Quantifying the ISO 9001:2008 Quality Management System Audit Reports to Measure the Implementation Performance

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Abstract: High competition in education sector has made school managements to improve performance of their organizations. Inline with such a purpose, Al-Azhar BSD Islamic High School in Tangerang Indonesia has been implementing ISO 9001:2008 Quality Management System since 2010. The aim of the research is to perform an analysis of audit findings registered between 2010 and 2015, as a part of the review process of the ISO 9001:2008 QMS. Audit findings consist of non-conformities, opportunities for improvement and positive observation. They are then analyzed using Context-Input-Process-Product (CIPP) evaluation model. A new method is introduced to transform the narrative based conformity reports into quantitative ones. Having this approach, comparison among each CIPP's component can be performed in time series basis. The result shows that the proposed quantification method can be used to present the performance improvement of QMS implementation for each CIPP component.

1 INTRODUCTION

High competition in education sector has made the school managements to improve the performance of their organizations. They must be capable of identifying the current quality performance whilst realigning with their strategies, operations and processs in order to improve their performance. Rusjan and Alič (2010) and Fons (2011) presented a correlation between business success and implemented QMS. Inline with their findings, Smith, Bester and Moll (2014) have shown that many top-performing businesses that achieved superior levels of success and sustainability had also implemented a sound and well-maintained Quality Management System (QMS). It can be said that such a well maintained QMS is ISO 9000 series. Indeed, it is also the most successful standard in ISO history because there is over 1,1 million registrations with registrants in almost 200 countries from all continents (Charlet, 2017). ISO 9000 series standards provide clear guidelines for the top management of institutions or schools to improve the performance of their education system (Cheng, Lyu and Lin, 2004).

Basically it is a voluntary standard and its certification is not compulsory. Any organization can implement it solely for the internal benefits it brings in increased effectiveness and efficiency of their operations, without incurring the investment required in a certification program. Getting certification may be a business decision which will be mostly based on:

1. A legally binding necessity from a client as a condition for working together;
2. Organization's general risk executives strategy;
3. Recognition of an organizatiion's endeavors in building up a successful QMS;
4. A marketing tool for picking up a focused edge in the marketplace.

Al-Azhar BSD Islamic High School located in South Tangerang, Indonesia, holds an ISO 9001:2008 QMS Certification since 2010. The aim of the research is to assess and evaluate the effectiveness and efficiency of the school's operation after getting the QMS certificate by performing an analysis of audit findings registered between 2010 and 2015. Since it is a kind of accountability evaluation, a CIPP (Context-Input-Process-Product) Model of Evaluation founded by

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Stufflebeam will be used as a tool to measure the QMS implementation.

Kenny and Bourne (2015) regarded that performance measurement is the process and results of quantifying outcomes. Then, outcomes need to be distinguished from activities. However there is a natural tendency in organizations to measure activity and call this "performance measurement" (Kenny, 2011). This error occurs for two reasons. The first is that managers are surrounded by and deal with operations on a daily basis. Naturally when it comes to measurement, managers think of activity first. The second reason is that activities are undertaken by people and managers are driven to measure the performance of people. As a result, performance measurement often fails to progress beyond measuring activity.

ISO 9001:2008 clearly specifies performance measure as a part of its demand. Performance measure helps to bring additional scientific analysis into a decision-making method. It underlines the change towards management by information and knowledge, instead of primarily relying on experiences and judgment (Phusavat *et al.*, 2009). A performance measurement system can be defined as a set of metrics used to quantify both the efficiency and effectiveness of actions (Neely, Gregory and Platts, 1995, 2005; Neely, 2005). Smith, Bester and Moll (2014) proposed a method for quantifying QMS performance by introducing metadata into historical or current QMS internal audit data.

2 THEORETICAL FRAMEWORK

a. Quality Audit Process

The following definition is taken from the ISO 9011:2011 Guidelines for Auditing Management Systems:

1. Audit is an efficient, free and recorded procedure for acquiring review proof and assessing it impartially to decide the degree to which the review criteria are satisfied.
2. Audit evidence are records, statements of facts or other data which are applicable to the audit criteria and unquestionable. Audit evidence can be subjective or quantitative.
3. Audit criteria are set of approaches, techniques or prerequisites utilized as a source of perspective against which audit evidence is looked at. On the off chance that the audit criteria are legitimate (counting statutory or regulatory) prerequisites, the expressions "compliant" or "noncompliant" are frequently utilized in a audit findings.

