Quality Management System Practices Performed in ISO 9001 Certified Engineering Educational Institutions: A Critical Analysis of Indian Universities

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Abstract: This study aims to analyse the quality management system (QMS) practices performed in ISO 9001 certified engineering educational institutes of India. The literature divulged that QMS in engineering education mainly engrossed on teaching, learning, examinations, student results and infrastructure. Very few studies mentioned QMS in terms of organizational effectiveness. Thus the author has conducted the QMS analysis in forty-five engineering educational institutions (EEIs) of Delhi NCR area in India and selected two groups of institutions based on years of existence. Group-a consists of twenty institutions less than fifteen years old, and group-b consists of twenty-five institutions over fifteen years old. Data were collected using a questionnaire from forty-five engineering educational institutions. The questionnaire was prepared using QMS constructs (ten factors) followed by the institutions and the quality measures followed by the national board of accreditation-NBA in India. Data analysis was done using SPSS 26.0 software to conclude the student t-test and p-value. The author found that the group-b institutions received substantially higher scores in variables that had top management commitment, systemic management approach, customer satisfaction, employee involvement, training, teamwork, continuous improvement, corporate social responsibility, academic culture and knowledge audit compared to group-a institutions. The study also revealed the strong and weak points of the institutional QMS, and there is a strong need to incorporate ISO 9001:2015-based QMS practices for the continuous improvement of institutions.

Keywords: National Board of Accreditation, Quality Management, Customer Satisfaction, ISO 9001:2015 QMS

1. Introduction

Technology and globalization have turned nations into societies powered by knowledge. They are radically speeding up the world's rate of transition and rising long-term risks. Performance in the knowledge-driven and innovation-driven world order relies primarily on people's capabilities, and the key to building those necessary capabilities is higher education, especially engineering education (Africano, Rodrigues, & Santos, 2019). India has done phenomenally well in building extensive nationwide infrastructure to disseminate year after year engineering education to lakhs of aspirants in every province. However, we need to promote quality and certified technical education on a scale to be able to fulfil the next wave of standards for engineering skills (Kansal & Singhal, 2018).

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Despite some attractive empirical studies in the field of engineering education (EE), the critical dimensions of quality have not been fully described. To enhance the quality of education, professional and educational institutions should adopt a course of action that accredited institutions around the world can follow (Pandi, Sethupathi, & Jeyathilagar, 2016). The syllabus propounds in most of the engineering institutions in India does not meet a global criterion. Hence, the difficulty arises from the absence of comprehensive and existing QM models in engineering institutions (Papic & Garcia, 2017). However, the rapid growth of technical institutions in India has led to a decrease in the quality of the technical workforce supplied by these private institutions.

Today, the implementation and certification of the Quality Management Systems (QMS) are essential for any organization since it is seen as a distinguishing flag for the educational sector's institutions. Quality is still addressed, but because of bottlenecks in funding, curricula, and faculty and student bodies, management inefficiency is acknowledged (Kansal & Singhal, 2017). In India, to accredit engineering institutions, the All India Council for Technical Education (AICTE) and the National Board of Accreditation (NBA) were established. The All India Council for Technical Education (AICTE) was formed as a national apex advisory body in November 1945 to conduct a survey on facilities available for technical education and to promote the country's growth in a coordinated and integrated manner (Farm, 2005). Focused on the QMS practices advocated by the accreditation body, this research study aimed to investigate the QMS practices carried out and their impact on the organizational effectiveness of engineering institutions.

Theoretical Framework

Quality Management System-QMS in Engineering Institutions

The Quality Management System (QMS) has been one of the world's most popular and omnipresent management systems over the last three decades. The continuous development of QM in organizations was, therefore, motivated, on the one hand, by competition and on the other hand, by increasing customer requirements (Kansal, Singhal, & Kumar, 2014). Mass production shifted to a more and more pull strategy with a higher customer and company orientation with a pure push strategy. Yet better business performance is required for businesses to compete successfully in the global business world. Hence, it is not possible to disregard the value of using QM criteria such as ISO 9001 (Bravi et al., 2019). Thus, when properly applied, recognized and embraced by all, the Quality Management System (QMS) offers very significant benefits for organizations where clients are continually demanding to enhance the quality of life.

