



INTEGRATION OF QUALITY BASED MANAGEMENT STANDARDS INTO INTERNATIONAL MARITIME TRAINING AND EDUCATION

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ABSTRACT

Quality Management has been proven successful in many different enterprises around the world. Applications in engineering and business management have also been clearly advantageous in commerce. Although educators are among the first to write about new ideas, they are almost the last to apply them to their own activities. Thus it has happened that the quality movement in higher education has been active in United States and European Countries for the last decade.

The maritime education can be defined as a set of interdependent processes such as teaching, learning, researching and resources including human, material and information that function harmoniously to achieve specified educational objectives.

In this study, the quality management system implementation in maritime higher education institutions are observed considering the background of the IMO Conventional requirements. In addition to that, basic principles of maritime training institution accreditation rules are established.

Key words : Quality Management, maritime training, accreditation in education

1. INTRODUCTION

The quality management terminology needs to be explained in terms of higher education and training. In this consideration the relationship between the supplier and the customer additionally the product that is provided by the supplier should be indicated.

Actually the student is not a product. The product is the education of the student. In the manufacture of this product, as with any other product, it is essential that the worker (student) be an active participant in the design and creation of the product. The student, who is the person who stays with the learning process longest, should learn to become the comanager of his or her education. This means, according to the tenets of quality management, that the student should be involved, consciously and with skill, in the continuous improvement of the processes that create the product.

The customers for the education of the student are several. They are, in order of importance,

1. The student, who must live with the product for the rest of his or her life. The student must become the comanager of the production of the education and, having such a personal

stake, must be considered first when attempting to define what it means to have quality in education.

2. The student's parents and immediate family who, in many instances, are paying for the product and must also live with the results for the rest of their lives.

3. Potential employers, who will rely on the education of the student after graduation to achieve the purposes of their enterprises.

4. Society at large, which pays a substantial proportion of the cost of the education and requires the future participation of the student as a citizen in the operation of government, as a contributor to the general welfare of society, and as a taxpayer who will support the education of future generations of students.

In shipping business the management of training can be considered as the technical and the commercial management of maritime activities. The new regulations or rules that will be established by IMO have to be taken into account as a research work and the requirements of new rules have to be amended in relevant department curriculums in an efficient manner. As well as the Port State Control parameters and the effects of these parameters in shipping environment cause rapidly positive change improvements of ship management. As a result lecturer's academic research has to point out port state control inspection results and the classification society's survey requirements that complies the statutory certification of vessels [1]. From the commercial side of ship management, the charterers complaints and the condition of clauses in charter party directly affects the claim handling process. The marine casualties or cargo damages that have the direct significant impact in training needs must be considered.

2. EXPECTATION FROM EDUCATION AND TRAINING

The training and education concept can be analysed in four categories for determining the general expectations and reaching to customer satisfaction philosophy.

a. Knowledge, which enables the people to understand what they learn in relation to what they already know [2]. Knowledge is both practical and theoretical. Theoretical knowledge provides the people with the ability to generalise from unique instances. With theoretical knowledge, people can accumulate long years of experience such as twenty years. Otherwise, with only practical knowledge, people will have only one year repeated twenty times.

b. Know-how, which enables people to do. Know-how takes people past merely understanding. Know-how enables people to put knowledge to work [2]. Know-how differs significantly from knowledge. Knowledge can be organised into intellectually tight compartments, and these compartments may be taught as a subject on to themselves. Know-how, on the other hand, requires the purposeful organisation of knowledge from many different areas of learning. As know-how is extended to higher and higher levels of accomplishment, it requires extension to more and more areas of knowledge. When teaching know-how, it is impossible to put bounds on the areas of knowledge which will be encompassed.

c. Wisdom is the ability to distinguish what is important from what is not [2,3]. Wisdom enables people to set priorities on how to use resources of time, energy, and emotion.

d. Character, as Stephen Covey has said, is a combination of knowledge, know-how, and wisdom coupled with motivation [2]. People often recognise the

development of character by certain character traits, among which might be listed as: honesty, initiative, curiosity, truthfulness, integrity, cooperativeness, ability to work alone, ability to work in groups, self-esteem. It is up each maritime training institution to identify what to include in each of these four categories. It appears that in maritime education, attention is given only to the first of the four categories, with the last two not even given lip service.

In maritime education the lecturers often believe, that at the university level their sole duty is to develop knowledge and pass it on to the next generation. The development of the student's character is none of their business.

The list of knowledge that students are expected to acquire is usually a composite of what is required for accreditation and what the faculty decides itself. In general, the accrediting authorities should pay attention to the development of either wisdom or character in accordance with the goals for education in the new century.

