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IMPLEMENTATION OF ISO 9000 IN EDUCATIONAL INSTITUTION

Tonmoy kumer Dhar[1], Sattom Halder[2] and Shyamal Kanti Biswas[3]

[1,2]Department of Mechanical Engineering, CUET, Bangladesh
[3]Department of Mechanical Engineering, AUST, Bangladesh

[1]Tonmoy_07me@live.com, [2]sattom.cuet@gmail.com, [3]skbcuet@yahoo.com

Abstract*- The ISO 9001 standard which is a Model for Quality Assurance in Design, Development, Production, Installation and Servicing was written by engineers and quality professionals belonging mainly to large industries with emphasis on manufacturing in particular. So it requires an interpretation for application in educational institution. This paper briefly addresses the concept of the university production system and subsequently, ISO 9001 elements are re-ordered to follow the logical flow for a university's products, from the determination of customers' requirements and needs, to the evaluation of whether these needs have been satisfied. Each ISO 9001 element is then interpreted and examples of documentation/implementation of selected elements are provided. Finally, guidelines for a successful and cost-effective implementation have been shown.*

Keywords: University production system, TQM, Quality assurance Implementation ISO 9000 in educational institution, Process approach

1. INTRODUCTION

Education is vital in our modern society and no one can ignore its role and contribution. It should be noted that the developed world has a large proportion of the highly educated. Many developing countries are planning their higher education carefully. Their aim is to increase the number of the educated to the level now enjoyed by the developed nations. They believe that higher education is to furnish at least two fundamental prerequisites for growth, namely, to provide the necessary tools for analyzing changes in socio-economic structure and to provide the working knowledge of the old as well as the newly introduced technology.

The decade of the 1990s has begun and will likely conclude with quality as a major theme. In industry, commerce, government and now higher education, a focus on quality become an important factor. Its assessment and enhancement, and attempts to define and measure it, are major issues for higher education throughout the world. This is not only because of the growing demand within countries for better higher education with fewer resources, but also because of the growing inter dependence of national higher education systems.

Recently, especially in the UK, education institutions have come under increasing pressure to improve and adopt a market-based, quality management system such as ISO 9000. There is pressure from ISO, pressure from the changing global environment and diminishing resources, and pressure for educators to meet the needs of industry with a better-skilled, quality workforce.

In addition, education institutions face financial accountability from state and institutional supporters. ISO 9000 implementation is occurring in most countries around the globe. For example, ISO 9000 is being implemented in private schools in Thailand, in the Technion-Israel Institute of Technology, in private education institutions and higher education in Turkey, in primary schools in the United Kingdom, in universities, colleges of further education, in vocational education in the USA, in the education system of Hong Kong, and also in private education institutions and higher education in Bangladesh.

However, as ISO 9000 was originally intended as a quality system for the manufacturing industry, the transition of ISO 9000 to education has been far from smooth. Filled with controversy, the information surrounding ISO 9000 in education is immense and confusing as education institutions at every level and in every country are experimenting with the standards.

2. THE UNIVERSITY MANUFACTURING SYSTEM

In order to understand the University Manufacturing System (UMS), we need to understand its products: student knowledge, courses and research output, as well as its basic processes: learning, teaching and research. A summary of terms found in the ISO 9001 standard and explanations of these terms with respect to these products are given in Table 1

Table 1: UMS terms required for the ISO 9001

TERM (ISO 9001)	EXPLANATION		
	Student Knowledge	Program/Courses	Research
Product	Student knowledge, abilities &competencies	Programs & courses	New knowledge
Customers	Industry, community, alumni, Professional organizations	Students, industry, Community, professional organizations	Industry, research sponsors, other universities, community
Supplier	University/Faculty/Department		
Subcontractor	High schools, other universities, community colleges	Professional institutions, other universities	Researchers, industry sponsors, literature sources (journals)
Executive Management	For a faculty: Dean, department heads and program directors; For a department: Head and associate heads		
Design Plan	Undergraduate programs, M. Sc. Programs		Research objectives
Designer	Academic staff (professors and instructors)		
Process Plan	Individual student curriculum	Course outline, Research project plan, Program plan	Research project plan
Raw Material	Student knowledge and comprehension of basic arts and sciences before entering the university	Existing material on courses and programs	Existing practical and theoretical knowledge
Value Adding to Material	Value adding to student's knowledge and abilities	Improvement in course design, delivery& maintenance	Value adding to existing Knowledge
Manufacturing Process	Learning	Teaching	Researching
Lead Time	Time from enrollment to Graduation	Programs: 4 or 5 years; Courses: 1 or 2 terms	Time from contract to Delivery
Part	Student knowledge accumulated in a course	Program: course; Course: lectures, labs, tutorials	A phase in a research project
Operation/Tool	Learning opportunity' in labs, lectures	Teaching labs, lectures, tutorials	Work on a phase of a research project
Machine/Technology	Learning opportunity		`Research Opportunity'
Operator	Teacher and student	Teacher, teaching assistant	Researcher, research assistant
Part Specification	Course specification in the `General Calendar'		Specification of deliverables in a research contract
Quality Policy	The overall quality intentions and direction of the faculty (department), as formally expressed by the dean (department head)		
Quality Control	The operational techniques and activities used to fulfill the requirements for quality		
Nonconformity	The non-fulfillment of specified requirements		
	Student failure	Course, program failure	Research project failure

