

## **Quality Waves and its Impact in Educational Quality for Attaining and Sustaining Institutional Excellence**

L Ramanan<sup>1</sup>, Dr M Kumar<sup>2</sup> and Dr. KPV Ramanakumar<sup>3</sup>

<sup>1</sup>Founder - Raise Consultancy Services, Sr. Member of ASQ & QCI, Former Six Sigma Champion of GE Healthcare, Research Scholar & Member SJ Centre for Adv. Research, SCSVMV University

<sup>2</sup>Process Quality Subject Matter Expert & Former Principal Engineer GE Healthcare

<sup>3</sup>Dean, Department of Management Studies, SCSVMV University, India

<sup>1</sup>[raise@LRamanan.com](mailto:raise@LRamanan.com)

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**ABSTRACT:** *Engineering Institutions under the Globalised Industrial Scenario, advancements in Technology, multi domain involvement in product development pose a big challenge in delivering quality education to the students who are employable, able to apply their learnings from academics for real life applications either for new product development or for solving some of the quality issues in the product or process or carry forward their learnings towards Research. Deteriorating Quality of Education results in low graduation rates, dissatisfaction in the education system and survival of the Institutions themselves. Various Quality Models that have been evolved over a period of time by the Industrial Leaders, have been adopted successfully by the other Industries in addressing many of their challenging issues, both at Macro or Micro level in attaining and sustaining excellence. This work reviews the different quality models & approaches to impact educational quality from the Industry, to attain and sustain excellence. Apart from the comprehensive review of the literatures for analysing the various quality models that have been leveraged by the educational Institutions from the Industry and their status in the Waves of Quality as applicable to Educational Institutions.*

**KEYWORDS:** *Quality Waves, Quality Models, TQM, Six Sigma, Higher Education*

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### **I. INTRODUCTION**

Quality is a measure for the sustained success of a product or process towards meeting or exceeding the functional expectations. Quality as applicable to the educational institutions is largely measured by the students' ability to apply their knowledge acquired from the academics to practical applications either in products or in process. Keller [1] pointed well, that the student's experience of feeling of satisfaction from their learning experience is equity and a positive consequence. Consequences are strategies to provide 'meaningful chances for learners to apply their newly acquired knowledge'; positive consequences are ways to ensure learner's success, while equity is a tactic to help students to have positive feelings about their achievements. Hence, approaches and applications that are proven in the Industry are definitely candidates for making the change in the Educational Industry.

### **II. QUALITY WAVES IN THE INDUSTRY – THE SUCCESS BEHIND BUSINESS EXCELLENCE**

Industry, over a period of time on a constant basis evolved and consciously embraced many waves of quality, in its efforts towards not only in attaining excellence, but in sustaining the excellence achieved, while striving to achieve further heights, as seen in Fig. 1. These waves of quality aimed at achieving enhanced quality of products and services in the Industry over a period of time, delivered many approaches and quality models by Quality Gurus like Juran, Deming, Corsby and many others. As could be seen from Fig. 1 to achieve excellence, the Industry has gone through many waves of quality movement. Till 1990s in the Industry, the focus was on channelizing the efforts towards product quality, 'confirming to the specification' through approaches like SPC and Quality System standards like ISO. As a next level of achieving functional excellence, the focus of Industry was shifted to Institutionalising Quality by focussing on Employee involvement, by adopting Quality models like TQM. These first two waves are of critical importance in ensuring sustenance to product and process quality. As a step further in achieving excellence through quality, Industry focused on adopting cost control measures through quality models like Lean Six Sigma, due to the competition and also due to demanding expectations from the customers on low cost of products with best features. These demanding needs forces the Industry on the constant look out for new techniques and models for achieving higher level of performance, while sustaining the levels of quality already achieved. Thus, current waves of Quality in the Industry focus are towards Innovations in the process and products.

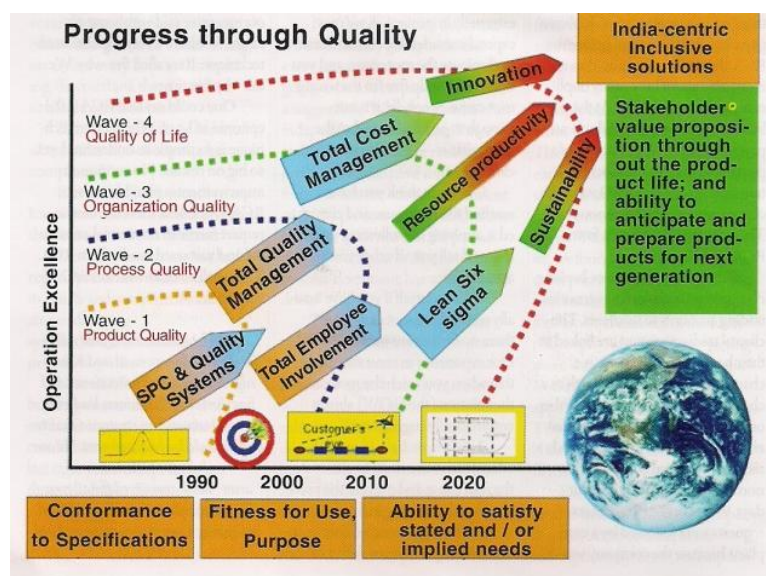


Fig. 1 Waves of Quality in Industry [2]