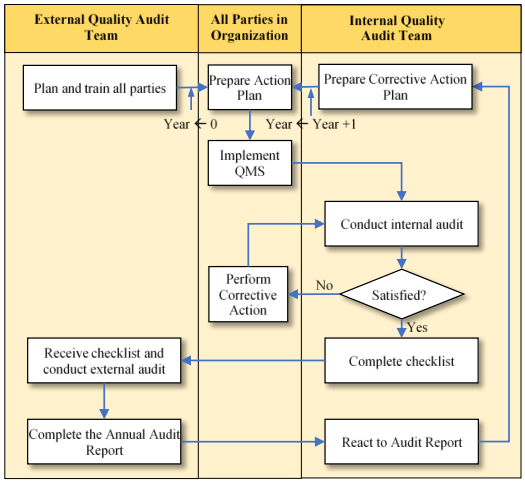


Figure 1: Quality audit process diagram

4. Audit findings are results of the assessment of the gathered audit evidence against audit criteria. Audit findings demonstrate conformity or nonconformity. Audit findings can prompt the identification of opportunities for development or recording good practices. On the off chance that the audit criteria are chosen from legal or other requirements, the audit finding is named compliance or non-compliance.

When all the audit data has been assembled likewise, auditor should investigate and decide the data, to be ordered in which category of audit finding. In general, there are three types of audit findings, i.e., Non-conformance (NC), Positive Observation (PO) and Opportunity For Improvement (OFI) (BSI-CEN, 2011).

1. Non-conformance (NC)
   Non-conformance means any breakdown, or partial breakdown of a process in the Quality Management System (QMS). An audit non-conformance typically requires:
   a) Root cause analysis
   b) Root cause elimination
   c) Change to how the process is to be performed
   Non-conformance requires a Corrective Action Request to document action taken. This type of finding also known as a major non-conformance or a systemic finding.
2. Positive Observation (PO)
   Positive Observation implies any good deviation from a generally all around actualized process or minor oversight with respect to the auditee.

Underlying root cause analysis is not frequently required for Observation. Observations might be recorded on an Audit Action List.

3. Opportunity for Improvement (OFI)
   OFI is a finding dependent on realities and data that demonstrates a potential improvement opportunity. Action is not required for OFI, but more supporting data should be included to encourage action by auditor.

b. Generating audit findings

Audit evidence ought to be assessed against the audit criteria so as to decide audit findings. Audit findings can demonstrate conformity or nonconformity with audit criteria. When specified by the audit plan, individual audit findings should include conformity and good practices along with their supporting evidence, opportunities for improvement, and any recommendations to the auditee.

Nonconformities and their supporting audit evidence ought to be recorded. Nonconformities might be reviewed. They ought to be looked into with the auditee so as to acquire affirmation that the audit evidencec is accurate, and that the nonconformities are comprehended. Every attempt should be made to resolve any diverging opinions concerning the audit evidence or findings, and unresolved points should be recorded. The audit team should meet as expected to review the audit findings at proper stages amid the audit.

c. CIPP Evaluation Model

CIPP is an abbreviation for Context, Input, Process and Product. The CIPP Model for evaluation, that was developed by Daniel Stufflebeam and colleagues, is a comprehensive framework for guiding formative and summative evaluations of programs, projects, personnel, products, institutions, and systems. The model originated in the late 1960s to to help improve and achieve accountability for U.S. inner-city school district reform project. It was to address the limitations of traditional evaluation approaches (Stufflebeam and Coryn, 2014). It requires the evaluation of context, input, process and product in judging a program's value. CIPP is a decision-focused approach to deal with evaluation and stresses the orderly arrangement of data for program management and operation.

Context evaluation is regularly alluded to as needs assessment. It asks, "What needs to be done?" and evaluates issues, resources, and openings inside a characterized communities and environmental context.

Input evaluation endorses an undertaking to address the recognized needs. It asks, " How should it be done? The aftereffect of the input evaluation step is a venture intended to meet the recognized needs.

Process evaluation oversees the project implementation process. It asks, "Is it being done?" and gives a progressing keep an eye on the project's implementation process. Essential goals of process evaluation incorporate archiving the process and giving input with respect to (a) the degree to which the arranged activities are completed and (b) regardless of whether modifications or amendments of the plan are necessary. An extra purpose of process evaluation is to survey the degree to which members acknowledge and complete their jobs.

