling , monitoring and managing quality costs. *The TQM Magazine*, *13*(6), 419–424.
Terziovski, M., & Guerrero, J. (2014). ISO 9000 quality system certifi cation and its impact on product and process innovation performance. *Intern. Journal of Production Economics*, *158*, 197–207.
Tiwari, A., Turner, C., & Sackett, P. (2007). A framework for implementing cost and quality practices within manufacturing. *Journal of Manufacturing Technology Management*, *18*(6), 731–760.
Tzelepis, D., Tsekouras, K., Skuras, D., & Dimara, E. (2006). The effects of ISO 9001 on firms ' productive efficiency. *International Journal of Operations & Production Management*, *26*(10), 1146–1165.
Visawan, D., & Tannock, J. (2004). Simulation of the economics of quality improvement in manufacturing. *International Journal of Quality & Reliability Management*, *21*(6), 638–654.
Waisarayutt, C., & Wongwiwat, T. (2015). Potential Application of a Quality Cost Model for Fresh Produce Packhouses. *Agriculture and Agricultural Science Procedia*, *3*, 26–31.
Weheba, G. S., & Elshennawy, A. K. (2004). A revised model for the cost of quality. *International Journal of Quality & Reliability Management*, *21*(3), 291–308.

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# OSCM 2016

## Proceedings of the 7th International Conference on Operations and Supply Chain Management (OSCM)

**December 18-21, 2016 Phuket Thailand**

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