

## **Quality Management System Practices Performed in Engineering Educational Institutions: Analysis of Indian Universities**

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*Received August 22, 2021; Accepted December 02, 2021*

*ISSN: 1735-188X*

*DOI: 10.14704/WEB/V19I1/WEB19072*

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### **Abstract**

The purpose of this research is to examine the quality management system (QMS) practices in ISO 9001 certified engineering educational institutes (EEIs) in India. According to the literature, QMS in engineering education is primarily concerned with teaching, learning, examinations, student results, and infrastructure. In terms of organizational effectiveness, very few studies mentioned QMS. A QMS analysis was performed on forty-five EEIs located in the Delhi NCR region of India, and two groups of institutions were chosen based on the number of years they had been in operation. Data was collected from forty-five engineering educational institutions using a questionnaire-based instrument. The questionnaire was created with the help of QMS constructs (ten factors), institutions, and quality measures recommended by India's national board of accreditation-NBA. To validate the measuring instrument and determine the student t-test and p-value, the data was analysed using SPSS 26.0 software. The author discovered that group-b institutions received significantly higher scores in variables such as top management commitment, systemic management approach, customer satisfaction, employee engagement, training, teamwork, performance development, corporate social responsibility, academic culture, and knowledge audit when compared to group-a institutions. The study also revealed the institutional QMS's strong and weak points,

highlighting the critical need to incorporate ISO 9001:2015-based QMS practises for institutional continuous improvement..

## **Keywords**

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

## **Introduction**

It is widely acknowledged that engineering graduates play a significant role in the growth of industry and service sectors, and their impact is long lasting. To make the "Make in India" initiative a success and to produce advanced, futuristic products, India needs well-qualified and competent graduates. IITs, NITs, and other public and private technical universities are certainly doing an excellent job. However, only 5-10% of total engineers produced in India come from these prestigious institutes. More than 90% are from institutes in desperate need of quality improvement. The majority of them are affiliated with various central and state universities and teach the curriculum of the affiliating university. These universities are not optimistic about adapting to changes in the job market and are unwilling to change the quality of teaching and learning. Furthermore, these colleges are primarily focused on undergraduate programmes, with post-graduate programmes that are frequently lacking. As a result of the aforementioned factors, they lack a high-quality education system.

Furthermore, these institutes do not make a concerted effort to provide high-quality education and research. The quality assurance and accreditation efforts of these institutions can be characterised by "compliance" rather than "improvement" tools. They place little emphasis on regional development offices, which can assist them in studying the local market and better understanding the economic players. As a result, they lack entrepreneurial and innovative spirit. There was no quality assurance programme or model in the education system, so the Indian National Board for Accreditation (NBA) was established in September 1994 to accredit programmes that met the pre-defined criteria. Because it is not required, many programmes in various engineering colleges continue to operate without NBA accreditation. Implementing ISO has been recognised as a successful and productive tool for gaining a market competitive advantage.

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 (Kansal & Singhal, 2018). 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 et al., 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).

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 et al., 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. 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.

## **Literature Review**

### **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 et al.,

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. 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 (Aminbeidokhti et al., 2016). 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. 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 et al., 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. 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 et al., 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).

### **Research Gap and Objectives**

The literature review revealed the inadequacy of research on assessing organisational effectiveness following the implementation of quality management systems in technical educational institutions. In India, there is no specific model for evaluating the organisational effectiveness of technical educational institutes. A small amount of research has been conducted to assess the impact of mandatory implementation of Quality Management Systems as part of a Performance Monitoring and Evaluation system. A comprehensive integrated competency model does not exist for enhancing the effectiveness of technical educational institutes.

- To investigate the key factors that contributes to organisational effectiveness in technical educational institutions.
- To create a tool for measuring the effectiveness of technical educational institutions' organisational effectiveness.
- To assess the impact of Quality Management System implementation on organisational effectiveness.
- The study also revealed the institutional QMS's strengths and weaknesses, emphasising the critical importance of incorporating ISO 9001:2015-based QMS practises for institutional continuous improvement.