Product evaluation identifies and assesses project outcomes. It asks, "Did the project succeed?" and is similar to outcome evaluation. The purpose of a product evaluation is to measure, interpret, and judge a project's outcomes by assessing their merit, worth, significance, and probity. Its fundamental purpose is to find out the degree to which the necessities of the considerable number of members were met.

d. ISO 9001 Quality Management System (QMS)

The ISO 9000 series standards are the most successful standard in ISO history because there is over 1.1 million registrations with registrants in almost 200 countries from all continents (Charlet, 2017).

A quality management system (QMS) is a lot of approaches, procedures and techniques required for planning and implementation (creation/development/service) in the inside business area of an association. ISO 9001 that was distributed by ISO (International Organization for Standardization) is a case of a Quality Management System.

The ISO 9000 family addresses to various parts of quality management and contains a portion of ISO's best known standards. This standards give direction and devices to companies and organizations who need to guarantee that their products and services reliably meet customer's requirements, and that quality is reliably made improved. ISO 9000 was first published in 1987 and was based on the BS 5750 series of standards from BSI that were proposed to ISO in 1979. Later an updated version in 1994 was published.

With an end goal to address the changing needs of its clients, ISO again refreshed its standard in 2000 and 2008 and again in 2015. The newest version is known as ISO 9001:2015.

ISO 9001 manages the requirements that organizations wishing to satisfy the guideline must satisfy. The standard covers eight clauses as follows.

1. Scope
2. Normative References
3. Terms and Definition
4. Quality Management System
5. Management Responsibility
6. Resource Management
7. Product Realization
8. Measurement, Analysis and Improvement.

e. Relationship between CIPP Model and ISO 9001:2008 QMS

Table 1: Relationship between CIPP Model and ISO 9001:2008 QMS

CIPP		ISO 9001:2008 QMS
CIPP Component	Typical questions for each component	Requirement Clauses
Context	Needs assessment → "what needs to be done?"	1. Scope 2. Normative References 3. Terms and Definition 4. Quality Management System 5. Management Responsibility
Input	Needs identification → "how should it be done?"	6. Resource Management
Process	Process monitoring →"is it being done?"	7. Product Realization
Product	Outcomes identification and assesment → "did the project succeed?"	8. Measurement, Analysis and Improvement

3 RESEARCH METHOD

Method to measure the performance of QMS implementation is inspired from European Commission, Tool #42: Identifying The Evaluation Criteria And Questions (EU, 2015, p. 271).

1. Effectiveness (EU, 2015, p.271)
   Effectiveness analysis considers how successful QMS implementation has been in achieving or progressing towards its objectives. The evaluation should form an opinion on the progress made to date and the role of the school activity in delivering the observed changes.
   On the off chance that the objectives have not been accomplished, an assessment ought to be gained of the degree to which ground has missed the progress regarding the target and what factors have impacted why something hasn't been fruitful or why it has not yet been accomplished.

$$Effectiveness = \frac{Product}{Context}$$

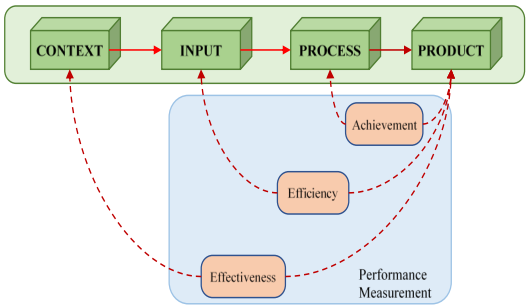


Figure 2: Method to measure the performance of the QMS Implementation using CIPP model.

Source: Inspired from European Commission, Tool #42: Identifying The Evaluation Criteria And Questions, (Better Regulation Toolbox as a complement to Better Regulation Guidelines SWD-2015) p. 271

2. Efficiency
   Effectiveness considers the connection between the resources utilized by an intervention and the progressions produced by this intervention (which might be positive or negative).

$$Efficiency = \frac{Product}{Input}$$

3. Achievement
   According to Merriam-Webster Dictionary, achievement means something that has been done or achieved through effort, a result of hard work, the act of achieving something, the state or condition of having achieved or accomplished something (https://www.merriam-webster.com/dictionary/achievement).
   Cambridge Dictionary characterizes accomplishment as (1) something extremely great and troublesome that you have prevailing with regards to doing, (2) something that you did or got subsequent to arranging and attempting to get it going, and that in this way gives you a feeling of fulfillment, or the demonstration of attempting to get this going." (https://dictionary.cambridge.org/dictionary/english/achievement). From the definitions above, achievement can be regarded as a comparison between product (i.e. "something that you did or got") and process (i.e. "the act of working").

$$Achievement = \frac{Product}{Process}$$

4 ANALYSIS

a. Audit Findings

A list of audit findings for the period of 2010-2015 is given as follows.

