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A Comprehensive Review of Engineering Education-Quality Management Perspective

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Abstract: Total Quality Management (TQM) is a business philosophy based upon customer satisfaction. TQM has been used successfully in variety of organizations including manufacturing and service organizations. Even though the TQM concept was first applied in industries in later stages, colleges and universities have gradually started applying the concept to enhance the quality in education. A high quality of engineering education is becoming increasingly important in India and abroad due to globalization and world wide demand for quality engineers. This calls for revitalizing the existing system of engineering education by adoption of integrated quality management approach. The study lists and examines various factors of TQM, identifies frequently used dimensions and critical factors that lead to success of TQM in various educational arena. To conclude this study, the researchers would prefer to suggest the ten successful critical factors of Integrated Educational Quality Management System (IEQMS) for achieving global quality in engineering educational institutions. The IEQMS is nothing but a bundle of global management practices namely Knowledge Management, ISO 9001:2008 QMS, ISO 14001:2000 EMS, Occupational Health and Safety Management Systems (OHSAS 18001:2007), Lean Management, Six-Sigma (DMAIC methodology) and TQM concepts.

Key words: Engineering educational institutions, quality management, IEGQM, TQM, lead

INTRODUCTION

TQM has been defined as an integrated organizational effort designed to improve quality at every level. It has to increase the efficiency of services in all aspects. Now a days few of the engineering institutions are aware and some are practicing the quality management concepts in order to compliance with the need of accreditation for enhancing the level of performance in academic fields.

It seems to be difficult for admission seekers to judge the quality of education due to the lack of knowledge of accreditation and the rising number of private varsities offering technical and higher education in the country. Prof. SS. Mantha, Chairman, All India Council for Technical Education (AICTE) said:

> The massive growth in the technical education system in India has spawned the need for quality. Thus, getting courses accredited is also gaining importance

In India, in spite of having ISO 9001:2008 quality management system and NBA certificates many technical institutions fail to offer the quality education as they fail to implement the quality concepts in toto. Unfortunately, though the quantum of engineering graduates produced is high, the failure to adopt and adhere to international quality standards by these institutions has resulted in producing sub-standard graduates who terribly lack in the required skill sets as demanded by industry. This results in critical shortage of employable and skilled engineering students which created a vast pool of unemployable workforce. It is felt by the researchers, unless the institutions through a systematic approach, implement an internationalized quality standards framework in engineering education in India, they could not satisfy the expectations of stakeholders. The objective of this study is to study through quality management perspective, the quality performance of engineering education. Researchers propose the Integrated Educational Quality Management System (IEQMS) practice to adopt for achieving global quality in engineering educational institutions.

LITERATURE REVIEW

There is a sea of literature about the Total Quality Management (TQM) in the manufacturing sector; health sector, etc. but literature regarding application of TQM in the educational sector especially in engineering education

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are lacking still. Some researchers have documented the experience of ISO 9001:2000 Quality Management System, Six-Sigma (DMAIC) and TQM implementation in some higher educational institutions for future studies. In this regard, the researchers have gone through the various research in respect of quality management practices in educational institutions which have been briefed.

Sureshchandar *et al.* (2001) discussed 12 dimensions of quality management as critical for the utilization of TQM environment in service organizations like banking and non banking financial institutions, insurance, health care system and education. A conceptual model for total quality control has been proposed demonstrating the relationships among its dimensions.

An empirical study conducted by Gupta (2000) on quality management practice of ISO 9000 certified and non ISO 9000 certified organization in India suggest that ISO and non-ISO certified organization do differ in the quality management practices. Further he pointed out ISO registered organizations having formal commitment to implement quality management practices.

Natarajan (2000) has explained quality engineering education is the development of intellectual skills and knowledge that will equip graduates to contribute society through productive and satisfying engineering careers as innovators, decision makers and leaders of the global economy of the 21st century.

According to Quinn *et al.* (2009), the techniques such as TQM, Quality Function Deployment; Six-Sigma; ISO 9001; the Malcolm Baldrige National Quality Award and the Academic Quality Improvement Programme (AQIP) for measuring and improving service quality in higher education. Further they suggest that the AQIP is a relatively new method of higher education accreditation for continuous quality improvement.

According to Demirbag *et al.* (2006), TQM is a factor that can improve quality and a holistic approach in continuous improvement in all organizations. TQM as a management philosophy and is a necessary tool for each organization to survive in a competitive environment.

In the view of Sila (2007), a complete assessment of TQM literature have shown that TQM practices could be secured in seven areas being leadership, strategic planning, customer focus, information and analysis, human supplier management.

The usefulness of TQM concept was explained by Deshmukh (2006) is that for technical education and also the six-sigma approach (DMAIC methodology) in evolving error free processes within the gamut of various activities of technical institutes.