## **Methodology**

The study is empirical and employs a cross-sectional research design. The intended population for this study was faculty, students, and stakeholders from various ISO 9001:2015 certified engineering institutes in Delhi-NCR, India. The research focuses on the examination of QMS dimensions and their interrelationships in order to improve organisational effectiveness.

The data was collected using a questionnaire-based survey, with the qualitative approach used to help clarify the relationship between the variables. A questionnaire survey and a structured interview were used in this study to investigate QMS practises and their impact on the organisational performance of engineering institutions. Forty-five ISO 9001 certified engineering institutions in India's Delhi NCR area were chosen at random for pre-audit and organised interviews, including Gurugram, Palwal, Faridabad, Rewari, Sonapat, Noida, Greater Noida, and Ghaziabad. The selected institutions are divided into two groups, the first of which consists of twenty institutions that are less than fifteen years old (group-a) and the second of which consists of twenty-five institutions that are more than fifteen years old (group-b).

The author developed a questionnaire based on ten criteria, including top management commitment, systematic approach to management, customer satisfaction, employee engagement, training, teamwork, continuous improvement, corporate social responsibility, academic culture, and knowledge audit, based on the quality assessment conducted by the All India Council for Technical Education (AICTE) and the National Board of Accreditation (NBA). Group-a institutions were statistically compared to group-b institutions for each of the ten factors listed above. Finally, the mean ratings obtained were compared using a student t-test. A P value of less than 0.05 in the test indicates a significant difference between the two obtained averages. In order to understand their position in terms of the overall quality mandate, all of the organisations under study were also evaluated using the quality model for their strong and weak points.

## **Results and Discussion**

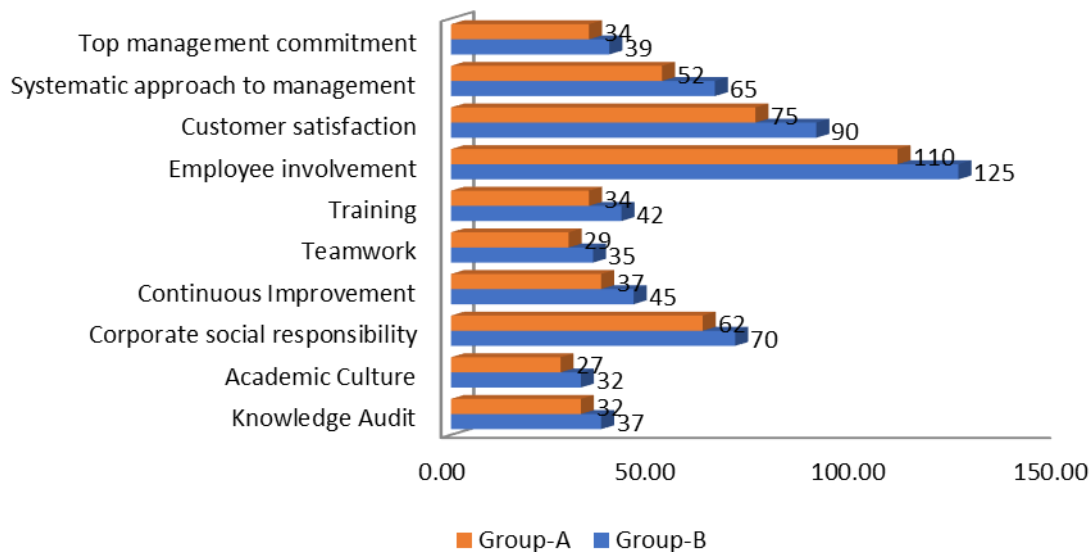
The quality evaluation report was used to assign points/scores to the ten factors examined. Table 1 and Figure 1 show the maximum points that the institutions could have received, as well as the average factor-wise scores obtained by group-a and group-b institutions.