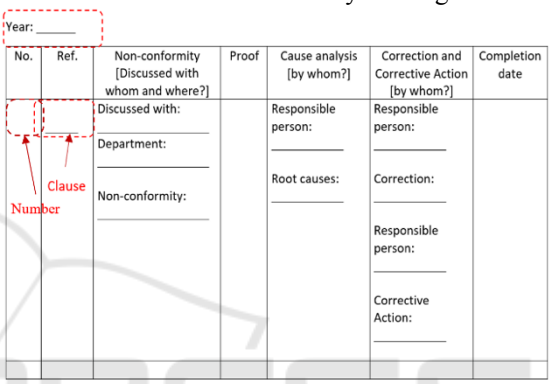
Table 2: A complete list of Audit Findings 2010-2015

Year	Cate-gory	CIPP Component	Number of Clause Codes / Audit Statements
2010	NC	Context	4 clause codes: 5.5.2 - 4.2.3.f - 4.1 - 5.5.3
	NC	Input	3 clause codes: 6.3
	NC	Process	1 clause codes: 7.2.1.d
	NC	Product	3 clause codes: 8.2.4 - 8.3 - 8.2.2
2011	NC	Process	1 clause codes: 7.4.1
	NC	Product	2 clause codes: 8.4 - 8.5.2
2012	NC	Context	3 clause codes: 5.6.2 - 5.4.2 - 4.2.4
	NC	Process	2 clause codes: 7.5.1 - 7.4.1
	NC	Product	1 clause codes: 8.5.2
	OFI	Context	1 audit statement
	OFI	Input	2 audit statements
	OFI	Process	2 audit statements
	OFI	Product	2 audit statement
	PO	Process	1 audit statement
2013	NC	Context	1 clause codes: 4.2.4
	NC	Product	1 clause codes: 8.2.1
	OFI	Context	2 audit statements
	OFI	Process	4 audit statements
	PO	Context	1 audit statement
	PO	Process	1 audit statement
	PO	Product	5 audit statements
2014	NC	Process	1 clause codes: 7.2.3
	OFI	Input	1 audit statement
	OFI	Input	1 audit statement
	OFI	Input	1 audit statement
	PO	Context	1 audit statement
	PO	Input	2 audit statements
	PO	Process	2 audit statements
	PO	Product	4 audit statements
2015	NC	Process	2 clause codes: 7.5.4 - 7.4.3
	OFI	Input	12 audit statements
	OFI	Product	7 audit statements
	PO	Context	1 audit statement
	PO	Input	1 audit statement
	PO	Process	1 audit statement
	PO	Product	4 audit statements

b. Analysis of Non-Conformity Findings

Table of Non-Conformity Findings is shown in the following table. It consists of eight columns but only three are taken as our data sources, i.e., Year, Number and Clause References.

Table 3: Non-conformity Findings



The selected columns are then listed in the following table of Audit Findings for NC that consists of additional column, namely, Category "NC."

Table 4: Audit Findings Attributes for NC

Category	Year	Clause	Number
NC			
NC			
NC			
		using conversion table	
Category	**Year**	**CIPP Component**	**Number**
NC			
NC			
NC			

The relation between Clauses and CIPP components can be seen in Table 1 above. The following table shows such a relation.

Table 5: Conversion list from Clauses to CIPP components

Clause Code	CIPP Component
1 – 5	Context
6	Input
7	Process
8	Product

Audit findings for category "NC" can then be presented as a variable with four attributes, .i.e., category (="NC"), year, CIPP component, and number.

$$Audit\ Findings: F_{category="NC",year,component,num}$$

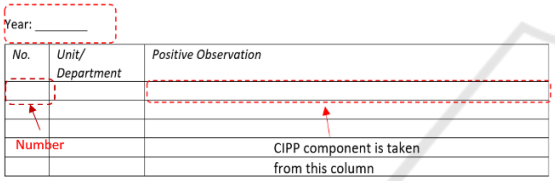
Where

year = 2010, 2011, ..., 2015
component = {"Context", "Input", "Process", "Product"}
num = 1, 2, 3, ...

c. Analysis of Positive Observation Findings

Report of positive observation findings uses much simpler table than that of Non-Conformity as shown below.