3. INTERPRETATION OF ISO 9001 STANDARD INTO THE MARITIME EDUCATION

The ISO 9001 (1994) standard: model for quality assurance in design, development, production, installation and servicing was written by engineers and quality professionals from large industries with a manufacturing organisation in mind and thus requires an interpretation for application in a maritime training institution's environment. The need for a systematic approach in interpreting the standard is the existing literature restricts the scope of the quality system to fewer than the full 20 elements [4,5]. As an example, Lewis and Smith consider only twelve elements of ISO 9001 to be directly applicable to education [4], while Willborn and Cheng address seventeen [5].

Although research is an integral part of university process and distinguishing characteristics of academic staff, existing interpretations focus on the learning opportunity and courses as a primary product of educational institutions [6,7]. These interpretations would most certainly become more clear and consistent if underlying production and quality system concepts were to be used.

Although the ISO 9001 standard is generic and it is applicable to manufacturing and service organisations, as well as health care, small business and education, a number of terms and concepts in the standard have manufacturing background. The Maritime Higher Education & Training Institution Production System (MHE&TIPS) 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 [8]. For example, faculty's objectives can be to create, preserve and disseminate knowledge. Mainly training institutions create three main products:

- student knowledge, abilities competencies
- courses and programs
- research (new knowledge).

ISO 9000 is about quality systems. A quality system is defined as a set of interdependent processes that function harmoniously in an organisation, using various resources, to achieve objectives related to quality. An objective related to quality is to meet and surpass customer needs and requirements. Another objective can be to create zero-defect products (an analysis of zero-defect products) in the faculty environment is presented in [8]. Processes within the quality system transform customer requirements (required output) into the product bearing the ability to satisfy the requirements (actual output). The current version of the ISO 9001 standard, approved in

1994, consists of twenty requirements, each representing one element of the quality

system.

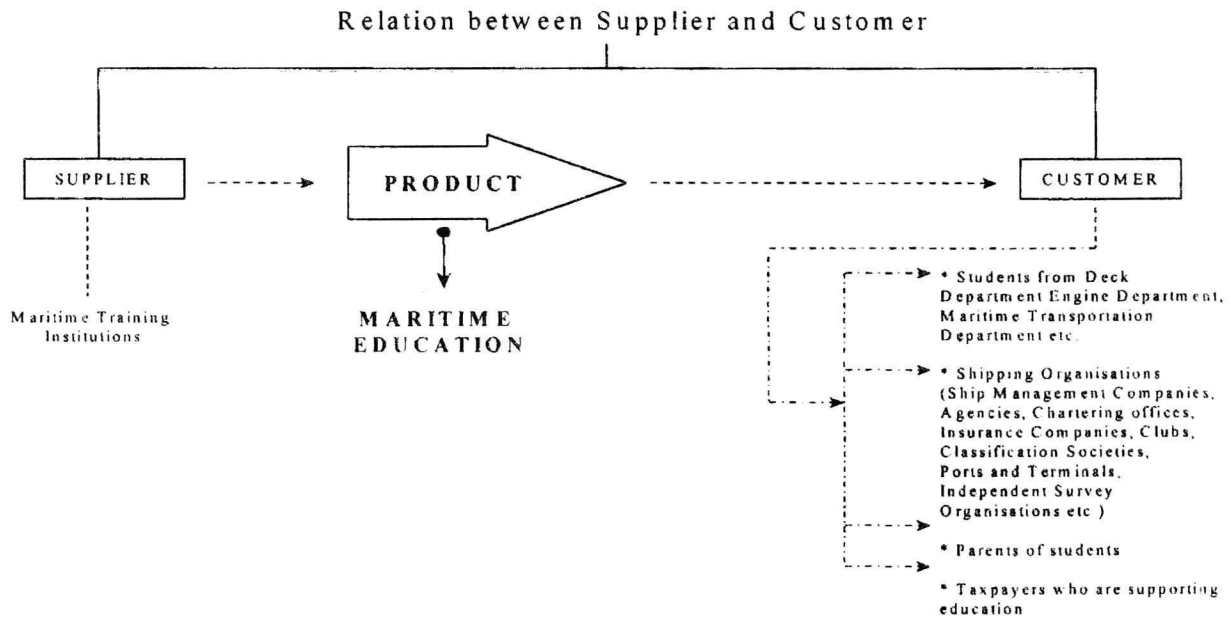


Figure 1. Identification of Quality Management Terminology in Maritime Education

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, and 4.6 Purchasing, after which comes 4.7 Control of customer-supplied product. control is followed by 4.5 Document and data.

Some organisations 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 a faculty environment, the development of a quality system and concepts of quality assurance will certainly encounter mixed reviews by academics, which are often weary of structured approaches requiring additional

documentation. In order to provide the faculties with a focus on a quality system, ISO 9001 elements have been re-ordered into two categories: (activity elements) quality loop and supporting elements according to. The activity elements are 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 organisation 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 subjects 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.