### III. LITERATURE SURVEY - QUALITY MODELS AND THEIR APPLICATIONS TO QUALITY IN EDUCATIONAL INSTITUTIONS

It shall largely benefit the Researchers and the stake holders working on the areas of "Educational Quality", if a literature review of existing work and application of Quality models to educational Institutions are brought out and mapped to Waves of Quality as presented in the later part of this work. Hence a brief work on the Quality Models as applied in academic Institutions, with their applicability, provide the scope for adjacent areas and research opportunities for these models from the published literatures. Ramanan et. al [3] explained the applicability of Six Sigma as a methodology in addressing the employability issue of engineering students and provided the broader frame work for applying the methodology with different phases, identified the root cause of issue and reserved case studies or application of tools etc. in further work. Ramanan et. al [4] explained the need for a quality metric for measuring quality in academic Institutions and proposed Six Sigma as a metric for it Ramanan et. al [5] detailed the two different models of Six Sigma, namely DMAIC and DFSS. The work focussed on DMAIC model & its applicability, at macro level of the Institution by comparing it to system level of product and also at micro level of the Institution, by comparing it to the component level of the product. Chitra [6] brought out the perception on employability from the angle of employer and students. She quantified the gap from the perceived views on employability from the structured survey questionnaire.

Prabhakaret. al [7] measured the quality of Engineering Institution by pass percentage of students, by considering education sector as a service sector of the Industry. They have quantified the success of Six Sigma application in improving the Quality to the pass percentage. Ramasubramanian [8] explained the various roles of Six Sigma as in the Industry and mapping it with educational Institution's academic roles in the implementation of Six Sigma for an Engineering Educational Institutions, with a fair complexity of educational process involved and the stake holders. Imam et. al [9] very nicely captured the 12 step process of Six Sigma and the variability, which is the fundamental concept of Six Sigma. Authors have explained how it will benefit the Institute if Six Sigma is implemented in all functions, process and departments and the design change, which is the philosophy of DFSS one process entitlement is achieved through DMAIC as explained in [5]. It also helps in sustaining excellence at its current level and raise the bar towards higher levels of excellence as shown in Fig. 2 Jayanta et. al [10] answers the question of whether the Educational Institutions can be run as an Industry, with a clear YES from published works. Explains the human value & knowledge assets created by Institutions as product than physical products like cars etc of an Industry and emphasises on the need for usage of tools like QFD in educational curriculum. The various phases of DMAIC model of Six Sigma is briefly explained, while briefing the experience of TQM and Continuous Improvements initiatives in Educational Institutions in the past. Ross et. al [11] Deals with document and content management solutions of higher educational Institutions by applying Lean and Six Sigma strategy. Briefs Lean Flow and Six Sigma with its origin and benefits. It quantifies Six sigma Application and its benefits from GE's products and business benefit of turnovers. Similarly, it traces lean flow history and benefits from Henry Ford's Day to adoption by Toyota with changes to suit the needs of Toyota

Production systems (TPS). Vidya et. al [12] explains in brief the quality models of Lean, Six Sigma and Lean Six Sigma and their adoption to Industries and higher educational Institutions. The authors after extensive literature survey concludes, that the scope for application and the opportunity for research in impacting Quality in Higher Educational Institutions with Six Sigma is higher, though the work already done are with particular parameters and particular area. Yulia [13] in her work emphasis on the significance of measuring student satisfaction in educational environment. It rightly quantifies the measure of student satisfaction and motivations are largely due to student interaction with other factors of educational environment. Joan [14] explains the proposal of applying Six Sigma to the System Level with emphasis on 3 Cs (Common Metrics, Constant Communication and Cultural Change). He views qualified Engineering graduates as a produce of defect free process. Few of the Six Sigma Projects executed have been explained, which can be compared to the Green Belt Projects as in Fig. 5 of [5] Norma [15] While reasoning higher education being at the cross roads, is due to higher tuition fees, low rate of completion rate of graduations and little accountability for improvements to attainments or achievements, explains how embracing of Lean Six Sigma Shall benefit educational institutions in academic accreditation process, DMAIC templates, remove hidden costs, establishing a common metric etc. Roger [16] quantifies the need for leveraging best management practices like Lean, six Sigma and Innovation Management concepts from corporate sectors for betterment of educational needs. He brought a new definition on the product of educational Institution, by defining the product of the Educational Institution as ' a process of educating the Student' and *student himself is not a product*. He defined further student as a team member actively participating in the design, execution and creation of the product, hence his involvement in the process. He has defined the customers of the educational Institutions product, their expectation, tent wastes in higher educational Institutions and means of eliminating waste.

