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A Critical Model for Achieving the Global Quality in ISO 9001 Certified Engineering Educational Institutions

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The technical institutes of India are seeking to create enough engineering graduates needed by employers. However, the capability to improve the quality of the average Indian engineering graduates has not yet been disclosed. The researchers of this paper suggested a critical model of integrated quality management systems (IQMS) with twenty key elements (IQMS 20-KE), which is nothing more than a package of global management concepts such as ISO 9001: 2015 QMS, ISO 14001: 2015 EMS, ISO 45001 OH & SM, Knowledge Management (KM), Lean Management (LM), 6- σ (DMAIC methodology) and TQM concepts. In general, the outcome of IQMS is to meet customer expectations and improve the work culture of the institution. Efforts have been made to elucidate the applications of IQMS model in the engineering education.

Keywords: ISO 9001:2015 QMS, ISO 14001:2015 EMS, IQMS, Knowledge Management, 6 σ DMAIC

Introduction

Employment prospects in India's manufacturing sector will hit a record high in the coming days. This prediction is of significant concern to those preparing corporate and public policy in an economy like India, where a large number of graduates from a rising number of engineering institutions continue to need infrastructure.¹ However, the fact that these institutes do not recognize and do not conform to international quality requirements is due to the vast number of graduates in the engineering sector. This has led to the fact that these graduates do not meet the standards and do not have the skills required in accordance with the industry requirements.² This in turn results in producing a stock of unskilled and untrained engineering graduates and immense number of unemployed engineers.

In India, engineering institutes do not have a standard quality strategy while there is no shortage of infrastructure available to them. This deficit is of great importance, since quality education makes a great contribution to national development, in addition to the social empowerment of a person.¹ The researchers conclude that if organizations that uses a systemic methodology do not adopt a model of global quality standards in engineering education, they would be unable to satisfy teachers, students and other

stakeholders perceptions of quality education.¹ Engineering knowledge is the fusion of research, experimentation, and experience. Engineering education is essential for improving a country's technical workforce. The ultimate goal of any educational institution is to ensure the quality and reliability of graduate students through the optimal use of students' potential, human resources and optimization of quality costs.^{2,3} Due to the effects of globalization, it is essential to ensure quality engineering education in an institution for its success and sustainability. Unfortunately, overall performance is not satisfactory in most engineering institutions in India. To overcome these challenges, institutions must practice an integrated quality management system in engineering education to achieve global quality in order to compete in the global market.⁴

Experimental Details

Conceptual Framework

The authors have conceptualized the following six global quality management practices relating to QMS in technical institutions and evolved a framework, the 'IQMS 20-KE Model', developing a correlation among these quality tools.^{1,2}

- ISO – 9001:2015 QMS standards in Engineering Education
- 6 σ (DMAIC Methodology) in Engineering Education
- Knowledge Management in Engineering Education

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- Lean Methodology in Engineering Institutions
- ISO 14001:2015 EMS Standards in Engineering Education
- ISO 45001 Occupational Health & Safety Management systems in Engineering Education

ISO – 9001:2015 QMS Standards in Engineering Education

ISO-9001 QMS certification is very essential for the service sectors like health care, hospitality, tourism and educational organizations etc. Now it is not limited to manufacturing/product industries only. A very important tool in trying to achieve quality in technical institutions is a “statement of mission and vision”.⁵ Mission and vision statements are the guidelines of the institution. ISO's mission is to support the implementation of standardization and associated practices worldwide to encourage the international trade of goods and services and the advancement of cultural, science, technological and economic cooperation.⁶ The ISO 9001:2015 QMS sequence is a compliance analysis, risk mitigation pre-requisite which offers a structure for introducing innovative management strategies in all organizations.

