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INTEGRATION OF QUALITY MANAGEMENT SYSTEM (QMS) AND ENVIRONMENTAL MANAGEMENT SYSTEM (EMS) – A STUDY IN INDIAN AUTO COMPONENT INDUSTRY

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Abstract

Business organisations are implementing more than one management system, including systems for quality management, environmental management, safety and hygiene and so on. Most of these systems focus on generating competitive advantage to the organisations, and the onus is on integration of these systems to the extent possible.

This research paper is based on a study on the Indian auto component industry. In the early nineties, with the entry of the multinational OEMs (Original Equipment Manufacturers) in to the Indian market, the local component manufacturers had to gear up to deliver world class components. In the process, various management systems such as QS 9000 and ISO 14001 were implemented.

This paper throws light on how the QS 9000 Quality Management System and ISO 14001 environmental system are an integrated approach for better competitiveness.

Keywords : Integrated Management Systems, ISO 14001, Auto Component Industry

1. INTRODUCTION

Owing to the booming automotive industry, the Indian auto component industry is seeing an unprecedented growth with a cumulative Average Growth Rate (CAGR) of 19 %. This is attributed to the derived demand for the automotive industry, rapidly growing replacement market. Post liberalisation with the influx of global OEMs into the Indian market, the Indian auto component manufacturers adopted various strategies to deliver to the requirements of these OEMs. One of the major reasons for the dismal performance of the Indian automobile sector in world markets was the

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lack of effective quality management systems (Khanna et al., 2002). Hence various management systems were implemented in order to ensure process compliance, enhanced product quality and attainment of competitive advantage. Quality is one of the important critical success factors to achieve competitiveness in organizations (Khanna et al., 2003). Since the success of the Japanese automobile industry owing to TQM implementation, TQM has played a major role in transforming manufacturing and service organizations world over and Indian companies have followed suit.

Indian automotive companies started off their quality journey with a quality assurance system such as QS 9000 or TS 16949. QS 9000 is the automotive standard developed by the global auto giants DaimlerChrysler, Ford and General Motors. ISO / TS 16949 harmonized different automotive standards around the world, including QS 9000 and it is based on the elements in ISO 9000. Ford and General Motors have decided to implement the Environmental Management System (EMS) ISO 14001 in all manufacturing facilities worldwide. Similarly, the two firms issued a mandate that all direct suppliers must also implement the EMS in their operations. ISO 14001 is useful to these firms as a tool to help achieve better environmental performance, as stated in their environmental principles. It is through the achievement of these principles that the firms believe they are demonstrating their commitments to greater corporate responsibility or being a better "corporate citizen." It is important to note in this discussion that ISO 14001 is not being used as a "green label" per se, though both firms are publicly proud of their actions.

2. QMS AND EMS – AN INTEGRATED APPROACH

A management system can be seen as a model that is good enough to reassure external stakeholders. It is a model of a better system that managers and internal stakeholders are trying to create. The implication for "integration" is that the "core" elements cover both the QMS and the EMS. The recent recommendation by the ISO technical advisory group is that ISO 9000 and ISO 14000 series should not be merged, but made more compatible, has also led to the need for yet another definition.

The ISO 8402 (1994) definition of a quality system can be applied to any other type of system and from this definition, an integrated system is seen as more than just the documentation. Putting separate systems into a single manual of policies and procedures is not integrating them. For integration, all the internal management practices must be put into one system, but not as separate components. Similarly, focusing on the integration of environmental, health and safety as functional matters is not enough; they need to be integrated into business strategies (Greeno and Willson, 1996).

It helps users to see the relationship between the elements of the standards that make up the QMS, EMS, OH&SMS etc., and how they fit into the overall management and business systems. Linking two systems in a way that results in a loss of independence of one or both, means that these systems are integrated. The integrated systems then form a "system of systems" where the individual systems still retain their identity.

The adoption of continuous improvement is a springboard for behavioral change, but a fully integrated management system must

cover all disciplines and the management processes should extend into all parts of the business, Hoyle (1996). The three components of any management system are: management responsibility; process management; and support systems and these are the building blocks of both ISO 14001 and QS 9000 standard. Thus both the systems integrated is a way of achieving "world class" status.

3. TQM CRITICAL SUCCESS FACTORS

Critical Success Factors (CSFs) of TQM are latent variables, which cannot be measured directly (Ahire et al., 1996) . The background for this study has been previous survey-based TQM studies by various researchers. A number of studies have been done by many researchers on identifying TQM critical success factors across a myriad of industries. Saraph et al. (1989) developed measures of each critical factor and overall organizational quality management. There is a strong relationship between quality improvement approach and performance quality, as well as operating and financial performance (Anderson et al. (1994).

