Adoption of Total Quality Management in the Educational Sector: Case Study of Engineering Institutions

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Abstract-
Due to the aspirations of various institutional stakeholders clamoring for improvement in the quality of education in their various institutions, the concept of total quality management has gained so much attention to this regard. In the recent time, several emphases have been made on the need for quality improvement and efforts are been put in place on the possible ways of increasing the standard of education globally. The productivity of any tertiary institution, especially the Engineering colleges is centered on the quality culture of such institutions, also, the customer’s satisfaction is another thing to put into consideration, to achieve the desired productivity. Generally, there are some constructs which are the major critical success factors that enhances quality improvement in any organization, customer satisfaction has been identified as another important factor to put into consideration to achieve optimum quality of products as well as services. This paper gives an insight on how the implementation of Total Quality Management in an Engineering educational system can aid the Quality of Engineering Education.

Key words: Quality, Engineering Education, Total Quality Management (TQM), Quality Award models, Six-sigma.

1. Introduction
The transformation agenda of quality revolution in the manufacturing sector began with Taylor in the 1920s [1]. Payne [2], enumerated in his study that many of the manufacturing sector were basically interested in the production output, rather than the “market in” situation. These are one of those things that facilitated and led to the development of the concept of Total Quality Management (TQM), both Deming and Juran were the initial Americans who embraced the concept of TQM having seen its implementation by the Japanese [3]. In the case of Deming, he centered his interest on how organizational practice, as well as organizational behavior, can be used to accomplish quality in an organization using his fourteen Quality points. The adoption of TQM concept in the manufacturing, service and industrial sector has gone from strength to strength over decades.

Total Quality Management which has been identified as an ethical concept, aimed at improving the quality culture of any organization or institution, this can only be attained with the individual employee change readiness will[4]. One of the main attributes of TQM is its ability to improve quality across all sectors, which is also a subject of the employees’ perception towards it. In this context, quality improvement process in any institution or organization involves the
collaborations of all the employees and employers’ effort. Therefore, TQM is considered as a unique broad management practice. The evolution of TQM started from the manufacturing sector, which involves operations of series of components to make a desired product useful to mankind.

According to Jain [5], the educational system operates the same operational techniques adopted in the manufacturing process. He further emphasized that the educational system was previously developed to suit the industrial era, where pupils were taught some specific skills with the primary motive of them being able to apply this acquired skills into their daily industrial engagements. He maintained that the educational system, which we are currently using was adopted from the mass production technique of manufacturing processes of standardization. He further explained this procedure as a process that entails availability of raw materials or resources which are assembled together based on a specific criterion. The raw resources for production are then transferred from one position to another position where a professional makes little modifications to it based on the task he’s given to do on it. After the whole assembly process, the assembled goods are made to go through a standardized test, to check if they meet the required criteria before they can be transferred to the succeeding complex assembly line. He postulated that the educational system is also using the same philosophy to teach the kids or student of nowadays, equating the process with the manufacturing process. The students are grouped together based on their date of manufacturing (which implies their age in the actual sense). They usually assemble in the education assembly line in their schools on daily basis, starting with one position or station (which implies their classroom) to receive some specific teaching from their teachers before automatically transferring them to the successive class where they are to take another teaching over a certain period. Either once or thrice a year, they are made to go through some standardized test to measure their eligibility for the next grade or higher class (education advanced assembly line.)[5]. The manufacturing system in which the educational sector adapted its operational process is now facing quality challenges, however, it becomes highly imperative for the educational system to adapt and embrace the concept of TQM.

There are a lot of technological innovations, modernizations across the globe, hence, the need for internationalization of Engineering education becomes necessary. The industrial sector has witnessed continuous trends in change owing to deregulation as well as global competition and, the emergence of new technologies which has caused disruption in the business environment, most especially, in the areas ICT.

