



The Assay of the Implementation of 5-S Principles Integrated With ISO 9001 Requirements on Automobile Industry

Silbert Jose S.V.

Abstract: India, as a country with unity in diversity and intensive skill options. Quality standardization and enhancement are the essential ingredients for automobile industry these can be achieved through the implementation of TQM. The design to achieve TQM in automobile industry is the 5-S kaizen principles (Seiri/Sort, Seiton/Set in order, Seiso/Shine, Seiketsu/Standardize, Shitsuke/Sustain) and ISO certification. There are many similarities between quality standard ISO 9001 and 5-s principles. This research was conducted at automobile industry. The implementation of 5-S principle integrated with the requirements of ISO 9001 used Analytical Hierarchy Process (AHP), Cross-Tabulation Correlation, and Importance Performance Analysis (IPA). The results of this research show the priority degree of 5-S principles on ISO 9001 requirements. It is also found that there is a close relationship between each 5-S principle and ISO 9001 requirements.

Key Words: Quality standardization, automobile, Analytical Hierarchy Process, Importance Performance Analysis, kaizen principles.

I. INTRODUCTION

Automobile Industry plays a vital role for the growth of economy it is the key driver in country's rapid economic and

industrial development. The Indian auto industry became the 4th largest in the world with sales increasing 9.5 per cent year-on-year to 4.02 million units (excluding two wheelers) in 2017. It was the 7th largest manufacturer of commercial vehicles in 2018. The Two Wheelers segment dominates the market in terms of volume owing to a growing middle class and a young population. Moreover, the growing interest of the companies in exploring the rural markets further aided the growth of the sector. India is also a prominent auto exporter and has strong export growth expectations for the near future. Automobile exports grew 14.5 per cent during FY 2019. It is expected to grow at a CAGR of 3.05 per cent during 2016-2026. In addition, several initiatives by the Government of India and the major automobile players in the Indian market are expected to make India a leader in the two-wheeler and four wheeler market in the world by 2020. Overall domestic automobiles sales increased at 6.71 per cent CAGR between FY13-19 with 26.27 million vehicles getting sold in FY19. Domestic automobile production increased at 6.96 per cent CAGR between FY13-19 with 30.92 million vehicles manufactured in the country in FY19.



In FY19, year-on-year growth in domestic sales among all the categories was recorded in commercial vehicles at 17.55 per cent followed by 10.27 per cent year-on-year growth in the sales of three-wheelers.

In order to keep up with the growing demand, several auto makers have started investing heavily in various segments of the industry during the last few months. The industry has attracted Foreign Direct Investment (FDI) worth US\$ 21.38 billion during the period April 2000 to March 2019, according to data released by Department for Promotion of Industry and Internal Trade (DPIIT).

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II. LITERATURE REVIEW

Martinez Costa, Martinez Lorente (2007), Despite the quantity of these studies there is still no clear conclusion about the impact of ISO 9000. **Terziovski et al. (2003)** stated that whether or not ISO 9000 is beneficial is likely to be the major determinant of the degree to which managers will embrace or reject ISO 9000 certification in the twenty-first century. **Hongyi Sun (2000)** in a sample of 316 companies in Norway stated that companies with ISO 9000 certification perform better productivity. **Rao et al. (1997)** surveyed companies in China, India, Mexico and the United States. They concluded that ISO 9000 certification was significantly related to productivity.

The findings of **Gavin Dick, Inaki Heras and Marti Casadesus (2008)** on 29 study showed that there were many studies reporting expectations of increased market share and improved product quality from ISO 9001 implementation. The studies fall into two categories snapshot (cross-sectional) and longitudinal studies. Analyses of first group indicate that the strongest findings are for the internal benefits of less waste and lower cost. The second group of studies which are longitudinal covers four research articles that used research designs that could provide evidence of causality. **Haversjo (2000)** reported that ISO 9000 certified companies have better earnings (rates of return) than similar non-certified companies (Clare Chow, Mark Goh, Tan Boon; 2003) which is not due to improved internal capacity utilization but rather to an increase in sales (Tord Haversjo; 2000). ISO 9000 certification does not have significant impact on the strategic management of quality and human resources development. These two criteria are significantly correlated to performance improvement (**Hongyi Sun; 2000**). **Evans & Dean, (2003)** determine that the standards cover requirements in design, production, process, and service. The registration of a company and the certification of its Quality Management System to the standards imply that the company can comply with its documentation and consequently guarantee a consistent level of quality. **Evans & Dean,**