Sarda *et al.* (2006) and Kaushik and Khanduja (2006) have explained the role of Six-Sigma (DMAIC methodology) in technical institutions for the continual improvement of the student results.

Rawat (2007) explained the following techniques of Knowledge Management (KM) and its application in higher education. They are Decision Support Techniques, Data Mining, e-Learning, Statistical Analysis System and Total Quality Management in higher education. He suggested KM is the need of the hour for education.

As cited by Bozbura (2007) knowledge management can be described as covering any intended and methodological process or put into practice the knowledge of acquiring, capturing, sharing and using knowledge wherever it resides in to improve the learning capability and performance of firms.

Thakkar (2011) explained that there is a great use of concept TQM in the manufacturing industries but its application in the education sector seems to be less. But now several colleges and universities have started using the concept of TQM and its values with a belief that TQM values are more compatible with higher education than many traditional management systems. Sakthivel *et al.* (2005) conceptualized five TQM variables and developed a 5-C TQM Model of academic excellence in technical institutions of India: commitment of top management, course delivery, campus facilities, courtesy and customer feedback and improvement.

Sahney *et al.* (2004) provided a very scientific application of QFD and SERQUAL in higher education. Their study examined statistically significant SERVQUAL and defined gaps in all aspects of business and engineering institutions in India. Results showed that the SERQUAL and QFD approaches helped organization to understand and fulfil the requirements and needs of the customer as constituting quality.

Sakthivel and Raju (2006) have concluded from the perception of students that the ISO 9001:2000 certified engineering institutions are moving towards the path of TQM offering better quality of service than the non-ISO certified institutions.

Sakthivel (2007) has explained the TQM implementation factors such as Commitment of Top Management and Leadership (CTML), Customer Focus (CFOC), Course Delivery (CDEL), Communication (COMM), Campus Facility (CFAC), Congenial Learning Environment (CLEN) and Continuous Assessment and Improvement (CAAI) that leads to the overall engineering education excellence.

Venkatraman (2007) proposed a TQM framework for the higher education with six core-values as the back bone for quality standard, i.e., leadership, educational management, HR management, information management, customer focus and satisfaction and partnership development. Further he has proposed a seven-step evaluation process to support the TQM framework model in which the guidelines have been given to suit the higher education.

Viswanadhan (2009) has identified some 'Indicators of Quality' and to prioritize the quality indicators in assessing the performance of an undergraduate engineering programme in technical institutions in Kerala, India. Further, he analyzed the perceptions of teachers about the quality issues under different management styles (autonomous, government, aided and self-financing) of engineering institutes in India and highlighted the differences in quality problems under the above four styles of managements in India.

Sayeda *et al.* (2010) explored the adoption of quality management practices in Engineering Educational Institutions (EEIs) in India from management's perspective and observed there was a positive and significant relationship among the TQM dimensions and institutional performance parameters. Finally they proposed a model for achieving institutional excellence from the macro perspective of the management.

Bilen (2010) outlined that although, TQM has been implemented with success in other service sectors its implementation inhigher educationhas been mostly limited administrative processes. He discussed about that the challenges in TQ Mimplementations face in higher educationand provides directions to overcome these challenges. Pal Pandi have developed a model, converging the various aspects of quality, i.e., ISO 9000 quality management system, six-sigma (DMAIC methodology), knowledge management, lean thinking and TQM into a single concept Integrated Total Quality Management (ITQM). The broad objective of ITQM Model is to satisfy the needs of all the stakeholders of the educational institutions. The ITQM Model includes seven critical factors, namely, Top Management Commitment (CF1), System Approach to Management (CF2), Customer Satisfaction (CF3), Employee Involvement (CF4), Training (CF5), Team Work (CF6) and Continuous Improvement (CF7).

Pal Pandi *et al.* (2009) further studied the practice of Integrated Total Quality Management (ITQM) in engineering institutions in TamilNadu, India from the stakeholders' (government, faculty, parents, students and the public at large) perceptive. They concluded that this study can also be applied internationally in the institutions of professional learning.

Rana (2009) analyzed the quality assurance activities adopted by higher educational institutions which have improved their performance in Pakistan. The researcher highlights the important factors considered for maintaining quality in an institution.

Faisal *et al.* (2010) developed and proposed the conceptual framework and research model of TQM implementation in relation to company's performance. They have revealed that this adoption of such a theoretical model on TQM for company's quality performance would help managers, decision makers and practitioners of TQM in better understanding of the TQM practices.

According to Manjula and Vaideeswaran (2011), the Capability Maturity Model for Engineering Education System (E^2-CMM) was proposed for improving the practices of key educational processes and contributes to enhancethe overall quality education. Further they suggest that the E^2-CMM Model can be used for continuously evaluating the education process which serves as the mantra for effective accreditation of higher education system.