Globalization is another factor that contributes to research and teaching in engineering [6-9]. Many companies in the developed countries found research institutions and graduates schools in higher education institutions, especially the Engineering colleges in carrying out their research plans. They equally believe in the expertise and skills of the Engineering graduates, and therefore, offer them job opportunities. Adoption of new teaching technologies such as integration of computer-supported cooperative as well as collaborative learning which serves as technique supporting self-driven as well as work-related learning procedures. This new adoption must be well incorporated in engineering education. They are targeted at ensuring quality culture is attained, create the philosophies of an error-free task.
An appraisal of TQM in the Engineering Education ensued through illustration from definitions perspective, from the viewpoint of Taylor et al [10], it was emphasized that aside other sectors, it was established that TQM which can be termed as a philosophical instrument for quality improvement is a concept on its own, which might be difficult to appraise in higher education easily. Harris [11], in his study, enumerated the three basic approaches to TQM viz: customer focus approach, this entails the process by which services to students are being given attention by the staff members with adequate staff training as well as staff development programs organized for them to sensitize them. Secondly, a staff focus approach, this involves the improvement and input of the entire staff members towards the success of the institution. Thirdly, the service agreement perspective which aims to ascertain compliance to the requirement of measurable points of the educational process. Dahlgaard et al. [12] defined TQM in education as an educational quality culture process and instructive culture, basically aimed to achieve upmost improvement in customer fulfillment via the use of continuous improvement approach which involves both students and employee’s active participation. From past findings, most of the attributes of TQM are mostly suitable for incorporation in the technical institutions.

There are different definitions on Quality in education by several scholars, Feigenbaum [13] viewed the concept of quality as a great value addition in the educational system. Brennan et al., perceived quality as a fitness for purpose, which basically serves as fitness in achieving educational outcome as well experience for use as buttressed by Juran and Gryna [15]. David [16], sees quality in education as total conformance of education productivity to planned goals of the educational institutes and, total avoidance of defects in the education process. Sahney et al. [17] Describes quality in education using TQM viewpoint as multi-faceted which operates on the basis of an academic establishment based on systems style, inferring management techniques, technical techniques as well as social techniques.

2. Theoretical Review on Total Quality Management in Education

Several Scholars have conducted researches on TQM in education, Holmes and McElwee [18], presented their view on TQM in higher education institutions, they believed that the adoption of TQM model as a managerial ideology has made it unavoidable for its adoption by most Human Resource Managers in formulating their policies and practices. Though, their study concluded with a view that adoption of TQM in education might restrain the efficiency of some of the staff members. Crawford and Shutler [19], elucidates on the operational modalities of TQM in an industrial setting, comparing both Deming and Crosby framework on the relevance of TQM to education, gives an insight on how TQM framework developed by Crosby can be implemented in the educational settings. Harvey [20], exemplified in his study that the concept of quality should be perceived as a transformative process and not as a perfection process, his study suggested that educational managers should engage in transformation agenda program aimed at changing student’s life experience by introducing empowering programs to them.

Kwan [21], attempted in his study to criticize the benefits and relevance of TQM in education and enumerated the differences observed in the application of TQM in the educational sector as well as the industrial sector. Owlia and Aspinwall [22], adopted the system dynamics approach to strengthen and unravel the benefits of TQM in HEIs, he conducted a survey study to categorize the main critical success factors responsible for the quality performance
improvement in higher education. They equally developed a checklist suitable for applying TQM model in HEIs, using the United State of America as a case study. Sahney, et al[23], introduced a unified approach to ascertain the discrepancies in the literature on quality in the educational setting as well as the customer requirement in the present day educational settings.

3. Quality Award Model in TQM

Quality framework has been identified as one of the greatest irreplaceable tools used by institutions and organization to achieve quality improvement as well as performance improvements. This brings about various discussions pertaining to how likely improvements can be achieved in a project through determination, classification, and prioritization. In choosing a framework for an institution, the choice of the framework must be determined by the stakeholders of the institution, which is the overall quality strategy. The adoption of an external quality award can be helpful in maintaining the quality of an institution, while it becomes highly imperative to ensure the adopted quality award features are interrelated with the institutional vision and priority. There are some notable recognized TQM frameworks in higher education institutions, some of them are; Malcolm Baldrige’ Award, adopted in the USA, the ‘European Foundation for Quality Management (EFQM) adopted in Europe as well as NCEA adopted in the Ireland.