2003; Evans & Lindsay, 2001; Okes & Westcott, (2001), The standards are not specific to a particular process, product, or industry. Hence there are no limitations in terms of the application and can be used in virtually all businesses: electronics, chemicals, services such as hospitals, banks and transportation. **Evans & Dean, (2003)**, ISO 9000 is extremely important for a company that wants to enter some specific international markets. Europe uses ISO certification as a method to assure product safety, and ISO requirements are applied to telecoms, medical devices, toys, appliances, etc. Resulting from its widespread use, it has been universally adopted by many nations for over 400,000 companies around the world. **Okes & Westcott (2001)**, Mutually beneficial supplier relationships. An organization and its suppliers are interdependent, and a mutually beneficial relationship enhances the ability of both to create value. **Evans & Lindsay (2001)**, New market: it allowed salespeople to bring more customers and helped companies to enter new markets which had mandated safety requirements for a variety of products. **Okes and Westcott (2001)** gave the definition that TQM was a customer driven and process improvement management style, and it involved technical

analysis using quantitative and qualitative methods in the efforts to continuously improve quality from all aspects. **Okes and Westcott (2001)** listed eight elements that were considered essential to TQM. These elements were so important that many companies translated them directly into their core values or principles for daily operation **George (2002)** defined Six Sigma as the disciplined application of statistical problem-solving tools that showed where wasteful costs were and pointed to the steps to take for improvement. **Pande, Newman and Cavanagh (2000)** noted that Six Sigma was similar to TQM to some degree and could be considered as rebirth of TQM

TQM

TQM is an approach to run a business to try to maximize the competitiveness of the organization through continuous improvement of the products, services, people, processes, and environment. TQM also has relation with the innovation statistically (Antunes, Quirós, & Justino, 2017). Overall, TQM is a management system that elevates the quality as a business strategy and customer satisfaction-oriented by involving all members of the organization (Gapp, Fisher, & Kobayashi, 2008; Goetsch & Davis, 2002). TQM emphasizes the focus of internal and external customer satisfaction (Juran & Godfrey, 2001), the high obsession to quality, disciplined methodology using a scientific approach to make decisions and solve problems, make continuous improvement, build teamwork, have a long-term commitment, build education and training, give freedom from control, and have a united purpose (Ho, 1999b). TQM is universal to be implemented in different types of organizations, including the educational institutions, especially in college (Ho & Fung, 1994; Ho & Wearn, 1995). Similar to Psomas and Jaca (2016), the implementation of TQM in service organization is concerned on quality practices of top management, employee quality management, employee knowledge and education, and customer focus.

Quality certification

When the quality is credence attribute the market for quality collapses, no matter what price consumers are willing to pay, and no matter what quality producers are willing to provide. For every customer quality is important attribute, customer are willing to pay for quality product, means if they are satisfied for particular product. So for credence attributes the solution is certification. Certification is a process whereby an unobservable quality of product is made known to the customer through some guarantee system. For example the environmental quality of goods means that product follows the natural environment throughout their life cycle and it score more related to environmental quality. In the automotive industry most of the standards have designed keeping in mind customer need and suppliers. It contains many different requirements and criteria which make pressure on suppliers. Different requirements for documentation, various independent audits, Lack of standardized terminology, more terms for the same concept, the same term with different meanings, Different classification scheme