Table 6: Report of Positive Observation findings



Column Positive Observation (PO) presents the findings on good performance that has been performed by a particular unit or department of the School. The list of PO needs to be converted into CIPP component in order to develop a variable of Audit Findings. Unlike NC category that uses a conversion table, the PO category asks for expert judgement to convert the findings into CIPP component. This is shown in the following table.

Table 7: Audit Findings Attributes for PO

Category	Year	Number	Audit Statement
PO			
PO			
PO			
↓	↓	Judgement	
Category	**Year**	**CIPP Component**	**Number**
PO			
PO			
PO			

Audit findings for category "PO" can then be presented as a variable with four attributes, .i.e., category (="PO"), year, CIPP component, and number.

$$Audit\ Findings: F_{category="PO",year,component,num}$$

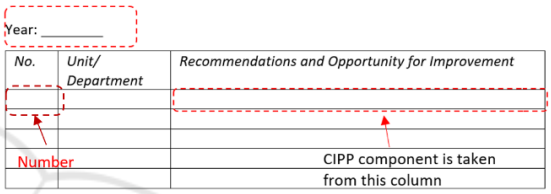
Where

year = *2010, 2011, ..., 2015*
component = *{"Context", "Input", "Process", "Product"}*
num = *1, 2, 3, ...*

d. Analysis of Opportunity for Improvement (OFI) Findings

As mentioned in the previous section, OFI is a finding based on facts and data that shows a potential improvement opportunity. Action is not required for OFI, but more supporting data should be included to encourage action by auditor.

Table 8: Report of Opportunity for Improvement (OFI) findings



Column OFI presents the findings on opportunity to improve that is performed by a particular unit or department of the School. The list of IFO needs to be converted into CIPP component in order to develop a variable of Audit Findings. Like the PO category, the OFI alse asks for expert judgement to convert the findings into CIPP component. This is shown in the following table.

Table 9:Audit Findings Attributes for OFI

Category	Year	Number	Audit Statement
OFI			
OFI			
OFI			
↓	↓	Judgement	
Category	**Year**	**CIPP Component**	**Number**
OFI			
OFI			
OFI			

Audit findings for category "OFI" can then be presented as a variable with four attributes, .i.e., category (="OFI"), year, CIPP component, and number.

$$Audit\ Findings: F_{category="OFI",year,component,num}$$

Where

year = *2010, 2011, ..., 2015*
component = *{"Context", "Input", "Process", "Product"}*
num = *1, 2, 3, ...*

e. Scoring the Audit Findings

The above list then can be summarized as the following table.

Table 10: Summary of the Audit Findings

Year	Non-conformities (NC)				Positive Observations (PO)				Opportunity for Improvement (OFI)			
	C	I	P	P	C	I	P	P	C	I	P	P
2010	4	3	1	3	0	0	0	0	0	0	0	0
2011	0	0	1	2	0	0	0	0	0	0	0	0
2012	3	0	2	1	0	0	1	1	1	2	2	1
2013	1	0	0	1	1	0	1	5	2	0	4	0
2014	0	0	1	0	1	2	2	4	1	1	1	0
2015	0	0	2	0	1	1	1	4	0	12	0	7
TOTAL	8	3	7	7	3	3	5	17	4	15	7	8

$$Quantity\colon Q_{year,category,component} = \bigcup_{num} F_{category,year,component,num}$$

Where

year = *2010, 2011, ..., 2015*
category = *{"NC", "PO", "OFI"}*
component = *{"Context", "Input", "Process", "Product"}*
num = *1, 2, 3, ...*
$\bigcup_{num}$ = *count notation for num*

The Category variable basically represents the degree of achievement. NC for example denotes a negative value since it represents any breakdown in the QMS implementation. Contrast to PO, it shows a positive one as it represents a good achievement. On the other hand, OFI represents something in between the two but a bit closed to PO but still needs to be improved. Hence to represent such description we can assign NC as -1, PO as +1 and OFI as +½ as shown in the following table.