4. HYPOTHESIS OF THE STUDY

In order to understand the impact of ISO 14001 certification on the critical success factors of TQM in certified auto component manufacturers, the hypothesis formulated was as follows :

Ho: There is no significant relationship between TQM critical success factors and ISO 14001 certification.

5. RESEARCH METHODOLOGY

This study on TQM implementation in Indian auto component industries was focused on auto component manufacturing companies in and around Chennai, Tamilnadu. Chennai was chosen as the area of study as it contributes to 35 per cent of India's auto component production.

After reviewing the above quoted literature on TQM critical success factors and brainstorming with quality experts in the auto industry, ten critical success factors were identified for the auto component industry. The critical success factors that were chosen to be validated for this study on TQM in auto component industry were top management leadership & commitment, strategic planning, quality measurement, benchmarking, Training, HR Focus, Process Management, Supplier Quality Management, Customer Focus and Product Design.

The research instrument was a structured questionnaire with all the identified 10 critical success factors as constructs. In order to identify the sampling frame, a list of QS 9000 / TS 16949 certified in and around Chennai was obtained from quality certifications bodies BVQI, DNV and TUV. Totally there were 383 companies certified. After deliberations with TQM experts in the industry, it was decided that companies with more than one year of certification should only be chosen for the study as they would be able to assess any impact of the quality certification on TQM in their organizations. The population size was thus reduced to 295. Primary data were collected from the quality managers and executives of QS 9000 / TS 16949 certified auto Component-manufacturing companies in Chennai.

Questionnaires were sent out to the 295 QS 9000 / TS 16949 companies and 153 replies returned, a rate of about 40%. 18 were rejected as data was incomplete and could not be processed. Fieldwork basically refers to data collection period; primary data collection was started on 1st of January 2007 and ended on 15th May 2007.

6. MEASUREMENT INSTRUMENT

Based on the literature review, post identification of the critical success factors and the outcomes, items were developed to measure each dimension (critical success factor / enabler) under study. A structured questionnaire with 10 constructs as critical success factors and four constructs as the outcomes of TQM was used in this study .

The respondents were asked to evaluate the emphasis of the various dimensions on a five point scale. The instrument was empirically tested for validity by confirmatory factor analysis, correlation and regression. The reliability was established by establishing Cronbach's coefficient alpha.

6.1. Validity and Reliability of the Instrument

The instrument was empirically tested for validity by CFA (Confirmatory Factor Analysis), correlation and regression. The

*Table 1. Results of Confirmatory Factor Analysis**

No	Variable	No of Items	*RMSEA*	BFI	CFI
	Critical Success Factors				
1	Top Management Leadership	11	0.25	0.756	0.767
2	Strategic Planning	3	0.07	0.972	0.984
3	Quality Measurement	16	0.25	0.722	0.735
4	Benchmarking	4	0.15	0.888	0.904
5	Training	4	0.2	0.96	0.963
6	HR Focus	8	0.12	0.944	0.957
7	Process Management	11	0.3	0.78	0.787
8	Supplier Quality Management	9	0.24	0.883	0.89
9	Customer Focus	8	0.3	0.852	0.857
10	Product Design	11	0.22	0.865	0.874
	Outcomes				
11	Employee Satisfaction	4	0.34	0.956	0.957
12	Customer Satisfaction	4	0.15	0.988	0.99
13	Supplier Relationship	3	0	0.974	0.998
14	Operational Performance	12	0.31	0.778	0.785

**EQS software (for Windows 6.0) was used to conduct the confirmatory factor analysis.*

reliability was established by establishing Cronbach's coefficient alpha.

Individual items in the model have to be investigated to see how closely they represent the same construct (Ahire et al 1996). Then for unidimensionality checking, a measurement model is specified for each construct and CFA is run for all the constructs. The resulting Comparative Fit Index (CFI) is equal to the discrepancy function adjusted for sample size and usually ranges from 0 to 1, with a larger indicating better value fit. Recommended values for CFI are 0.9 and above (very good), 0.8 and above (good) and 0.7 and above (satisfactory) (Hu and Bentler 1999). Since all the CFI values for this study were above 0.7 as shown in Table 1, a satisfactory unidimensionality for the scales was established. This instrument has factoral validity because the items have loaded as they were hypothesized, when the items were constructed.

Since the measurement instrument was developed based on defined quality management practices of Saraph et al (1989), Powell (1995) and Samson and Terziovski (1999), it is therefore considered to have content validity. In the present study, as there are 14 constructs, a total of 91 discriminant validity checks (that is $^{14}C2$) have been carried out. All the 91 tests were statistically significant at a level of 0.01, indicating that all the 14 constructs are distinct constructs – a strong demonstration of discriminant validity.