Each company competes in a market economy with others who offer the same product(Suryan, Radhakrishnan, Ramachandran, Abdul Rahman, & Isaac, 2021). This concept applies irrespective of the form of bid, including actual products and intangible services, or their combination thereof. While quality management since the early 1980s has become a notorious problem, it is not an innovation(Vijaya Kumar, Petkar, H. K., & Jangali Satish, 2021). In many ways, we can tell the tale of efficiency. A significant number of scholars accept that the principle or theory of quality has existed for a long time, disagreeing only with others that for hundreds of years the concept of quality has existed, and others talk for thousands of years. As a management discipline, Quality Management is rich in research on various aspects and hypotheses, empirical field evidence and theoretical elaborations (Mohammadian, Babaei, Jarrahi, & Anjomrouz, 2019). Some of its fundamental elements are well identified and developed by international management standards such as ISO 9001 quality management system and ISO 14001 environment management system that are well recognized and commonly used (Kumar, Singhal, & Kansal, 2020). Organizations of consistency don't thrive nowadays. Many organizations, therefore, incorporate QMS with other management systems, such as the Environmental Management System (EMS) and the Occupational Health and Safety Management System (OH&SMS), which seek to utilize, among other things human, material and financial capital. Therefore, in various forms of organizations around the world, ISO 9001 is used (Aniskina & Lunina, 2018).

To evaluate the challenges posed by the Sustainable Development Goals (SDGs) of quality education, understanding the plan of education reform is crucial (Richert et al., 2016). Nowadays, the goal of all educational programs is to provide quality education. In several countries, the introduction of

quality management systems in educational organizations is a reality. In the most varied areas of science, including education, the word "quality" has been used, but there are significant variations in its conceptualization, i.e. there is no standardized meaning. Recognizing consistency, both in goods and services, as a deciding factor for organizational development in an increasingly competitive environment, is universal (Sunitha & Avanija, 2021). In the educational context, the definitions of 'quality' focus on different aspects such as customer satisfaction, the management and administration of educational institutions, the availability of human, financial and infrastructural resources, as they relate to the successful performance of IES functions (Yang, 2018).

Based on ISO 9001:2015, the introduction of the QMS in engineering education in India is intended to make management more effective, with an impact on academic training, financial resources management and human resources (Kumar et al., 2020). Through this introduction, the quality of both the offer of movement and the services offered to the academic community will be enhanced continuously. In addition to being a differentiating factor and affecting the attractiveness and notoriety of engineering educational institutions for teaching of recognized standard, it can also be an essential help for Institutional Marketing, for the external attention that certification can offer (Sá, Amaral, Barreto, Carvalho, & Santos, 2019). In this context, the study is designed and conducted to determine the standard of the randomly selected forty-five engineering institutions located in Delhi, India, using a questionnaire based on the quality standards of National Board of Accreditation (NBA).

2. Methods

The current study is based on a questionnaire survey of 365 faculty members from various ISO 9001 certified engineering institutes in Delhi-NCR, India. The purpose of this study was to look at QMS practises, analyse interrelationships, and compare the QMS procedures used by various groups of engineering training institutions.

In order to collect the data, the analysis used the qualitative approach, the conceptual structure helps to clarify the relationship between the variables, and a questionnaire-based survey was conducted.

1) Conceptual Framework

This study used a questionnaire survey and a structured interview to examine QMS practises and their impact on the organisational performance of engineering institutions. Forty-five ISO 9001 certified engineering institutes in India's Delhi NCR area, namely Gurugram, Palwal, Faridabad, Rewari, Sonepat, Noida, Greater Noida, and Ghaziabad, were chosen at random for pre-audit and structured interviews. The chosen institutions are separated into two groups, with the first group consisting of twenty institutions that are less than fifteen years old (group-a) and the second group consisting of twenty-five institutions that are more than fifteen years old (group-b).