4. Six Sigma Approach for Quality

Six-sigma is a well-organized approach, a customer-focused approach designed to aid organizations and educational institutions to project progressively the establishment of an accurate products as well as services. Sigma means a statistical term which assesses the manner by which certain processes diverges retrogressively, leading to imperfection. The principal clue about six sigma is illustrated by Glory[24], if one can quantify the number of “defects” in a process, systematically, someone can be able to figure out the possible ways to remove the defects and achieve almost a “zero defects”. According to Ken[25], defect can be defined as “anything that dissatisfies either internal or external customer’s expectations and requirements”. In the Educational settings, the following could stem to defects which could eventually lead to student dissatisfaction, which is the customer in this case:

- inaccessibility to teacher at a time student needs clarification on some doubts;
- unwarranted postponements in evaluation as well as preparation of results;
- deranged structure of examination paper implies inappropriate provision of essential scale to different categories of students towards demonstrating their abilities;
- uncultured behavior of teachers both within as well as outside the lecture rooms;
- teacher’s ineffectiveness understanding student psychology as well as learning curve;
- Inability of the teachers to encourage the students to take their studies as their priority.

Six-Sigma is known to be demanding and well-organized approach that makes use of information as well as statistical analysis, basically for measuring as well as for enhancing a company's quality and operational performance using the identification as well as eradication of "defects" in different processes. Six- Sigma is seen by various researchers as an integrated method to attain quality. The idea of Six-Sigma is basically to detect a default in a process, employ project to precisely to rectify the default, appraise the process as well as adopt the
continuous improvement approach to ensure and ascertain improvements in the process is achieved. In the educational sector, Six Sigma relates to how quality of a subjects imparted on students can be improved, and also, the attitudes of the students, as well as the quality of study[26]. In this approach, the process suggests a situation where a work environment as well as quality of work life in which all and sundry within organization wishes to accomplish the Six Sigma goal, to improve customer fulfillment, to improve effectiveness, to lessen costs as well as to expand prominence of the institution. This philosophy offers a vital and unending direction towards management. Adoption of Six Sigma implementation in the educational sector, this entails the involvement of the teachers as the dynamic service provider. In this case, the customers are considered as the parents who is responsible for the fee’s payments, who automatically seeks for quality in return.

In Six Sigma implementation, the attention begins by acknowledging problems to be solved as well as defining a suitable project to resolve it. The project can be executed using DMAIC approach. The DMAIC method implies; “Define, Measure, Analyze, Improve as well as Control”. These could be explained further as:

**DEFINE**: At this phase, outlining a project to be executed is imperative using a process map, an application area, anticipated improvement, likely advantages are well spent out. This is essential to stand a chance of achieving a successful delivery of an improved quality as well as achieve costs saving. In the academic setting, the failures include recognizing as well as defining the problem to be addressed. Projects may characterize as realistic challenges, which could be in form of disturbance and commotions in the classroom, low turnout or non-compliance of students in attending class.

**MEASURE**: In this stage, analysis are being carried out on the process, this is conducted to establish its current status as well as its anticipated future state. Data collection is one of the core prominences of this phase.

**ANALYSE**: The analytic phase entails analyzing data to identify some parts of the process that directly or indirectly affect the quality of the problem been addressed. Some analytical tools were adopted for this process, flow charts, the use of cause-effect drawings as well as other useful quality enhancement tools were usually adopted in analyzing this distinctive problem.

**IMPROVE**: The improvement phase adds up to the process to ensure a lasting resolution to the problem. The improvement phase involves the introduction of better strategies such as; better forecasting, effective scheduling, better procedures, indicating specific teaching approach, ensuring suitable working environment for both students and teachers.

