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Total Quality Management

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TQM is the outgrowth of a long line of developments seeking to evaluate and improve the quality of manufactured goods. The idea behind TQM is that much can be achieved by innovation, but competitive advantage is largely affected by continuous process improvement. Universities and colleges have applied TQM to both the administrative aspects of university operations and, to a lesser extent, the academic aspects. Experience with the TQM process on university campuses has found it to be inexpensive to undertake and relatively quick to complete while achieving significant improvement.

INTRODUCTION

What we today call Total Quality Management, or TQM, is the outgrowth of a long line of developments dating back to Frederick Taylor's efforts in the 1920s to evaluate and improve the quality of manufactured goods. Following Taylor's efforts, the next major improvement came with the introduction of statistical quality control procedures as pioneered by the Bell Telephone Labs in the 1940s. This effort was, in turn, followed by Demming's work with quality assurance. Demming focused on continuous improvement and the elimination of waste. Ultimately, quality assurance efforts began to broaden so that they became a concern of all management and led to the Total Quality Management approach used today.

The literature is rich with descriptions of TQM as a process for improving productivity and customer satisfaction. The purpose here is not to present a detailed description of the process, but rather to highlight the general principles involved and to point out how this process has been and can be used to improve the quality of academic institutions.

Capecio and Moorehouse refer to Total Quality Management as:

> *a management process and set of disciplines that are co-ordinated to ensure that the organisation consistently meets and exceeds customer requirements. TQM engages all divisions, departments and levels of the organisation - Top management organises all of its strategy and operations around customer needs and develops a culture with high employee participation. TOM companies are focused on the systematic management of data in all processes and practices to eliminate waste and pursue continuous improvement* [1].

DESCRIPTION OF THE GENERAL PROCESS

The goal of TQM is to deliver the highest value for the customer at the lowest cost, while achieving sustained profit and economic stability for the company. Top management must commit to a vision and align and train its employees toward a common mission.

To do this, cross-functional teams work on improvements that respond to customer requirements. Long-term relationships with customers, suppliers and employees focus on quality beyond short-term profit. In essence, TQM alters the way a company thinks about work and all of its relationships as it impacts every function, system and person connected with the company.

Coate says that Continuous Process Improvement Teams are at the heart of TQM and are based on the belief that better solutions emerge when everyone is given a chance to work on process problems [2]. Just as importantly, solutions are accepted and implemented more quickly and are longer lasting because the people affected have helped develop them.

Continuous Process Improvement Teams are composed of people who normally work together on the process being reviewed. As per Coate, the team examines a process that can be improved by utilising resources they already control. Each team includes a team leader (most often the supervisor of the process being reviewed), a facilitator/trainer and no more than ten team members. The team sponsor (usually the team

leader's boss) ensures that the team's work is guided by the university's vision. TQM teams use a ten-step problem-solving model to complete their work [2]:

- The team identifies and interviews customers of the process to determine which services are not meeting their needs.
- The team charts customer problems, selects one major problem to work on, prepares an issue statement to direct the study and uses customer data to set a measure of improved performance.
- The team constructs detailed flow charts/process maps of the process and sub-processes as they currently exist.
- The team brain storms possible causes of the process problem, then uses TQM tools to select critical causes for further study.
- The team collects data, graphs it concisely and uses it to determine root causes of the customer problem. This data becomes a benchmark for measuring future progress.
- The team develops possible solutions for the root causes that are verified by data, then measures them against criteria that reflect customer needs.
- The team identifies benchmarks for the process being studied, ie processes used by other organisations or work areas that produce a high-quality product or service. Possible solutions are measured against the benchmarks.
- The best solutions are implemented and their performance is monitored. If the solutions work, they are adopted.
- The team measures the results of the improvement and refines performance measures. If the problems are solved, the *fixes* are standardised and become Standard Operating Procedure.
- The team selects another process to review and improve.

As Capecio and Moorehouse state, TQM does work: companies run better; customers remain loyal because they are satisfied with the responsiveness of companies to their needs. Companies develop high-performance, cross-functional teams. Institutional learning is captured. Data is collected, analysed and used to make continuous process improvements; companies invest in training and measure the value of the training by assessing its impact in the workplace; suppliers and unions buy in; and productivity and quality continue to improve at lower costs for the customer.

The idea behind TQM is that much can be achieved by innovation, but competitive advantage is largely affected by continuous process improvement. To implement this practice a commitment is necessary that includes a plan of action. As Capecio and Moorehouse indicate, commitment means being the best you can be in your job as well as looking for opportunities to improve the work. A five-Step process designed to help turn opportunities into on-the-job improvements is listed below:

- Awareness: recognising an opportunity to improve a process.
- Assessments: identifying the gap between where you are and where you want to be.
- Preparation: developing strategy, assembling resources and going through readiness steps.
- Action Plan: establishing specific goals, time-bound steps and measures to implement an improvement.
- Evaluation: reviewing how well you met the goals established in the Action Plan and re-planning is needed.

APPLICABILITY TO HIGHER EDUCATION

In the United States many colleges and universities are now experimenting with TQM to ensure that quality, ie consistently high levels of college learning as an outcome is no longer left to chance. Universities and colleges have applied TQM to both the administrative aspects of the university's operations and, to a lesser extent, the academic aspects (ie teaching, research, etc). Coate indicates that TOM teams at the University of California-Santa Cruz campus have tackled problems in the faculty review process, faculty resource budgeting, provision control, the chemistry lab supply process, travel accounting and the student check disbursement process, to name just a few. They found TQM to be inexpensive to undertake and relatively quick to complete, while achieving significant improvement.