Reliability relates to the extent to which an experiment, test, or any measuring procedure yields the same results on repeated trials (Carmines and Zeller 1979). Internal consistency is measured by calculating a statistic known as Cronbach's coefficient alpha (Nunnally 1978, Cronbach 1951). Coefficient alpha measures internal consistency reliability among a group of items combined to form a single scale. It is a statistic that reflects the homogeneity of the scale. The value of Cronbach's alpha above 0.7 is usually acceptable (Nunnally, 1978). The Cronbach's alpha values for this study were above 0.7 as shown in Table2.

Table 2. Cronbach's coefficient alpha (α) values

Construct	**Cronbach's coefficient alpha (α)**
Critical Success Factors	
Top management	0.9303
Strategic planning	0.7119
Quality measurement	0.9705
Benchmarking	0.7002
Training	0.8186
HR focus	0.9164
Process management	0.9773
Supplier quality management	0.9708
Customer focus	0.968
Product design	0.9754
Outcomes	
Employee satisfaction	0.9615
Customer satisfaction	0.9273
Supplier relationship	0.9416
Operational Performance	0.9839

Thus this testifies that all the scales are internally consistent and have acceptable reliability values in their original form.

7. ANALYSIS AND DISCUSSION

The influence of the ISO 14001 certification on the perceived level of TQM, was studied. One way Analysis of Variance

Table 3. ANOVA for TQM CSFs Outcomes with ISO 14001 certification

ANOVA						
		Sum of Squares	df	Mean Square	F	Sig.
TOPMGMT	Between Groups	0.001	1	0.001	0.015	0.903
	Within Groups	9.946	133	0.075		
	Total	9.947	134			
STRGPLG	Between Groups	0.275	1	0.275	1.222	0.271
	Within Groups	29.95	133	0.225		
	Total	30.225	134			
QUALITY	Between Groups	0.06	1	0.06	1.581	0.211
	Within Groups	5.049	133	0.038		
	Total	5.109	134			
BENCHMARK	Between Groups	0.655	1	0.655	5.792**	0.017
	Within Groups	15.041	133	0.113		
	Total	15.696	134			
TRAINING	Between Groups	0.095	1	0.095	1.445	0.231
	Within Groups	8.755	133	0.066		
	Total	8.85	134			
HRFOCUS	Between Groups	0.06	1	0.06	1.323	0.252
	Within Groups	6.034	133	0.045		
	Total	6.094	134			
PROCESSM	Between Groups	0.019	1	0.019	0.335	0.564
	Within Groups	7.597	133	0.057		
	Total	7.617	134			
SUPPLIER	Between Groups	0.047	1	0.047	1.385	0.241
	Within Groups	4.501	133	0.034		
	Total	4.548	134			
CUSTFOCU	Between Groups	0.093	1	0.093	1.729	0.191
	Within Groups	7.182	133	0.054		
	Total	7.275	134			
PRODESIG	Between Groups	0.206	1	0.206	5.190**	0.024
	Within Groups	5.278	133	0.04		
	Total	5.484	134			
HRSATIS	Between Groups	0.001	1	0.001	0.004	0.95
	Within Groups	17.849	133	0.134		
	Total	17.85	134			
CUSTSATI	Between Groups	0.003	1	0.003	0.055	0.815
	Within Groups	7.272	133	0.055		
	Total	7.275	134			
SUPPSATI	Between Groups	0.12	1	0.12	1.002	0.319
	Within Groups	15.88	133	0.119		
	Total	16	134			
COMPANY	Between Groups	0.252	1	0.252	5.332**	0.022
	Within Groups	6.273	133	0.047		
	Total	6.525	134			

** *indicates significance at 0.01 level*

(ANOVA) was performed to ascertain the relationship between the ISO 14001 certification and the demographics and the variables of the study, namely, the CSFs and the outcomes. The summary of ANOVA with F values is shown in Table 3.

From the above analysis, it is evident that ISO 14001 certification has significant influence on many critical success factors, benchmarking, product design and operational performance. ISO 14001 is an environmental management System (EMS) that is concerned with the outcome of an organisation's activities and ensuring that it conforms to the environmental policy, objectives and targets. The respondents perceive that environmental certification influence performance benchmarking both internal and external to the organisation. One key principle of ISO 14001 is to make EMS mandatory for supplier and partners (John.F. Affisco, 1997). Since QS 9000 companies are focused on building a quality supply chain, they include environment into the performance specifications of their supplier. The benefits that companies would gain would be risk reduction in storing hazardous material, effective corporate social responsibility, improved processes, and opportunities for innovation and ultimately protect the company's reputation and image (Dayna. F. Simpson, 2005).