Based on the quality assessment carried out by the All India Council for Technical Education (AICTE) and the National Board of Accreditation (NBA), the author has prepared a questionnaire on ten criteria, such as Top management commitment, systematic approach to management, customer satisfaction, employee engagement, training, teamwork, continuous enhancement (Fakhrzad, Talebzadeh, & Goodarzian, 2018), corporate social responsibility, academic culture, information audit. For the ten factors listed above, group-a institutions were compared statistically with group-b institutions. In which the mean ratings obtained were compared using a t-test of students to conclude. In the test, a P value of less than 0.05 reveals a substantial difference between the two averages achieved. In order to understand their position in terms of the overall quality mandate, all the organizations under study were also evaluated according to the quality model for their strong and weak points.

Hypotheses formulated on the basis of literature.

H1: There is a significant difference in QMS practices performed between Group-A and Group-B respondents.

Table I shows, an independent sample t-test was conducted to compare the QMS practices (TMC, SAM, CS, EI, TG, TW, CI, CSR, AC, and KA) for Group-A and Group-B respondents. There were significant differences (t $(335.711) = 4.971$, p=<.001) in the score with the mean score for Group-B (M=3.9822, SD= 0.73903) was higher than Group- A (M=3.5852, SD= 0.86389) respondents. The magnitude of differences in the means (mean

Table 1: T- Test for equality of means :

		Mean	SD	Levene's test for equality of variances		t-test for equality of means					95% confidence interval of the difference	
				F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
QMS Practices	Group B	3.9822	0.73903	6.651	0.010	4.971	335.711	.000	.39703	.07986	.23994	.55413
	Group A	3.5852	0.86389									

difference= 0.39703, 95% CI: 0.23994 to 0.55413). Hence, the above formulated hypothesis is accepted. QMS practices directly and positively influence the institutional performance identified by results domain shown in the table I.

3. Results

The quality evaluation report was used to provide points/scores to the 10 factors examined. Table II and Figure 1 illustrate the maximum points that the institutions may have earned, as well as the average factor-wise scores attained by group-A and group-B institutions.

Table 2 :
Score/points secured by the Institutions (MEAN* ±SE)

QMS PRACTICES	MAXIMUM OUTCOME POINTS	POINTS SECURED GROUP-A	POINTS SECURED GROUP-B	t-TEST VALUE
Top management commitment	50	$34^a \pm 1.0$	$39^b \pm 2.2$	0.001
Systematic approach to management	100	$52^a \pm 0.9$	$65^b \pm 1.9$	0.33
Customer satisfaction	175	$75^a \pm 2.6$	$90^b \pm 6.4$	0.01
Employee involvement	200	$110^a \pm 2.7$	$125^b \pm 5.9$	0.04
Training	80	$34^a \pm 1.5$	$42^b \pm 2.7$	0.001
Teamwork	50	$29^a \pm 0.7$	$35^b \pm 2.9$	0.06
Continuous Improvement	75	$37^a \pm 0.8$	$45^b \pm 2.6$	0.002
Corporate social responsibility	120	$62^a \pm 2.4$	$70^b \pm 3.0$	0.04
Academic Culture	50	$27^a \pm 1.1$	$32^b \pm 2.2$	0.001
Knowledge Audit	100	$32^a \pm 0.8$	$37^b \pm 2.4$	0.03
TOTAL	1000	492	580	

*The mean values of various superscripts differ considerably between columns.