**Table 1 Score/points secured by the Institutions (MEAN\* ±SE)**

QMS practices	Maximum outcome points	Points secured		t-test value
		Group-A	Group-B	
Top management commitment	50	34 <sup>a</sup> ± 1.0	39 <sup>b</sup> ± 2.2	0.001
Systematic approach to management	100	52 <sup>a</sup> ± 0.9	65 <sup>b</sup> ± 1.9	0.33
Customer satisfaction	175	75 <sup>a</sup> ± 2.6	90 <sup>b</sup> ± 6.4	0.01
Employee involvement	200	110 <sup>a</sup> ± 2.7	125 <sup>b</sup> ± 5.9	0.04
Training	80	34 <sup>a</sup> ± 1.5	42 <sup>b</sup> ± 2.7	0.001
Teamwork	50	29 <sup>a</sup> ± 0.7	35 <sup>b</sup> ± 2.9	0.06
Continuous Improvement	75	37 <sup>a</sup> ± 0.8	45 <sup>b</sup> ± 2.6	0.002
Corporate social responsibility	120	62 <sup>a</sup> ± 2.4	70 <sup>b</sup> ± 3.0	0.04
Academic Culture	50	27 <sup>a</sup> ± 1.1	32 <sup>b</sup> ± 2.2	0.001
Knowledge Audit	100	32 <sup>a</sup> ± 0.8	37 <sup>b</sup> ± 2.4	0.03
<b>TOTAL</b>	<b>1000</b>	<b>492</b>	<b>580</b>	

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

The average scores of both group-a and group-b institutions fall short of the commission on accreditation's requirement of a minimum of 650 for three years of certification and a minimum of 750 for five years of certification in order to become accredited. Group-b institutions fall short of the three-year grant by a score of 70 (10.77 percent), while Group-a institutions fall short by a score of 158 (10.77 percent) (24.31 percent).



**Figure 1 Bar chart showing the results obtained by both groups**

The comparison of group-a and group-b institutions revealed that group-b institutions scored significantly higher on the following parameters top management commitment, systematic approach to management, customer satisfaction, employee engagement, training, teamwork, corporate social responsibility, and academic culture.

The higher scores of Group-b institutions could be attributed to their comparatively longer experience. Group-a institutions lack a well-defined systemic management approach and make insufficient use of financial resources. Furthermore, training and human resources, such as professors and workers, fall short of expectations. It is also clear that group-a organisations have not implemented organisational frameworks, employee involvement, training, or academic culture. Although group-b institutions performed better than group-a institutions, their efficiency remained suboptimal, as evidenced by their cumulative ratings. Faculty and student performance has been subpar in both types of institutions. Both types of institutions lack opportunities for knowledge auditing, corporate social responsibilities, systematic management, research, teamwork, customer satisfaction, and so on. The following are the factor-wise, strong and weak points evaluated for both group-a and group-b organisations.

### **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.

### **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.

### **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.

### **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.

### **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 points:

- 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.

### **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.

### **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.

### **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.

### **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.

### **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.

QMS practises must therefore be implemented in all organisations to improve the quality of commitment, empowerment, and engagement among employees, all of which will ultimately lead to higher-quality engineers being produced by these organisations. National accreditation boards can serve as a quality indicator on the job market, reducing the amount of uncertainty about the quality of engineering education on the market.

### **Conclusion**

According to the findings of this research, high-quality institutions should pay attention to the improvement and well-being of the local community as part of their integrated social and environmental management policies. In order to train students and technical teachers, QMS is necessary not only in local jobs but also in jobs on the global market. All engineering organisations must undergo a sea change in their approaches and behaviours, and they must incorporate and adopt QMS practises for long-term sustainability and quality improvement. QMS processes will also ensure that formal professional training in

India is signalled by the National Accreditation Board. QMS methods can also help to reduce the number of low-quality engineering schools.

### **Limitations and Future Scope**

The current study also identifies the absence of a consolidated model for assessing the maturity level of management systems, as well as the absence of process management considerations in ISO 9001 and organisational performance studies. These gaps could be addressed in future studies on quality management systems and organisational performance, as suggested by this study.

### **Conflict of Interest**

The authors declare that there is no conflict of interest in the article contents.

### **Acknowledgements**

The authors are grateful to the directors/heads of all the ISO 9001 certified engineering institutes of Delhi NCR for providing research facilities and for contributing their valuable time.

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