Before we can begin to apply TOM to engineering schools, or for that matter any institution of higher learning, we need to define what we mean by quality, what is appropriate and adequate evidence of quality and how evidence of quality should be communicated. The author had the pleasure of participating in a meeting at Wingspread, the Johnson Foundation offices in Racine, Wisconsin, in June 1994 to discuss the whole issue of quality assurance in undergraduate education. The results of this conference were published as a report entitled *Quality Assurance in Undergraduate Education: What the Public Expects.* Most of the principles that were ultimately identified can be applied equally an well to an institution's graduate programmes. The following discussion is taken directly from this report.

For purposes of quality assurance the paramount

issue for every college or university is the performance of its graduates. Among the important characteristics of college and university graduates, for example, are the following: technical competence in a given field; high-level communications, computational, technological literacy and informational abilities that enable individuals to gain and apply new knowledge and skills as needed; the ability to arrive at informed judgements (that is, to effectively define problems, gather and evaluate information related to those problems and develop solutions); the ability to function in a global community, including knowledge of different cultural and economic contexts as well as foreign language skills; a range of attitudes and dispositions, including flexibility and adaptability, ease with diversity, initiative, motivation and persistence, ethical and civil behaviour, as well as personal integrity, creativity and resourcefulness and the ability to work with others, especially in team settings; and, above all, demonstrated ability to deploy all of the above to address specific problems in complex real world settings and under enterprise conditions in which the development of workable solutions is required.

These desired attributes of graduates are listed as examples only, but they are distinguished by several factors. First, they are couched principally in the language of external stakeholders and reflect the involvement of these stakeholders in the conversation. Second, they demand the concerted attention of the institution as a whole. Third, they embody a conception of quality that is outside the mainstream of higher education's current quality assurance practices.

What is the evidence of quality? Given the definition of quality based principally on outcomes consistent with stakeholder needs, the evidence for quality should be generated from sources external to higher education to a far greater extent than occurs at present. The major types of evidence could include the successful and timely completion by students of their educational programmes; the placement and performance of graduates in the work place and their effective involvement in civic and community life; performance and further education, relevant licensing and certification examinations; results of direct assessments of students' abilities on exit consistent with both institutional and societal goals, and the value added to these abilities by the institution given entering student characteristics; and reported satisfaction of students with the contributions made by higher education toward the attainment of their own goals relative to the costs incurred.

Complete adequate assessments of the full range of these outcomes are not currently available, but the technology exists to create them. In the context of a clear demand for performance information of this kind, existing methods can and should be applied. Furthermore, that demand for information should generate both incentives for and commitment to the development of new and better assessments.

EXAMPLES OF TQM USE IN ENGINEERING COLLEGES

The process of Total Quality Management is being used by many institutions in the United States as a management tool to improve the productivity of the administrative side of university operations. For example, TQM can help, as previously stated, in improving the productivity of the Registrar's Office, the Admissions Office, the operation of the Physical Plant, and indeed can help in improving productivity of any purely administrative function of the university. It has, however, been much more difficult to apply TQM to the academic side of the institution; ie classroom teaching, faculty advising, curriculum content and research. A few schools have utilised TQM concepts to help professors improve their teaching. Oregon State University, for example, with support from IBM, utilised student focus teams to evaluate course design, content and delivery based on customer feedback. At the present time, student focus teams have evaluated twelve College of Engineering courses ranging from first year to graduate offerings.

TQM is not a magic bullet that will solve all of an institutions problems; however, if the broad principles of TQM are followed, startling changes can be made in improving the productivity of the administrative side of the university as well as strengthening the academic and research aspects of the institution.

In its broadest sense, we should look at utilising TQM or any similar process as a way of discerning innovative and improved approaches in how the university accomplishes its work. TQM will help the institution understand the needs of customers both inside the university (students) and outside the university (research supporters, alumni, etc). It will assist in answering the question: *how do we focus the university's resources, both human and technical, to meet customer requirements?*

CONCLUSION

In summary, TQM is a process that promotes bringing the right people together in teams where the boundaries between organisations have been eliminated and where the participants on the teams have been empowered to make changes. The process assists in identifying problem areas, utilises process mapping to thoroughly understand the nature of the work involved so that unnecessary steps or work can be

eliminated, with the final objective of aiming for speed and simplicity which results in improved productivity.

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BIOGRAPHY

Dr Clifford V. Smith, Jr. was President Emeritus of the General Electric Foundation (1990-97) and Chancellor Emeritus of the University of Wisconsin-Milwaukee (1986-90). Prior to his Wisconsin position, Dr Smith held several positions within the Oregon State System of Higher Education. There he served as Special Assistant to the Chancellor of the State System for Science Technology and Economic Development. He also served as Vice-President for Administration at Oregon State University, where he also held joint appointments as Director of the Radiation Center, Director of the Institute for Nuclear Science and Engineering, and Head of the Department of Nuclear Engineering.

Dr Smith holds a BSc in Civil Engineering from the University of Iowa, a MSc in Environmental Engineering from Johns Hopkins University and a PhD in Radiological Science from Johns Hopkins University. He is a registered professional engineer and the author of many articles in the technical literature. He is currently a member of the Board of Trustees for Johns Hopkins University, the Board of Directors for the University of Iowa Foundation, the Board of Trustees for the Institute of International Education, the Board of Trustees for the Eisenhower Exchange Fellowships and a member of the UNESCO International Committee on Engineering Education.