6 σ in Engineering Organizations

Six-Sigma's-6 σ importance in industries and global markets has contributed to the fact that educational institutions use the same to improve the quality of education. Six-Sigma's-6 σ is a systematic and structured approach (Define, Measure, Analyse, Improve and Control – DMAIC approach), which uses statistics and mathematical analysis to assess and enhance an educational institution's academic success by detecting and correcting "defects" (i.e., student failure rates). Over the years, many improvement models have been applied to the process, based on the steps introduced by Edward Deming, that is, plan, execute, verify, and act (PDCA).⁷ The revised version of the PDCA is called DMAIC. So, DMAIC is a positive proactive methodology, and Six Sigma uses it as a roadmap to solve problems and improve processes in engineering institutions.^{1,6}

Knowledge Management in Engineering Education

In the modern knowledge economy, information practices and learning strategies are very popular in the area of education. The variation between failures, sustainability and achievement lies in how engineering institution make use of its knowledge and its quality system.⁸ Knowledge management (KM) is engaged in the exploitation and development of an organization's knowledge assets in order to promote

the organization's objectives. Managed knowledge includes both explicit and documented knowledge, as well as implicit and subjective knowledge. Engineering education should focus on knowledge management to improve students' ability to learn and respond to challenges through the creation, inventory, dissemination and transfer of knowledge.⁹

Lean Methodology in Engineering Institutions

Lean methodology is now considered as a powerful economic tool for successful business growth.¹⁰ Adaptive management can be defined as: “A systematic approach to identifying and eliminating waste by continually improving by providing the product to the customer in search of excellence”. Lean thinking involves changing and improving work areas for continuous flow. Continuous improvement is one of the basic principles of lean thinking. Currently, many industries use lean tools, so they are called lean companies. Similarly, if educational institutions use lean tools, they should be called lean institutions.

ISO 14001:2015 EMS Standards in Engineering Education

Each service organization is aware of its environmental responsibility. The fulfillment of this duty is usually achieved through the established Environmental Quality Policy. ISO 14001: 2015 EMS: can be merged with other management systems to achieve environmental and economic objectives.¹¹ As a process, in accordance with the principles of IQMS, the management of the environment should focus on the needs and requirements of the client. The organization need to show that it actually practices what is said in the documentation. In other words: "Say what you do and do what you say"⁶ promotes environmental awareness among students, teachers and society.

ISO 45001 Occupational Health & Safety Management Systems in Engineering Education

Workplace health and safety is an interdisciplinary field regarding the protection of the workers or employees participating in workplace.¹¹ The objective of all workplace health and safety policies is to encourage healthy working conditions, as people are a more valuable asset. Occupational Health at work focuses on three specific aims: (i) maintaining and supporting workplace wellbeing and job efficiency (ii) improving working and working conditions that contribute to occupational health management system and (iii) developing organized labour and working cultures in an environment that enhances health and

safety at work.¹² Therefore, it is included in the QMS of education.

Methodology

The authors of this study conducted a comprehensive review of the literature for the conceptualization of various structures and the development of an integrated model, namely IQMS Model 20-KE (Model of an integrated quality management system) related to engineering education in India. Several experts in the field of education, consultants on the QMS ISO 9001: 2015 and potential employers were consulted to check the articles in accordance with the quality designs described for this research. People from leading engineering universities

in northern India (Delhi NCR region) were also consulted for a critical review of the subjects included in this framework. Furthermore, the model proposed namely the IQMS 20-KE, was distributed among experts for its approval. The previous model was developed after several consultations and brainstorming and recommended by the researchers for acceptance into institutions.

Results and Discussion

The authors developed a new Model namely “IQMS 20-KE Model” (Fig. 1) using the identified six quality constructs and twenty key elements, and establish the relationship binding these constructs.⁵ Continuous improvement (CI) is one of the core