Product Design has a strong relationship with ISO 14001. ISO 14001 has a significant influence on product design, especially on outbound logistics, warehousing and packaging. Use of standardized reusable containers, good warehousing layouts, and easy information access reduce storage and retrieval delays which leads to savings in operating costs whilst being environmentally sound (Purba Rao, 2005).

Among the outcomes of TQM, Operational performance is influenced by ISO 14001 certification. EMS is identified as a potential factor in the enhancement of financial performance and competitiveness of the firm. A EMS in place reduces inefficiency by initiating savings in raw materials, water and energy usage and thus leads to competitiveness and economic performance (Porter and Van der Linde, 1995) Organisations that minimise negative environmental impacts of their products and processes, recycle post-consumer waste and establish EMS are poised to improve performance and expand their markets (Klassen and Mclaughlin, 1996).

There is synergy between an environment management system and a Quality management system because of similar criterion, both are integral part of an organisation's overall management system and both are on-going iterative processes (John.F. Affisco, 1997).

Thus it can be inferred that ISO 14001 certification does influence TQM critical success factors. Hence the hypothesis Ho is rejected.

8. LIMITATIONS OF THE STUDY

Nevertheless, the findings and implications of this study should be interpreted with caution due to its limitations. Firstly, although this study was conducted among QS 9000 certified companies, they were all only Indian auto component manufacturers. Studies in other countries should be conducted to ensure the reliability of the results obtained. Secondly, though the study throws light on the interrelationships between the critical success factors of TQM and the ISO 14001 certification, it does not establish

interdependence among the critical success factors and the ISO 14001 certification. Finally as empirical relational relationship is only in the formative stage, further research need to be conducted to validate the same.

9. CONCLUSION

QS 9000 and ISO 14001 are so similar that they require integration in order to give improved performance and remain focused on objectives (Beechner and Koch, 1997). Although there are similarities between ISO 14001 and QS 9000, it is important to appreciate the differences. In QS 9000, the system provides a way of ensuring that the automotive products conform to specific requirements, but the EMS standard is concerned with the outcome of an organisation's activities and ensuring that it conforms to the environmental policy, objectives and targets. Though many authors such as MacGregor Associates (1996) opine that it is therefore unrealistic to consider integration of ISO 9001 with ISO 14001, but alignment may be possible.

There is need for an organizational declaration of environmental policy and the commitment to improve its quality performance, which requires a culture change in the organisation. Shillito (1995) sees responsibilities for implementation and operation, and professional and institutional pressures, as additional hurdles on the path towards integration of these tow management systems. Overcoming these hurdles requires behavioural change which he sees as a major step, and to achieve a "unity of purpose", an approach based on an assessment of the risks and the effects on quality, safety and the environment, and continuous improvement is needed.

In order to effective integrate QS 9000 QMS and ISO 14001 QMS, a conceptual model is suggested, such as the EFQM Model for Business Excellence, which should be operationalised by employing a method such as a questionnaire for selfassessment and by ensuring that the principles of feedback and improvement are addressed. A system based on the standards is required but for integration, both the similarities and differences have to be recognised. Finally, instructions and manuals have to be considered, where integration is achieved by merging instructions and procedures. Both the MBNQA and the EFQM model take a wide and holistic view of quality and propose "an integrated systems perspective of performance management".

ИНТЕГРАЦИЈА СИСТЕМА МЕНАЏМЕНТА КВАЛИТЕТОМ И ЕКОЛОШКОГ МЕНАЏМЕНТА - СТУДИЈА У ИНДИЈСКОЈ ИНДУСТРИЈИ АУТОМОБИЛСКИХ КОМПОНЕНТИ

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Извод

Бизнис организације обично примењују више од једног менаџмент система, укључујући систем за менаџмент квалитетом, еколошки менаџмент, менаџмент безбедности и хигијене, итд. Већина ових система фокусирана је на постизање компетативне предности организације, и циљ је што већа интеграција ових система. Истраживање у овом раду се заснива на студији индијеске индустрије аутомобилских компоненти. Током раних деведесетих, уласком интернационалних OEMa (Original Equipment Manufacturers) на тржиштре Индије, и локални произвођачи су морали да повећају квалитет своје производње. У том процесу различити менаџмент системи квалитета као што су QS 9000 и ISO 14001 су имплементирани. Овај рад говори о томе како интеграције QS 9000 Система менаџмента квалитетом и ISO 14001 система заштите животне средине као интегрисани приступ могу побољшати позицију компаније.

Кључне речи: Интегрисани менаџмент системи, ISO 14001, Индустрија ауто компоненти

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