Ilies *et al.* (2010) analyzed the quality of the university system from the industrialists' perspective. They concluded that the input from industrialists for the higher education will definitely improve the educational process and outcomes.

Sanjay Agarwal explained the basic concept of knowledge management and tried to develop knowledge management framework for technical education, particularly for teaching-learning process and they concluded to bring required changes in technical education through the introduction of knowledge management.

Arnheiter and Maleyeff (2005) pointed out both six-sigma and lean management has evolved into comprehensive management systems. In each case the effective implementation involves cultural changes in organizations, approaches to protection and to servicing customers and a high degree of training and education of employees from upper management to the shop floor. Moreover, they concluded the lean Six-Sigma concept emphasized on customer satisfaction, high quality and comprehensive employee training and empowerment and also leads to more benefits of the organization. Pal Pandi *et al.* (2008) introduced Lean Six-Sigma concepts in technical institutions for enhancing performance of the institutions by reducing the non-value added activities. Finally they concluded the adaptations of the Lean Six-Sigma concept in the technical institutions for the improvement of quality.

Many studies have proved that the performance of educational institutions is significantly and positively linked with the critical factors of quality. The above studies have focused on various quality improvement concepts like Six-Sigma (DAMIC), Knowledge Management, Lean Thinking, ISO 9001:2008 Quality Management System individually but not on the

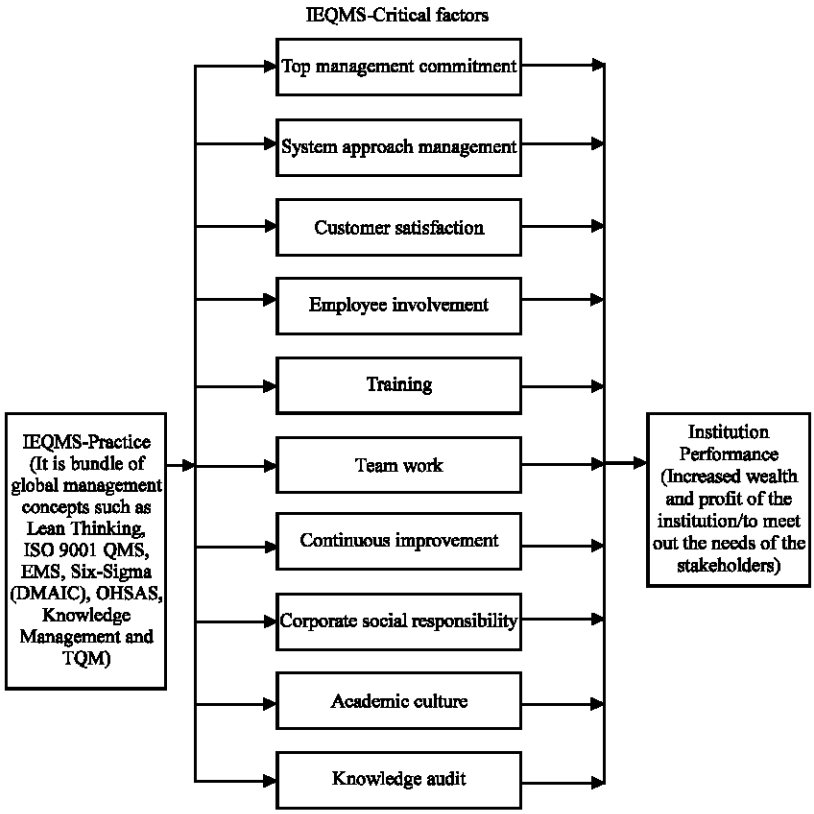

Fig. 1: A Proposed IEQMS for Engineering Educational Institution (Pal Pandi *et al*., 2012)

compounded manner where in all the quality aspects were brought under one umbrella called IEQMS (Fig. 1) which may inflict performance on implementation in Engineering educational institutions across the world.

DISCUSSION

Education in the field of quality is a key link in the chain of creation of new knowledge necessary for successful development and implementation of philosophy of quality in organizations and in society. The people and the government very well realized the importance and necessity of engineering education. So, the educational institutions are vested with tremendous responsibility to transform youth into highly talented intellectuals in their respective fields by imparting quality based education.

CONCLUSION

To conclude that in spite of availability of as many as research papers outlining various quality improvement concepts such as ISO 9001QMS, Six-Sigma (DMAIC) and TQM in higher educational institutions due to the lack of studies in quality education through integrated approach, the researchers recommend to implement Integrated Educational Quality Management System (IEQMS) for achieving global quality in engineering educational institutions not only in India but also in the international educational institutions. IEQMS as a model for institutional performance excellence and provides a scope for an academic environment in order to satisfy the needs of the stakeholders as well as maintaining universal accreditation requirements.

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