This systems approach to ISO 9001, as well as the concept of the MHE&TIPS, will proceed with the interpretation of all twenty elements and the standard for application in maritime higher education. Figure 1 illustrates the MHE&TIPS Quality Management system for the interpretation of ISO 9001.

3.1 QUALITY LOOP ELEMENTS

Firstly the contract review clause can be discussed. Quality can be defined as the ability of the product to satisfy stated and, or implied customer requirements. Therefore, the first step in the development of a quality system in a faculty is to adequately identify these requirements. The objective of the contract review element of ISO 9001 is to provide the faculty with a clear understanding of customers' needs and specifications, to evaluate if these needs can be achieved, and to provide the customers with a clear understanding of the manner in which the faculty shall meet them. The following processes are covered:

- ◇ Defining and documenting the industrial requirements with respect to undergraduate and graduate programs offered, by means of alumni and surveys, questionnaires, interviews, as well as the analysis of available legislations, international rules and regulations.

- ◇ Accreditation of programs by regulating bodies such as the Canadian Engineering Accreditation Board (CEAB) in Canada or the Accreditation Board for Engineering and Technology (ABET) in the United States [9].

- ◇ Review of contracts with the employers participating in cooperative programs offered by the faculty.

- ◇ Review of students' understanding of the admission requirements, program content and context, graduation requirements, and their responsibilities and authorities, through interviews and surveys.

- ◇ Review of industry and sponsored research contracts.

- ◇ Assessment of the faculty's ability to meet the requirements.

- ◇ Contract changes, such as when a research sponsor changes the requirements.

As an output of contract review activities, program and research design planning teams should have a clear understanding of the kind of programs, courses, research required, as well as the faculty's ability to offer such programs and research. A document outlining core requirements can be prepared in the form of a program or research project brief, much like product briefs in manufacturing.

Following contract review activities, the faculty must demonstrate the ability to translate customers' specifications into appropriate design of programs, courses offered, individual student curricula and

research projects. Design control may consist of several stages, such as: identifying the input into the design process, verification of the program, curriculum, research design against design input, as well as validation of

the design output against customers' requirements.