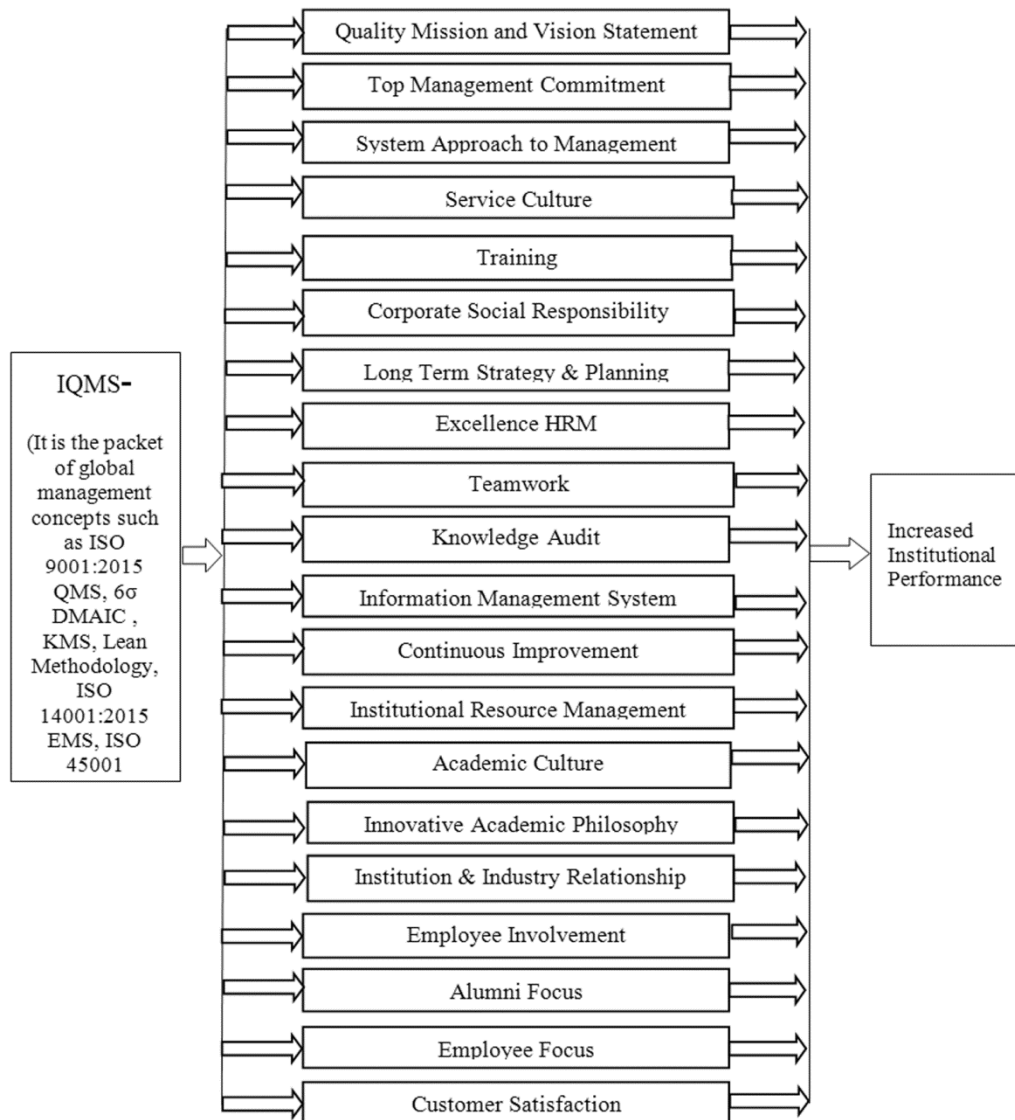


Fig. 1 — A Proposed IQMS Model for Engineering Educational Institutions

elements of ISO 9001:2015 QMS, ISO 14001:2015 EMS, ISO 45001 OHSMS, Six-Sigma, KM and LM concepts. That is why all the global management constructs are included into the Integrated Quality Management systems Model. The 20 key elements of IQMS Model are QMVS, TMC, system approach to management, service culture, training, corporate social responsibility, long term strategy & planning⁴, excellence HRM⁴, teamwork, knowledge audit, information management system, continuous improvement, institutional resource management, academic culture, innovative academic philosophy, institution & industry relationship, employee involvement, alumni focus, employee focus, customer satisfaction to be considered in engineering educational institutions.

The current research framed several engineering education-related quality concepts and utilized them to develop the IQMS 20-KE model. The whole approach is based on extensive research and understanding which provides an awareness of the requirements and needs of the students. The program of engineering education has to be capable of providing high quality educational services to students in order to stay competitive in global markets. Therefore, the IQMS model should find reasonable recognition in all educational engineering institutions, since it uses a latest methodology to explore the applicability of all aspects of quality management in technical institutions. Thus IQMS as a model for improving the efficiency of the institution offers opportunities for the academic environment to meet the needs of employees, society and other stakeholders.

Conclusions

From this article, the authors want to conclude that high-quality institutions should pay attention to the improvement and well-being of the surrounding society within the framework of the integrated social and environmental management policies of the institution. This is necessary to prepare both students and technical teachers not only for local employment, but also for employment in the world market.

Therefore, the authors propose that the top management of Indian institutions decide to implement IQMS Model as a strategic decision in their organization.

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