The accreditation commission requires a minimum score of 650 for three years of certification and a minimum score of 750 for five years of certification for institutions to be certified, although the average scores of both group-a and group-b institutions fall short of this standard. Compared to group-a institutions, which fall short of the three-year award by a score of 158 (24.31 %), institutions in group-b fall short by a score of 70 (10.77 %).
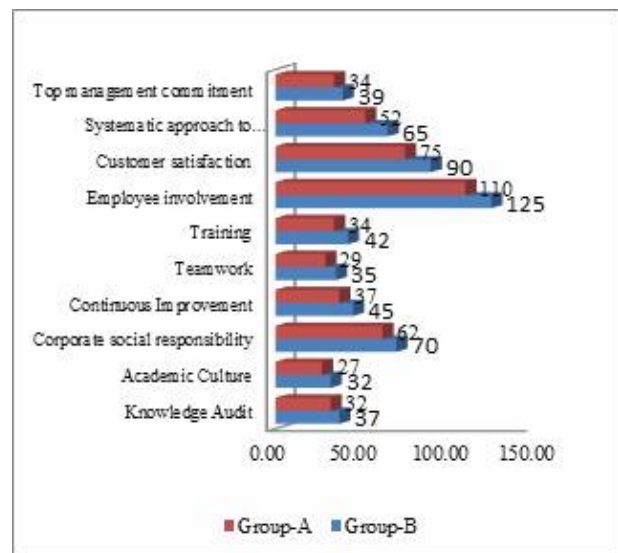

Fig. 1 : Bar chart showing the results obtained by both groups

Comparing group-a and group-b institutions, it was obvious that group B schools had a significantly higher score on the following parameters. Commitment from the top management Customer satisfaction, employee engagement and teamwork are all part of a methodical management approach.

Group-b institutions may have a higher score since they have been around longer. Financial resources are insufficiently utilised by group-a institutions, which lack a well-defined systemic management strategy Training and human resources, such as professors and

employees, are also lacking in quality. Group-a organisations have also failed to implement organisational structures, employee involvement, training, and academic culture. Group-b institutions performed better than group-a institutions, but their overall efficiency remained unsatisfactory, as evidenced by their cumulative scores. In both sorts of institutions, professors and students are underperforming. As a result, both types of institutions do not have the ability to conduct knowledge audits or implement corporate social responsibility in a systematic manner. Group-A and Group-B organisations are evaluated in terms of the following factors:

1) Top Management Commitment

Strong points:

a) Top-management takes an attempt to maintain customer attention and consistent performance metrics for all in the organization.

Weak points:

a) The efforts of employees or superiors regarding the production, enhancement and maintenance of quality have not been acknowledged by top management.

b) Quality circles or services for employee participation are not explicitly enforced in departments.

c) Lack of an appropriate human resources strategy relating to the institution's reward & recognition.

d) The organization does not have a systematic goal-setting mechanism for quality.

e) Workers shall not be permitted, by regular transfer, to make use of work experience in all areas of the organization.

2) Systematic Approach to Management

Strong points

a) To ensure consistency in the educational process, institutions have an academic performance analysis cell (APAC).

b) There is a separate coordinator set up to take care of the method of quality assurance.

Weak points:

a) Regular meetings were not conducted in the institutions to discuss the standard of education.

b) The allocation of funding for specific faculty development activities does not exist.

3) Customer satisfaction

Strong points:

a) Institutions promote the participation of parents in educating students.

b) Awards honouring the successful performance of both faculty and students are awarded.

Weak points:

a) Industry-institution engagement activities are not carried out periodically.

b) Better student placement programs are not given by campus recruitment.

c) In organizations, benchmarking procedures are not pursued.

4) Employee Involvement

Strong points:

a) The workers have the correct attitude towards improving the efficiency of the organization.

b) The institution frequently holds seminars/workshops/conferences.

c) Academic decisions are taken by consulting senior members of the faculty.

Weak points:

a) Through the consistency circle scheme, problems are not solved.

b) The workers are not driven by non-financial incentives.

c) There is no high and adequate wage and compensation.

5) Training

Strong points

a) Management offers effective leadership to improve the expertise of the members of the community and to delegate tasks for the smooth realization of quality targets.

b) Cooperation between departments is formed concerning the creation and enhancement of the standard of students.

Weak point

a) Educational programs are not performed at the principal and faculty level using sophisticated mathematical techniques.

b) The ISO 9001 /Six-Sigma / TQM implementation training are not provided at the institutions.

c) There is no internal audit of the ISO 9001:2015 program in the institutions with a trained faculty.

6) Team Work

Strong points:

a) Management makes reasonable efforts to take advantage of faculty expertise to enhance the institution's efficiency.