Sean [17] explains the benefits offered by the Six Sigma to the Industry and academic courses offered in US Universities since 2004. He also explains the applicability of Six Sigma to academia and refers literature references in the myth that six sigma is applicable to larger Industries only. Detailed explanations of each phase of DMAIC are explained with literature references, along with the curriculum and tools. Quantifies with NAIT accredited program's requirement and evaluates the skill levels, while quantifying the awareness in academia. Deepak et. al [18] Tracing briefly from the origin of Quality to TQM and its applicability to service sector like Educational Institutions. Briefly explains the principles of TQM and the applicable tools. With a broader literature survey proposes four steps process, for adoption of TQM in service sector. Robert [19] Traces the origin of TQM with Deming's 14 Steps, which was embraced by Japan first and later my Motorola. Author explains how TQM was implemented in the Academy for the core course on Energy System and narrates for successful implementation how the support of everyone in the chain of the organisation is important. Author pointedly identifies the customers of an Educational Institution as Students and the employer employs them after a detailed consideration of all stake holders involved. Also precisely touches upon the attitudinal behaviours questions like "What we, faculty and staff, can do to make the learning experience in this class room better?" Quoting the reference from Winn [20], which is true till today on evaluation process, author explains the changes needed in process on testing & evaluation, which shall be focussed on progress in learning. Author has very well mapped the 14 points of Deming to the Educational Process. Norhayattiet. al [21] while tracing the origin and success of TQM in Industry for embracing it into Higher education suggest, it be addressed as TQE (Total Quality Education) as it extends beyond customers to the society and as a business beyond students. Authors with an extensive survey of existing literatures conclude that TQM as a quality model have not penetrated widely and got popularised to reap the benefit of Quality Impact in Education, like that of an Industry.

Irfan et. al [22] after a detailed survey of existing literature relevant to Engineering education identifies the gap in deteriorating quality level and the standards and the macro level contributions by the Governmental Institutions and the accrediting bodies like AICTE. Author suggests that quality model like TQM embraced by the educational Institutions to address the issues concerning engineering education. Murad et. al [23] attributes deteriorating quality of education to developing nation and reasons it due to paucity of funds. He details the functions of education and its purpose. They cite the definition of Quality, relates it to three dimensions of educational quality and the three acronyms in TQM. This work provides the great deal of references on Customers and Information flow in educational System. They have dwelt in detail *Students* as a customer and their changing roles. Author narrates that generally students prefer to select the Institution closer to their locations, which is correlating with Nagi [24]. Authors have touched upon how Technological changes impacted the educational system, the delivery of educational process and how they will contribute to the excellence if repeatedly as a continuous process. Abdul Raheem [25] explains how Leadership commitment is important in

Higher education quality from the experience of commitment and involvement from the King of Jordan. He traces the benefits of TQM to higher education and quality and define customers of higher education by citing various literature references. By citing literature references identifies one of the biggest resistance in TQM implementation is Professors, while narrating the importance of Leadership commitment and other factors that offer resistance in TQM implementation. Author proposed a conceptual Model, (which can be broadly compared to SIPOC of Six Sigma?), concludes TQM can be implemented to higher education with suitable modifications. Shramet. al [26] draws the conclusion after review of literatures that TQM implementation is not completed across all Industries and that too in small scale Industries of developing countries and reasoning out the investments needs for TQM implementation, while acknowledging the benefits of TQM implementation as observed from the Industries which have adopted. Wlodzimierz [27] relates Quality of Engineering Education and accreditation of Engineering education programs are closely connected to the engineering degrees awarded and also the professional competency of the Engineers himself and a precondition for International mobility. While explaining the three basic approaches, emphasis the need for worldwide standards from the principles of accreditation. Xilia [28] quoting from the popular Chinese proverb "Teach me, I will forget; Show me, I may remember and Involve me, I will understand", explains the need for reformation of engineering education of next generation with two key points i) Shift from Knowledge Transformation to Capacity building as complete knowledge transformation in class room is not possible, ii) shift from teacher centred education system to student centred education system. Author explains educational quality depends on how well the students learnt the subject rather than how well it was taught and with feedback explained in distribution frequency. Author explains that it is not possible to educate engineers everything from engineering school, which is the reason why engineering schools of China are called "cradles of engineers".