3. WHY ISO 9000 IN UNIVERSITY

Today, customers expect quality in all aspects of their lives. Companies are re-engineering to assure the customers of high quality of their products and services. In light of this fact, education is no exception. The customer wants to be assured that educational institutions provide quality service. To assure that their students have adequate knowledge in the area of expertise, engineering faculties undergo the accreditation process. This provides a platform for standardizing degree programs, such as mechanical engineering. However, increasing globalization yields a need to assure customers, not only locally, but internationally, of the quality of educational services being provided

Although educational institutions are considered as service organizations, this paper views the university as a production system. Final customers of the university are organizations the graduated students work for. The customers specify quality characteristics, such as employability, ability of students to solve engineering problems and ability to upgrade their knowledge.

Universities all over the world state that this is exactly what they do. The objective of this paper is to show that `quality' must and can be assured more clearly and convincingly to the general public with reference to the ISO 9001 standard

4. INTERPRETATION OF ISO 9001 REQUIREMENTS FOR EDUCATIONAL INSTITUTION

Although the ISO 9001 standard is generic, i.e. it is applicable to manufacturing and service organizations, as well as health care, small business and education, a number of terms and concepts in the standard have manufacturing background. To assist us in the interpretation, the concept of the University Production

System is introduced. This concept is addressed in detail in, however a brief outline of main terms and concepts is provided here. The University Manufacturing System (UMS) [3] can be defined as a set of interdependent processes, such as teaching, learning and researching, and resources, including human, material and information that function harmoniously to achieve specified educational objectives. For example, a university's objectives can be to create, preserve and disseminate knowledge. Universities create three main products:

❖ Student knowledge, abilities and competencies
❖ Courses and programs
❖ Research (new knowledge).

A summary of terms found in the ISO 9001 standard and explanations of these terms with respect to these three products are given in Table 1. ISO 9000 is about quality systems. A quality system is defined as a set of interdependent processes that function harmoniously in an organization, using various resources, to achieve objectives related to quality. The current version of the ISO 9001 standard, approved in 1994, consists of twenty requirements, each representing one element of the quality system. Nevertheless, interrelationships of the twenty elements of ISO 9001 are not clear, and the elements do not seem to follow a logical order. For example, element 4.4 Design control is followed by 4.5 Document and data control, and 4.6 Purchasing, after which comes 4.7 Control of customer-supplied product. Some organizations have tried to document and implement these quality system elements in the order in which they appear in the standard, and encountered a treacherous path. The danger in this approach lies in the increased emphasis on documentation and a loss of the focus on the quality system.

In order to provide the universities with a focus on a quality system, ISO 9001 elements have been re-ordered into two categories: quality loop and supporting elements (Fig. 1) according to. The quality loop is a set of interacting activities and processes that influence the quality of the product through various stages of its life-cycle: from determining customer needs to the evaluation of whether these needs have been met. The first process in the loop is the determination of customer requirements, and the ability of the organization to meet them. This is the subject of the ISO 9001 requirement 4.3 Contract Review. The product that meets these requirements is then designed (4.4 Design Control), and a quality plan addressing this specific product is prepared (4.2.3). The procurement of necessary resources follows, with sections 4.6, 4.7 and 4.11 of ISO 9001 focusing on these issues. Human resources must be trained to effectively use procured resources (4.18 Training). The product subsequently goes through processing (4.9 Process Control), inspection and testing (requirement 4.10 and 4.12), as well as handling and storage (4.15). Defective products are removed (4.13) and corrective and preventive actions implemented (4.14). Finally, servicing is available, if required (4.19).

The group of seven supporting elements consists first of the requirement 4.1 Management responsibility, which is implied in all other elements of the quality system.