**CONTROL**: The control stage is achieved by ending the problem through adoption of the precise and suitable procedures as well as management instruments.

5. Conclusion

TQM has been identified as a managerial instrument deployed into organization to achieve quality and performance improvements. In this study, the attention is centered on the possibilities of how TQM can aid Engineering Education in an academic institutional
environment. It has been established from the Literature earlier discussed in this study on the possible factors to put into consideration. To achieve quality improvement in an Engineering educational institution, the educational process must be based on learning approach as against the traditional teaching-based approach which has been the order of the day in most of the developing countries. The learning approach entails deployment and installation of latest technological equipment’s, such as interactive boards and other learning equipment’s like the Virtual reality application software and hardware gadgets as educational learning tools should be installed into lecture’s rooms. This will create an enabling avenue for the students to share knowledge as well as experience within the engineering colleges, hence, this will aid and improve their learning productivity. Continuous feedback has been identified as another means of evaluating learning process. It becomes highly imperative for both staff and students to adopt this clue.

Both industrial sectors and educational sectors are the key factors of economic growth in a society. Therefore, it becomes imperative for all sectors to team up strategically to accomplish the task and responsibility of wealth creation for their nation. In lieu of this, industry engages the services of academic professionals to enhance the learning abilities of their staffs continuously. Also, it is important for the educational institutions to exploit the industrial talent as well as their facilities to amplify the result of the learning process. Several TQM constructs such as Teamwork, Leadership, Customer Focus, Program design, and Continuous improvement are closely connected to one another. Continuous improvement is essential to accomplish higher customer satisfaction; hence, it is best efficient when motivated by customer wants. Continuous improvement goes beyond hierarchical, efficient and organizational boundaries, so, teamwork is essential. Thus, Total Quality Management is a conventional underpinning philosophy, which are targeted at satisfying customer's needs. TQM philosophy is founded on three fundamental concepts, which are: to turn out to be customer motivated rather than being self-focused, to pay more attention on the process instead of being anxious of the expected results; and lastly, to utilize employee’s thinking ability.

The TQM philosophy developed by Deming aids in sensitizing and training the educational institutions. The measurable framework of several TQM Award model pinpoints some of the essential requirements as well as the characteristics of the Engineering Institutions. It is anticipated that the relationships and the characteristics identified will develop helpful insights largely in developing and streamlining the processes. Also, the six-sigma method aids in developing an error-free processes within the scope of several activities of these institutions. It could also help in giving a measurable outlook to numerous processes in DMAIC format. In the phase of an evolving competitive situation, where performance of an institution is meticulously inspected by various stakeholders, it becomes highly important for all Engineering institutions to start adopting and implementing the concepts of TQM.

An operative TQM operation in an Engineering Education Institutions needs a management commitment shown via examples and not through gimmicks. The top management personnel should act as facilitator and not as dictators. Operative Strategic planning, as well as Information management, should be encouraged, clarification of the mission as well as the vision of the institution should be made known among all employees and emphasis should be placed on long-term academic requirements rather than short-term commercial needs. To get the best service of
the faculty and supporting staff members, their own needs to be met as a matter of priority. Problem-solving style through teamwork should be encouraged. Employee's commitment should adhere strictly to the systems procedures, and, an improved work culture can be achieved through an open trust environment. Constant review and reduction of non-value-added activities should be done.

Emphasis are made on the need for quality improvement of daily basis, the need for all higher education to embrace quality continuous is becoming an arduous one. In order for higher education institutions to survive and be able to compete globally, quality improvement must be acknowledged as a goal and practiced. Quality is seen as a state of mind, which is an outcome of a devoted work culture, a steadfastness in doing one’s best, and attending and focusing to the given task in professional manner. To ensure the success of Quality ascendancies in educational sector, effective change in culture, attitude of people and environment, must be achieved.

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