#### IV. WAVES OF QUALITY IN THE EDUCATIONAL INSTITUTIONS

##### 4.1 Current Scenario and Status

It is observed from the literatures, that the quality waves penetration in academic Institutions is in very slow phase, when compared to the Industry and is not specific to one country or region, though there have been few Institutions attempted and benefitted by embracing quality Models of the Quality Waves. From the literature survey, it can be broadly analysed and mapped to the waves of Quality in educational Institutions in achieving Excellence as presented in Fig. 2. As detailed in Fig.2, almost all of the educational Institutions, in particular higher educational Institutions have embraced Quality System Standards like ISO in enhancing the process of education and to make them defect free. However, the other waves of Quality are yet to penetrate and deliver results in the Educational Institutions. Embracing Quality wave not only benefits the academic Institutions, but also the educational system across the globe in solving some of the critical challenges like "Employability", this requires multi-pronged approaches both at Institutional and national level. The educational Institutions are forced to look at the Quality models for addressing the Quality issue of the products and the process of educational system, not only from the point of achieving excellence but their existence itself due to deteriorating quality. Towards this objective, It appears that the Quality Wave-2 in academia is started with multi-pronged approaches at macro levels from the Policy makers of the Nation and at the Micro level from the educational Institutions themselves across the globe. It is foreseen from the Industry's experience of sustaining excellence achieved and to strive for higher level, academic Institutions too shall face the challenge of sustaining the excellence once the quality issues like "employability" etc., are addressed. To sustain and to scale-up further levels of excellence, educational Institutions shall be forced to embrace other waves of Quality as seen in Fig.2

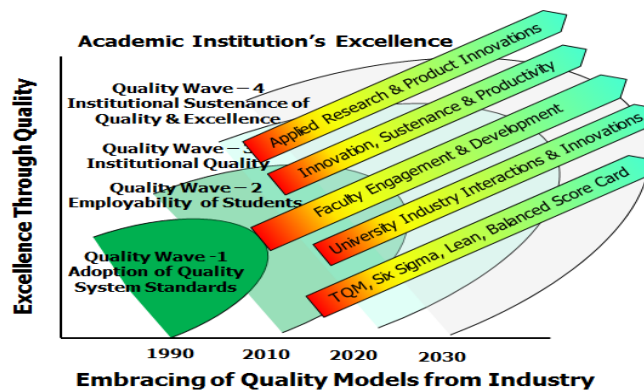


Fig. 2 Waves of Quality in Higher Educational Institutions

#### 4.2 Quality Models and Their Success

It is observed from the success in every waves Industry embraced, the success was achieved when there was a leadership involvement, commitment and adopted 'Top Down approach'. Though TQM was embraced by the Industry in 90s, penetration in educational Institutions appears not effective due to lack of management support as found from literature. Success of quality model like Six Sigma and consequent benefits in the Industries like GE is achieved due to the involvement of everyone in the chain of the organisation. Academic Institutions should embrace the six sigma structural model as presented in Fig 5 of [5] by involving everyone. As observed in literature, there will be resistance for Six Sigma Implementations in educational implementations, which shall be overcome by change management approach. As Six Sigma is a structured approach, metric driven and encompasses all the tools of TQM Fig 6 [5], it shall benefit the Educational Institutions largely as proved by Industrial leaders like GE, Motorola etc. However, it is left to the comfort levels of the Individual Institutions on adopting Quality Models like TQM, Six Sigma, Lean etc.

It is quite obvious Six Sigma as a metric [4], as a methodology and approach to the system level [5] at the macro level or for addressing an issue specific issue [3] at the micro level of Institutions, shall largely benefit Educational Institutions in enhancing the Quality in the Education. It is imperative the educational institutions need to adopt the Quality models and embed within their organisations by embracing the waves of quality as presented in Fig 2, depending on their current level of adoption not only for attaining excellence and sustaining excellence, but also from the stand point of existence of Institutions themselves.

#### 4.3 Scope for Further Research

As observed from the literatures as presented, there is no clear and consensus on the 'Customer' of educational Institutions, unlike the Industry. Since any of the Quality models like TQM or Six Sigma or Lean etc starts and end with customer, in the absence of clarity on 'Customer' of educational Institutions achieving excellence shall be a distant dream. May be this could be one of the reasons of slow penetration of quality model in educational institutions. It throws opportunity of research on stake holder analysis towards defining the customer of educational institutions.

### V. SUMMARY AND CONCLUSION:

Educational Institutions have realised the benefits achieved by the Industry, it is important by embracing the Quality Models depending on Institution's current level of maturity with a 'top down approach' and adopt multiple waves of quality in stages. It benefits the Educational Institutions not only in achieving different goals at every wave and attain excellence. It is extremely important that educational institutions adopt the quality models to exist, attain & sustain excellence and to scale-up for higher goals of achievements. It is extremely essential that the commitment and involvement of everyone in the chain of the Institution for successful implementation of Quality models and Leadership commitments towards embracing waves of Quality.

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