Table 11: Scoring of Category

Label	Findings Category	Value
NC	*Non-conformity*	- 1
PO	*Positive observation*	+ 1
OFI	*Opportunity for improvement*	+ ½

Formula to assign values of the above category is given as follows.

$$Transform_{category} = \begin{cases} -1 & category = \text{"NC"} \\ +1 & category = \text{"PO"} \\ +½ & category = \text{"OFI"} \end{cases}$$

Having this formula, the category as shown in Table 11 can be transformed into scoring value using the following formula.

$$Score\colon S_{year,category,component} = Transform_{category} \times Q_{year,category,component}$$

Also the Total Score is calculated as follows.

$$Total\colon T_{year,component} = \sum_{category} S_{year,category,component}$$

The result can be found in the accompanying table.

Table 12: Score of the Audit Findings

Year	Non-conformities (NC)				Positive Observations (PO)				Opportunity for Improvement (OFI)				TOTAL			
	C	I	P	P	C	I	P	P	C	I	P	P	C	I	P	P
2010	-4	-3	-1	-3	0	0	0	0	0	0	0	0	-4	-3	-1	-3
2011	0	0	-1	-2	0	0	0	0	0	0	0	0	0	0	-1	-2
2012	-3	0	-2	-1	0	0	1	1	0.5	1	1	0.5	-2.5	1	0	0.5
2013	-1	0	0	-1	1	0	1	5	1	0	2	0	1	0	3	4
2014	0	0	-1	0	1	2	2	4	0.5	0.5	0.5	0	1.5	2.5	1.5	4
2015	0	0	-2	0	1	1	1	4	0	6	0	3.5	1	7	-1	7.5
TOTAL	-8	-3	-7	-7	3	3	5	17	2	7.5	3.5	4	-3	7.5	1.5	14
NOTE	(b) = -(a)				(b) = +(a)				(b) = (a)/2				for each C-I-P-P			

5 RESULTS

The above method and analysis is a good way to transform the narrative audit findings into numerical values and can be represented into the following chart.

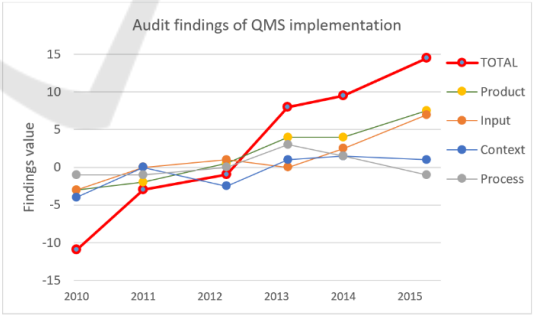


Figure 3: Audit findings of QMS implementation using CIPP Model

Having such a method the main intention of the research, i.e. to evaluate the QMS implementation of Al Azhar BSD Islamic High School, can be easily shown a good implementation progress for the period of 2010-2015.

Table 13: Peformance measurement of QMS implementation

Year	Effectiveness: Product/ Context	Efficiency: Product/ Input	Performance: Product/ Process
2010	1.2	0.8	0.8
2011	0.8	0.8	0.9
2012	1.7	1.1	1.3
2014	1.4	1.1	1.4
2015	1.5	1.2	2.0
TREND	**1.5**	**1.2**	**2.0**

Moreover, having the value of CIPP components the QMS performance – represented by effectiveness, efficiency and achievement – can be calculated as shown in the above table. It then can be represented in the following chart.

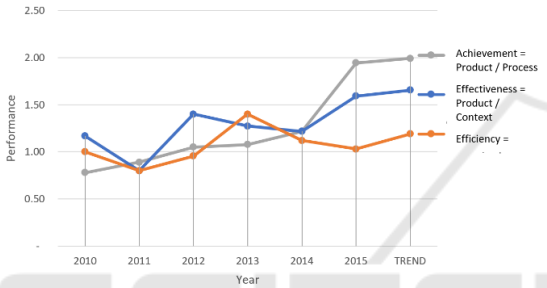


Figure 4: Chart of QMS peformance measurement

6 DISCUSSION

Attempts to quantify ordinal category data have been going on for decades. The most widespread is the attitude scale construction after Rensis Likert published an article entitled "A Technique for the Measurement of Attitude" in 1932 (in Jamieson, 2004; Chyung *et al.*, 2017). Likert scale uses ordinal values to differentiate people's attitudes toward a given topic or a number of issues. The scale uses a familiar five-point bipolar response format to indicate how much they agree or disagree, approve or disapprove, believe to be true or false, for example, in the form of (1) Strongly disagree, (2) Disagree, (3) Neither agree nor disagree, (4) Agree, and (5) Strongly agree. Likert scale is in great demand by many researchers.