Necessary documentation resources are the subject of sections 4.2, 4.5 and 4.16 of the standard. Element 4.8 Product Identification and Traceability, is also implied throughout the product's life cycle. Finally, 4.17 Quality Audits and 4.20 Statistical Techniques are designed and implemented to improve the quality system.

Armed with this systems approach to ISO 9001, as well as the concept of the University Production System, we will proceed with the interpretation of all twenty elements of the standard for application Fig. 1.Graphical model of an ISO 9001 quality system.ISO 9001 quality system for the University 107 in higher education. In our preceding paper, a glossary and interpretation of ISO 9000 terms was included.
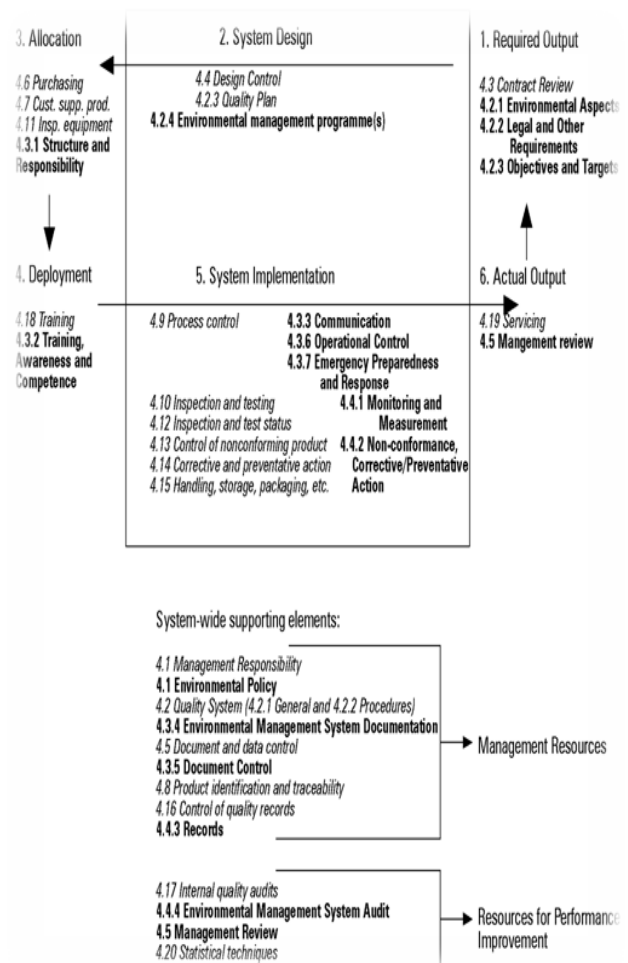

Fig.1: Graphical model of ISO 9001 quality system [4]

5. THE IMPLEMENTATION OF THE QUALITY MANAGEMENT SYSTEM AT THE UNIVERSITY

ISO series 9000 standards are the international standards worked out by the ISO, dedicated to the quality management system. This means that all activities having the influence on the quality should be planned, systematic, documented and supervised, and the organization should deliver proves that all works according to requirements described in ISO 9001:2008 standard and with customers requirements.

ISO 9001 standard makes the basis to implementation and certification the quality management system. The implementation of this system is equivalent with the

introduction of the processes management which is the foundation of the rational, effective management in each organization.

ISO 9001:2008 standard has the general and universal character. It relates neither to concrete brand or specialty nor to concrete product or service. It is applied by the production, service enterprises, by organizations set on the profit, but also by the non-profit organizations (e.g. the public administration offices, agencies, hospitals, universities). The basis of the quality management system according to ISO 9001:2008 standard is the processes orientation.

In processes approach the following principles are required:
- ❖ The basic processes in the organization are documented and analyzed,
- ❖ The relations inside processes are analyzed from the point of view of customers needs,
- ❖ Repeatability and the quality of the results of processes assure the procedures,
- ❖ The basis of defining the aims and the assessment of the processes results are measurable ratios,
- ❖ The processes management must lead to the continuous improvement,

Quality in educational process is understood as the agreement with settled requirements or the degree of the fulfillment of customers requirements or other interested sides, or also the degree of the fulfillment of the settled assessment criteria (e.g. to didactic tools, lecturers, the results of teaching, needs, satisfaction etc.).

Teachers should have the consciousness of the role, which they have to fulfill in the realization of this aim.

The process of implementation of the Quality Management System includes the following stages (Fig.2).

5.1 Taking the decision about the implementation of the system by the highest management of the organization

Rector of an university takes the decision about implementing the quality management system and sends it to deans of all faculties.