5-S Principles

5-S Principle was initially introduced by the Japanese named Takashi Osada, as 5-S practices (*Seiri, Seiton, Seiso, Seiketsu, dan Shitsuke*; Ho, 1997, 1999a; Osada, 2004). 5-S is the first step as the foundation toward TQM and Business Excellence (Ho, 2007; Shil, 2009). 5-S Practices help all facets of life, including how to run a business. The benefit of 5-S practices is not only to improve the quality of the working environment physically but also to develop the thinking process of the workers to be more positive (Osada, 2004; Pheng & Khoo, 2001). 5-S Principles include stratification management, functional management and system, maintenance, standardization, as well as habituation/discipline (Pheng, 2001). As stated by Randhawa and Ahuja (2017), the total implementation of 5-S in the majority of organizations over the world has shown significant benefits such as improvement in overall organization, productivity, quality, safety, employee morale values, effective workspace utilization, and cost optimization.

5-S Principles represent Japanese words which are describing the steps of workplace in a process. In simple terms, 5-S methodology helps to remove items that are no longer needed (sort, in Japanese, is called *seiri*). 5-S Method also offers improvement of efficiencies and flow on the process (straighten, in Japanese, is called *seiton*). This method provides approach to clean the area of workplace to more easily find some problems (shine, in Japanese, is called *seiso*); 5-S is also introducing labeling system of the processor any items to stay consistent with other areas (standardize, in Japanese, is called *seiketsu*); and, last but not least, 5-S is giving approach to develop behaviors that keep the workplace organized for the long term (sustain, in Japanese, is called *shitsuke*).

Analytical Hierarchy Process (AHP)

AHP is a method of decision making in complex situations, unstructured, strategic, dynamic, and hierarchy arranged. The level of the importance of each variable is subjectively assessed by using a numerical value about the significance of a variable relatively compared with the other variables, using the paired comparison technique. Consistency ratio (CR) is a parameter used to examine whether the paired comparison has been conducted consequently or not. The ratio is considered good, that is, CR ≈ 0.1 (Marimin & Maghfiroh, 2011; Saaty, 1993).

Cross-Tabulation Correlation

Cross-tabulation correlation is used to find out the relationship among ordinal data variables. Spearman's correlation and Pearson's R are aimed at examining the relationship between variables and the level of association. The significance level (α) is 5%. If $p > .05$, the variable does not have a significant relationship, whereas if $p < .05$, the variable has a significant relationship. Correlation test is aimed at testing the relationship between two variables, not distinguishing the type of dependent and independent variables. Correlation test consists of Pearson, Spearman, and Kendall. This relationship is expressed in terms of the correlation coefficient (Devore, 2012; To, Lee, & Yu, 2012; Walpole, Myers, Myers, & Ye, 2012).

Importance Performance Analysis (IPA)

IPA methods or quadrant analysis was initially introduced by Martilla and James (1977). IPA is aimed at quantifying the relationship between consumer perceptions and priorities to improve the quality of products/services. IPA gives information about the factors that influence

satisfaction and loyalty and the factors that need to be improved because of unsatisfactory factors. The factors are ranked and grouped into four quadrants (Ramadhan, Setyanto, & Efranto, 2013). Cartesian diagram IPA matrix can be seen in Figure 1.

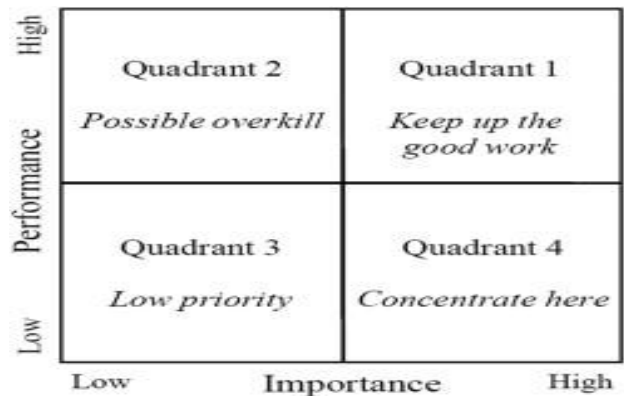


Figure 1: IPA = Importance Performance Analysis.