A researcher, Edirisooriya (1997), has proposed a different approach to attitude scale construction. Surprisingly, his method is in favor with our research. His formula of decision-making process – as a representation of his/her attitude – that an individual, S_i, utilizes can be presented as follows.

$$D_i = f(X_j) = (d_{i+}) + (d_{i-})$$

where

D_i = decision and it includes two components, d_{i+} and d_{i-}.

d_{i+} = represents the sum of the weighted-positive pieces of evidence

d_{i-} = represents the sum of the weighted-negative pieces of evidence

X_j = a piece of evidence where j = 1, ..., k_1 (positive pieces of evidence) or k_2 (negative pieces of evidence)

The general form of the component d_{i+} and d_{i-} in the above equation can be expanded in the following manner.

$$d_{i+} = \sum_{i,j=1}^{k_1} w_{1,i}(+X_j)$$

where

$w_{1,i}$ = the amount of weight S_i attaches to a positive piece of evidence, $+X_j$

k_1 = the number of positive pieces of evidence.

and

$$d_{i-} = \sum_{i,j=1}^{k_2} w_{2,i}(-X_j)$$

where

$w_{2,i}$ = the amount of weight S_i attaches to a negative piece of evidence, $-X_j$

k_2 = the number of positive pieces of evidence.

If we assign

$w_{1,1}$ = +½ to represent OFI findings,

$w_{1,2}$ = +1 to represent PO findings, and

$w_{2,1}$ = –1 to represent NC findings,

then in order to meet our method we remodify the formula as follows.

$$d_+ = OFI\ portion + PO\ portion$$

$$= \sum_{j=1}^{k_1} (w_{1,1} \cdot X_{1,j} + w_{1,2} \cdot X_{2,j})$$

$$d_- = NC\ portion = \sum_{j=1}^{k_2} w_{2,1} \cdot X_{2,j}$$

Then we will have

$$D = d_+ + d_-$$

$$D = \sum_{j=1}^{k_1} \underbrace{(w_{1,1} \cdot X_{1,j}}_{\text{OFI portion}} + \underbrace{w_{1,2} \cdot X_{2,j})}_{\text{PO portion}} + \sum_{j=1}^{k_2} \underbrace{w_{2,1} \cdot X_{2,j}}_{\text{NC portion}}$$

Note that index i is ommited in the above equation, since in this case S_i is only one individu or precisely one party, i.e. the representative of external auditor.

The Likert-like scale of our research, is between - 1 to +1 to represent the conformance status of ISO 9001 QMS usage. The reason to assign such a range is to allow negative (for NC) and positive (for OFI and PO) values. Similar reason is also used by Başak Manders (Manders, de Vries and Blind, 2016, p. 147) allowing respondents to report both negative and positive changes in order to measure the performance of QMS implementation that ranges between –2 to +2 (e.g. a scale from -2 to 2; -2=Large decrease; -1=Small decrease; 0=No change; 1=Small increase; 2=Large increase). Other usage of Likert-like scale is proposed by R.A. Smith, A. Bester and M. Moll (2014) that employ different way to assign the non-conformity of the QMS in order to quantify QMS performance measure. According to them non-conformity grade consists of rating value and safety weight, where rating value is grouped into three levels, i.e. Low = 0.3; Medium = 0.8; and High =1 and safety weight as Management = 0.3; Enabling = 0.6; and Core = 1.

On the contrary, Nikolay (2016) did not apply Likert-like scale but rather the number of non-conformity findings. Compare to our method, there are at least two differences. Firstly, our method regards three types of audit findings, i.e. NC, OFI and PO whereas Nikolay uses NC only. Secondly, Nikolay traces the number of resolved NCs with allocated cost for implementing corrective actions.

Future research development may adopt Nikolay's method by taking into account the number of NCs of the past period that have been resolved by corrective actions. This method concern with all corrective actions to address identified non-conformities of the past period are carried out before the start of the planning period.

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