5.2 Establishing the Quality Representative at the University

The Quality Representative established by Rector fulfils the function of the connecting link between the Rector of the given university and working group, to which the implementation of the Quality Management System will be charged. The leadership of all activities connected with the Quality Management System is a task of the Quality Representative and also supervision and improvement of this system.

5.3 Establishing the working teams to the implementation of the Quality Management System

Appointing persons (organizational units) responsible for implementation of the key elements of the system and specifying the duties range of these persons (organizational units) and relations between them.
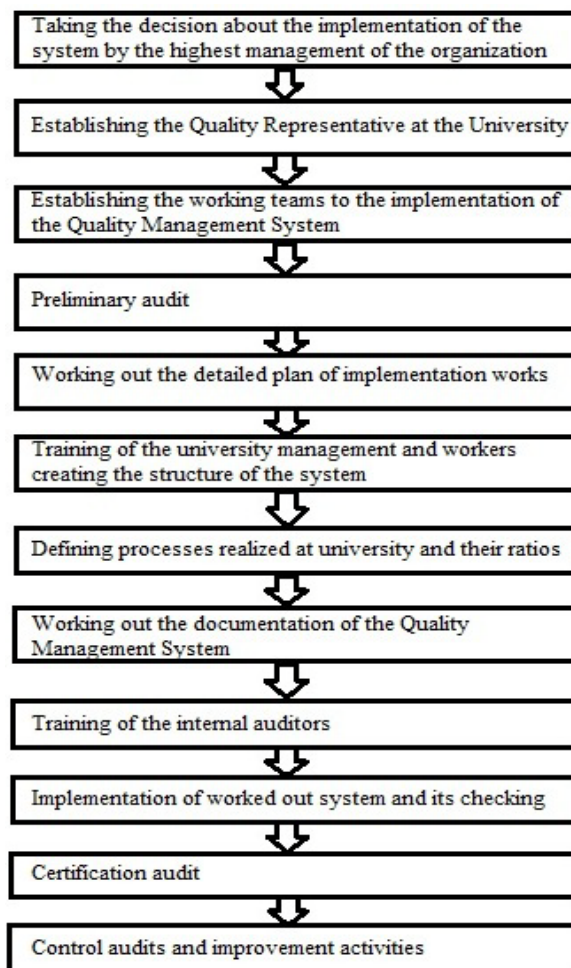

Fig.2: Stages of the implementation of the QMS

5.4 Preliminary audit

Zero audits are the next stage of the implementation of the system. It estimates the current condition of the university from the point of view of the Quality Management System implementation. It covers the Whole University at which the implementation of the system will happen. Report defining the current qualitative situation of the university is prepared after its execution.

5.5 Working out the detailed plan of implementation works

The Quality Representative together with the working team works out the detailed plan of implementation works. It marks the dead-lines of fulfilling each stage of implementation and people responsible for it.

5.6 Training of the university management and workers creating the structure of the system

At the beginning of the implementation, the training from the quality area is better to entrust to professional external firms and then carry out the internal training using own specialists from this area.

5.7 Defining processes realized at university and their ratios

The whole process of the education consists of many components, that is: projecting (the programme of

studies, the programmers of subjects, didactic tools, and ways of estimating), recruitment, preparation and the validation of didactic tools, planning of subjects, didactic process, job practices, the processes of estimating (plan and the programme of studies, students, worker – by students and by superiors, by graduates, by employers) etc. In the turn, each of mentioned process also possesses its own components. For example, the didactic process consists of: aims, contents and principles of teaching and forms, methods and the ways of working the academicals teachers and students – and these also pass through the whole cycle of projecting and validation and estimation and actualization. For example, as forms of leading the didactic process can be applied lectures, practices, laboratory practices, project practices and seminars and job practices.

Generally speaking, processes can be divided on (for example):

- ❖ General processes (management):

The settlement of policy and aims, the office of the student service, management, resources, the quality management system, communication, continuous improvement, book-keeping and administration;

- ❖ Basic processes (main):
- Recruitment, that is the process, aiming gathering the students, - the designing and planning, that is process connected with working out the programmes of studies, the plan of subjects and indispensable documents to carrying out the subjects,
- The didactics, that is process including all stages of the students education. This is a very wide process, having the largest influence on the obtainment of the education. It is also the largest carrier of information on the topic of the quality of education at the university,
- Scientific personnel, that is scientific workers directly connected with students didactics, passing on them knowledge and checking it,
- Obtaining professional and scientific degrees, that is the final stages of studies. In this process students get the suitable education for the level of studies what they participate,
- Scientific investigations, that is the process of carrying out the every kind of investigations in investigative laboratories at the university,
- The control and estimation, that is the process of verification both the students, and scientific workers.
- ❖ Supporting processes are: library managing, computer system managing, supervising the documents, trainings, the activity of the scientific circle and other organizations, foreign co-operation, scientific conferences, infrastructure and job practices.