III. RESEARCH METHODOLOGY

This study focuses on investigating the correlation between 5-S principles and ISO 9001 requirement standards. This study also looked at the priority level of its correlation. This priority is expected to facilitate integration when implementing 5-S principles and ISO 9001 standard requirements. An automobile company has been chosen as a case study in this research. The integration of these standards in the scope of production quality is expected to improve the quality of automotive services. Questionnaire approaches are used in the first phase of this study to determine the level of importance of each attribute to either 5-S principles or ISO 9001 standard requirements. A statistical approach is the hybrid cross-tabulation—IPA is used to define the correlation between 5-S principles and ISO 9001 standard requirements. Then, AHP is used to figure the priority level of that correlation.

The research instrument is a questionnaire, with quantitative data. The method used is a survey. The questionnaire is divided into two stages. The first phase of the questionnaire is aimed at determining the level of importance of each attribute of 5-S principles toward the requirements of ISO 9001 in automobile industry. The second phase of the questionnaire is aimed at finding out the relationship as well as assessing the concordance between the expected condition and the actual performance of the attribute of 5-S principles integrated with the requirements of the ISO 9001 in automobile industry.

Each variable in the questionnaire is related to the attributes of 5-S principles, which are *Seiri, Seiton, Seiso, Seiketsu, dan Shitsuke*, as well as the requirements of the ISO 9001 QMS particularly from the fourth clause to the eight clauses, which are QMS, management responsibility, resource management, realization of educational services, and measurement, analysis, and improvement.



IV. RESULTS AND DISCUSSION

Validity test uses Pearson product–moment correlation. The question in questionnaire is valid if the value of r is greater than the critical value in the table r (Pearson product–moment correlation) based on the degrees of freedom (df) and significance. The table value of the correlation coefficient “ r ” (Pearson product–moment correlation), with $df = n - 2$, then $df = 0.361$ (Devore, 2012; Walpole et al.,

2012).

The results of the validity test questionnaire state that all of the attributes have values $r_{count} > r_{table}$. Thus, each question in the questionnaire has eligibility in defining each variable.

Table 1. The Priority of 5-S Principles on the Implementation of ISO 9001 Requirements

No.	Clause QMS ISO 9001	ISO 9001 requirements	Priority 5-S principle
1.	Clause 4. Quality Management System	4.2.4. Control of quality records	Discipline (<i>Shitsuke</i>)
2.	Clause 5. Management Responsibility	5.1. Management commitment	Discipline (<i>Shitsuke</i>)
		5.4.1. Quality objectives	Discipline (<i>Shitsuke</i>)
		5.5.1. Responsibility and authority	Discipline (<i>Shitsuke</i>)
		5.5.3. Internal communication	Discipline (<i>Shitsuke</i>)
		5.6. Management review	Standardization (<i>Seiketsu</i>)
3.	Clause 6. Resource Management	6.1. Provision of resources	Discipline (<i>Shitsuke</i>)
		6.2.2. Increasing competence, training, and awareness of HR	Discipline (<i>Shitsuke</i>)
		6.3. Infrastructure	Maintenance (<i>Seiso</i>)
		6.4. Work environment	Maintenance (<i>Seiso</i>)
4.	Clause 7. Realization of Educational Services	7.1. Realization of educational services	Discipline (<i>Shitsuke</i>)
		7.2.1. Terms of service education	Discipline (<i>Shitsuke</i>)
		7.2.3. Communication with students	Discipline (<i>Shitsuke</i>)
		7.6. Control of monitoring and measurement equipment	Discipline (<i>Shitsuke</i>)
5.	Clause 8. Measurement, Analysis, and Improvement	8.2.1. Monitoring and measurement of student satisfaction	Discipline (<i>Shitsuke</i>)
		8.2.2. Internal audit	Structuring (<i>Seiton</i>)
		8.3. Control of educational services that do not fit	Standardization (<i>Seiketsu</i>)
		8.4. Analysis of data and information	Standardization (<i>Seiketsu</i>)

Data Processing With AHP

The assessment was conducted by more than one expert respondent. As a result, the consistency of some experts' opinion needs to be checked one by one. The value of CR is considered good, that is, ≤ 0.1 . Opinions, which are consistent, are then combined by using the geometric mean. These data were processed by using Expert Choice 2000 software. The result of the expert respondents' opinions after they are merged indicates the priority 5-S principles on the implementation of the requirements of ISO 9001 which can be seen in Table 1.