Weak points:

a) The ISO coordinator does not work successfully in addressing quality-related problems or issues.

b) Experts are not used in the resolution of the quality-related problems within the organization.

c) Individuals do not make their best contribution to achieving success within the organization.

7) Continuous Improvement:

Strong points:

a) The organization has a cell for an academic performance review or a quality assurance cell for institutional enhancement.

b) Management promotes workers to develop their

talents and innovation.

c) Continuous methods of change are implemented within the organization.

Weak points:

a) Suggestions are not accepted based on feedback/audits on academic affairs for the institution's elevation.

b) Helpful recommendations made by stakeholders are not generally made within the organization.

8) Corporate Social Responsibility:

Strong points

a) Protection and safety services are available for individuals concerning emergency exits and fire extinguishers in schools, labs, libraries, etc.

b) An agency used to solve social issues such as AIDS, seasonal illnesses, infanticide among women and child labour.

c) The institution coordinates annual general medical check-up services in the surrounding villages.

Weak points:

a) Social activists should not have special sessions and instruction to mould socially conscious students and faculty.

b) Agencies are not used for such social programs to receive the support of non-governmental organizations (NGOs).

c) In nearby villages, social health awareness activities are not carried out by organizations.

9) Academic Culture

Strong points:

a) A deep dedication to the preservation of discipline and a friendly learning atmosphere exists.

b) The institution's academic improvement team functions to improve student success.

c) Management facilitates the involvement of faculty

and students in the process of decision-making related to academics.

Weak points:

a) Workers are not provided with input on all aspects of their results.

b) Relevant instruction is not given to all personnel within the institution to preserve the academic culture.

c) The faculty members do not have an exact academic work schedule and work distribution.

10) Knowledge Audit

Strong points:

a) After completing faculty learning programs/refresher courses/seminars/workshops, evaluation of faculty members is performed annually.

b) Faculty members are assessed and reported on an annual basis; benefits are offered based on overall academic results.

Weak points:

a) Academic performance review cells do not efficiently assess the production performance of both faculty and students in terms of research papers, academic performance, etc.

b) Policy architects should not register all academic processes.

c) Information Mapping is not designed to optimize the use of people's resources.

d) The process of diffusion of information is not carried out by inter/intra-college activities conducted periodically within the university.

Therefore it is of crucial importance that QMS practices are introduced in all institutions to enhance the quality of not only the commitment of top management but also the empowerment and engagement of employees to ultimately increase the quality of engineers generated by these institutions. National accreditation boards can signal quality in the labour market, thus reducing quality uncertainty in the education market and mitigating the prevalence of low-quality education in engineering.

4. Discussion & Conclusion

One thing is clear: The leadership and commitment of top management are driving forces in the QMS culture at the institute. In terms of the total effect, leadership has a considerable impact on all of the other enablers. found similar results, while found similar results in another field. Leadership, policy and strategy, and people and process management all have a good impact on education, according to ".

When it comes to creating staff policy and managing resources and processes, it is imperative that top management's commitment is a reference point. Among the five enablers, shows that policy and strategy play a significant role. According to — and , management of people and resources is closely linked to the implementation of policy and strategy. "Top management commitment" has been found to have a considerable impact on the management of people, infrastructure, and administrative services in this empirical investigation.

Employee participation in continuous improvement initiatives is critical to the success of a Quality Management System (QMS). For greater performance at work, stress the importance of motivation and training. Educators and non-educators alike must be kept up-to-date on the latest methods, tools, and technology in order to teach pupils the information they need. Faculty training needs are identified and addressed by management by assigning them to suitable workshops and industries through ISO implementation. Teaching and learning become more efficient as a result of this element.

The authors of this study hope to draw the conclusion that high-quality institutions should pay attention to community improvement and well-being as part of their integrated social and environmental management plans. QMS is crucial for both local and global employment, training both students and teachers in the field of technology. Engineering businesses must undergo a paradigm shift and embrace QMS methods to ensure long-term sustainability and quality improvement, according to this study. For the National Accreditation Board, the QMS processes will help ensure that formal training is recognised in India. Quality Management Systems (QMS) can also be used to reduce the number of low-quality engineering institutes.

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