5.8 Working out the documentation of the Quality Management System

The university documentation includes (Fig. 3):
- ❖ Quality Manual - it contains the quality policy (it should contain the obligation to fulfilling the customer requirements and to the continuous improvement of the system) and quality objectives, the system description with discussion and explanation of possible exclusions, the description of relations between processes in the QMS and procedures (their content or only relations to them),
- ❖ Procedures,
- ❖ Instructions,
- ❖ Other documents (drafts, forms, records).

The System Documentation is supervised by Quality Representative. All documents functioning within the System are properly appointed in the aim of their identification.

5.9 Training of the internal auditors

It is necessary to choose the potential internal auditors and order all trainings in the independent external certification organization.

5.10 Implementation of worked out system and its checking

Audit proceeds for defining the degree of the fulfillment of criteria described in processes, in the quality system documentation and the requirements of standards and the effectiveness of the quality system, from the other side audit serves to the estimation of the ability, how they worked out system allows to achieve the planned results.

The most important advantage of audit is the possibility of the critical view on realized activities and defining if the present documentation and staff assure the proper realization of tasks and the organization objectives.

Fig.3: The pyramid of the QMS Documentation

The most effective tool, which lets to estimate the correctness of system solutions, is in the case of university the process audit.

5.11 Certification audit

It is described in next chapter.

5.12 Control audits and improvement activities

Top management of the university carries out in the settled period of time the review of the Quality

Management System in the aim of its continuous usefulness, adequacy and effectiveness. This review includes the estimation of the possibility of the improvement and the need of changes in the quality management system, quality policy and realization of the objectives contained in it.

6. THE CERTIFICATION OF THE ISO IN EDUCATION

The certification is understood as the estimation of the compatibility of the Quality Management System at the university with definite requirements, accomplished by the independent organization. If the required compatibility is shown, the proof in the form of certificate will be given to the university for the period of three years. After the period on which the certificate was given, recertification follows, it means prolongation of the validity of the certificate for the next period.

The main reasons of subjecting to the certification, carried out by the independent third party are: enlargement of the credibility to the enterprise, the obtainment of competitive superiority on the market, adjusting to requirements imposed by laws, standards, customer and also the co-operating firm, already possessing the certified quality management system.

The stages of the certification includes
a) The choice of the certification unit and establish the contact, One should take into account, that the good-will of the certification firm will have the influence on the university image. One should also consider, that at the moment of starting the co-operation with the given certification unit, the university is tied up to this co-operation by the whole period, in which it will want to keep the certificate.
b) The certification payment,
c) Initiating the audit,
d) Execution of the review of the university documentation, that is defining compatibility of documentation with audit criteria,
e) The preparation of audit activities realized at the university,
f) The execution of audit activities at the university,
g) Preparation, confirmation and dissemination of the audit report,
h) Closing of the audit,
i) In the case of the positive opinion from the audit, the university obtains the certificate.

After receiving the certificate the certification organization begins the program of supervisory visits, which are usually established in six month periods. The aim of supervisory visits is verifying if the confirmed Management System is still maintained, applied and that the continuous improvement is assured.

The quality management system, which has become implemented, documented and is certified, assures the supervision over the whole university and makes possible the efficient management, monitoring and improvement of all processes and elements.

7. CONCLUSION

The care about the quality of education by the universities is one of the basic process, which creates the present market of educational services. The quality of education becomes the basis to working out and implementing the strategy of the development of educational units.

When we are concerned in designing and implementing the quality management system at the university we should take into account that this is the long-term process which should be realized in stages, at the significant and sustained support from the side of the university. After implementing the system, its elements should be permanently improved. [6]

The universities which implemented the quality management system according to ISO 9001 standard stay in eyes of their customers as credible, reliable and well organized. There are some important advantages:
- ❖ Guaranteeing the efficient flow of information about each task and their realization,
- ❖ Improvement of functioning the university and its management,
- ❖ Quick and effective solving problems,
- ❖ The change of approach to the quality of education,
- ❖ The improvement of planning and budget discipline,
- ❖ Increasing the productivity and effectiveness's of the university,
- ❖ The growth of responsibility, motivation and commitment of the workers.

At present the certified system of the quality management by the university becomes one of the most important requirements at concluding various contracts. The certificate of such a system confirms that the given university is organized and managed in the way which assures the fulfillment of all undertaken obligations.

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E-mail: umkarape@cc.umanitoba.ca

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