Data Processing With Cross-Tabulation Correlation

The hypothesis tests in this research are as follows:

Hypothesis 0 (H0): There is no real relationship among 5-S principles (*seiri, seiton, seiso, seiketsu, danshitsu*) and the requirements of ISO 9001 in automobile industry.

Hypothesis 1 (H1): There is a real relationship among 5-S principles (*seiri, seiton, seiso, seiketsu, danshitsu*) and the requirements of ISO 9001 in automobile industry. The

results of the hypothesis test showed that if $p < .05$ level of significant (α), then H_0 is rejected and H_1 is accepted. There is a real relationship between the 5-S principles (*seiri, seiton, seiso, seiketsu, danshitsu*) and the requirements of ISO 9001 in vocational school. The correlation of the two systems is positive.

The correlation value is grouped into very weak (.00-.20), weak (.21-.40), strong (.41-.70), very strong (.71-.90), highly strong (.91-.99), and perfect (1.00) correlation. The results of the cross-tabulation correlation on the implementation of 5-S principles integrated with ISO 9001 requirements in an automobile company where this study took place generate a weak, strong, and highly strong correlation value.

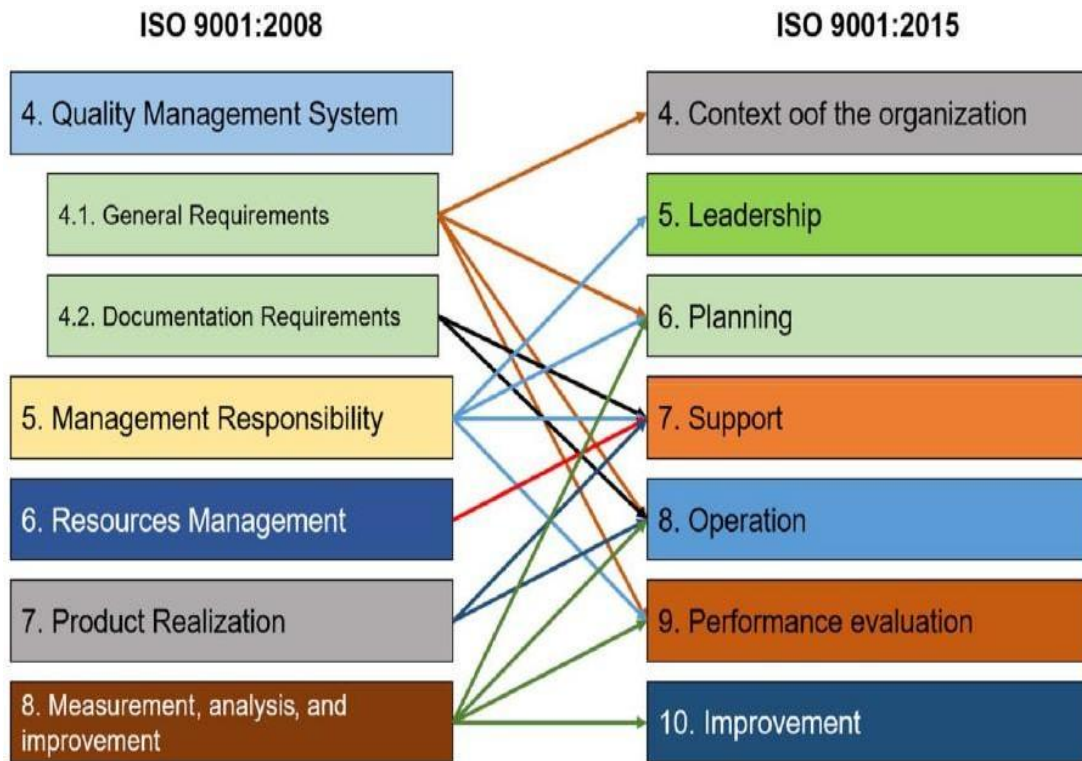


Figure 2. The correlation between clause of ISO 9001:2008 and clause of ISO 9001:2015.

The questions arise, after ISO 9001:2015 standard has been introduced in recent years, but why is this study still using ISO 9001:2008 approach. ISO 9001:2015 have improvements and innovations; however, most of the organizations still need to make much effort to implement the requirements (Rybski, Jochem, & Homma, 2017). Will this study be useless then? Of course, not. The basic principles of the quality assurance system in ISO 9001:2008 standard consist of Clause 4 (QMS); Clause 4.1, general requirements; Clause 4.2, document requirements; Clause 5, management responsibility; Clause 6, resources management; and Clause 7, product realization. Clause 8, measurement, analysis, and improvement, is still strongly connected with the seven main clauses listed in the ISO 9001:2015 standard. The connection between clause of ISO 9001:2008 and clause of ISO 9001:2015 is presented in Figure 2. The results of this study indicate that there is a priority degree of each attribute of 5-S (*seiri, seiton, seiso, seiketsu, danshitsu*) in implementing the ISO 9001 requirements in college. The priority of 5-S principles are put into quality record control; management commitment; quality objectives; HR's responsibilities and authorities; internal communications; provision of resources; increasing competence, training, and awareness of HR; realization of educational services; requirements of educational services; communication with students; control equipment, monitoring, and measurement; monitoring and measurement of customer's satisfaction are discipline/habitation (*shitsu*). The priority of 5-S principles on the management review, inappropriate service control, as well as data analysis and information is standardization (*seiketsu*). The priority of 5-S on infrastructure and working environment is maintenance (*seiso*), whereas the 5-S main priority of the internal audit is the arrangement (*seiton*). However, in

practice, all of the 5-S principles are still necessary to be implemented simultaneously to all clauses of ISO 9001 (Ho, 2007, 2014; Osada, 2004; Pheng, 2001). The relationship between the two systems, 5-S principles and ISO 9001, can also be known. The correlation is positive. It means that the variables of the two systems are proportional to each other. This relationship can be supported by standard operating procedures adopted by the college (ISO, 2007). These results indicate that the correlation in the implementation of 5-S principles integrated with ISO 9001 requirements in automobile industry is weak, strong, and very strong. The internal audit has a very strong correlation with 5-S principles. In general, the ISO 9001 requirements which are examined have a strong correlation with 5-S principles. Nevertheless, in the implementation, there are some requirements, the performance of which is still needed to be improved. Meanwhile, the requirement which has a weak correlation with 5-S principles is the quality record control, especially classification, arrangement, maintenance, and standardization.

V. SUGGESTIONS

Evaluation of the implementation of 5-S principles integrated with ISO 9001 requirements in the automobile industry indicates that there are some attributes, the performance priority of which is necessary to be enhanced, and there is also an attribute that is still considered a low priority by management so that its performance is lower. This definitely becomes the duty of the management at the company to carefully trace the causes. Furthermore, the cause why there are attributes which are still considered low priority has to be identified, whereas if the attribute is reviewed, it is very important to be implemented.



The actual performance of the attributes that have been good until now and in line with all parties' expectations, it is necessary to maintain the achievement. It is expected that all attributes in the case of quality standards to be increased.

VI. CONCLUSION

This study has shown that four until eight clauses of ISO9001 have a priority degree on each 5-S principle. Although there is a priority degree, the overall 5-S principles are still needed to be implemented in every clause. The evidence shows that the correlation between the two variables is positive with the following correlation value: weak, strong, and very strong. It is expected that both systems can be correlated very strongly until it becomes perfect. This, of course, requires a strong commitment and effective collaboration from all levels of management in automobile industry.

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