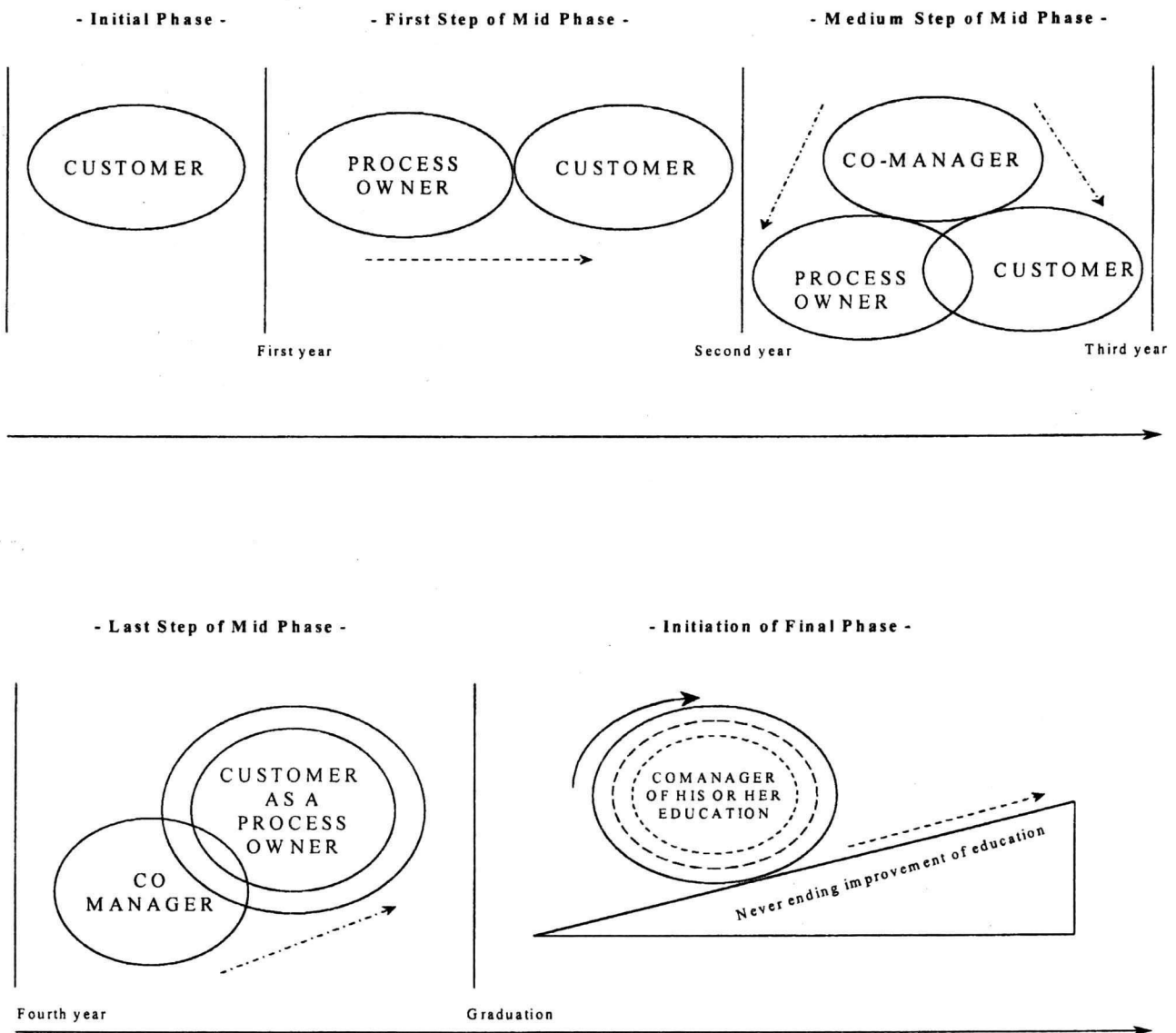


Figure 2. MHE&TIPS loop traceability

Design input may include suggestions for new programs from industry, analysis of customer needs and market position of the faculty, and feasibility studies for new

programs or research. Design output should include the statement of factual content and format of programs, skills and competencies to be developed in students or research

projects, as well as an illustration of how the course, program, research project content is relevant to its aims and objectives.

The responsibilities and authorities and the vertical and lateral interrelationships between the personnel which are involved in the design process should be defined and documented. Also, the faculty must identify, document, review and approve design changes and modifications. The following processes should be included:

- ◇ Design planning, review, verification and validation of new undergraduate and graduate programs and courses.

- ◇ Design control of the individual student curricula, including the statement of minimum paths to graduation, elective and compulsory courses, responsibility and authority of students, and defining the student's input into the design process.

- ◇ Contractual research with industry and government agencies.

- ◇ Identification, documentation, review and approval of program design changes, including the addition of new courses and deletion of existing courses and programs.

Quality planning covers the identification, classification and weighing of product quality characteristics, establishing the objectives, requirements and constraints for quality, as well as the preparation of quality plans. Quality plans are documents setting out the specific quality practices, resources and sequence of activities relevant to a particular product, project or contract. This means that each course, program and a contracted research project should have a separate quality plan, standing alone or as a part of the course or research project plan. A typical course quality plan should include:

- ◇ course requirements from the general calendar; course objectives and specific knowledge, competencies to be developed in students;

- ◇ course prerequisites and statement of any incoming inspection of student background knowledge;

- ◇ detailed topic layout and schedule of presentation (can be in a checklist form to provide the record of topics covered in class);

- ◇ list of required textbooks, software and laboratory notes;

- ◇ instructions for teaching assistants and laboratory technicians;

- ◇ detailed inspection plan, including the type of tests (exams) planned, topics covered and weights assigned for each test.

Product design and quality planning is followed by the acquisition of necessary resources, including academic and support staff, information and material resources (hardware, software, equipment and facilities), as well as students. The objective of the purchasing requirement of ISO 9001 is to ensure that these resources conform to the specified requirements. This is necessary because the faculty builds the acquired resources into its products. Defective purchased material, such as a faulty overhead projector or inappropriate software loaded on the network, may negatively affect the quality of the teaching, learning or research processes.

Also, the appropriate verification of a purchased product or an acquired resource must be planned, executed and reviewed. Where specific contracts require the department or faculty and staff members to verify purchased products or acquired resources at subcontractor's premises, this verification should be planned, conducted and

recorded according to the particular contract.

Control of inspection, measuring and testing equipment is the another set of resources that has to be allocated before the actual delivery of programs and research includes the inspection, measuring equipment and methods. This ISO 9001 requirement covers the methods and equipment used for measuring and testing of student knowledge, abilities, methods applied to ensure that programs, courses conform to the specified requirements, as well as the measuring and testing equipment used in research activities.

The objective of control of customer supplied product of the quality system is to demonstrate the capability of the faculty to identify, maintain, store, preserve and properly handle all material provided by students in the course of studies, and all products provided by external organisations with which the department has contracts for research projects. The identification, verification and handling of student supplied material, such as exams, tests, assignments, reports, theses, software and books are covered. Also, the examination, storage, maintenance, preservation, handling and proper usage of hardware and software provided by research sponsors, industry and governmental institutions should be documented by appropriate procedures and records.

Process control can be defined as; after the allocation and deployment of adequate resources, the delivery of programs and research is soon to follow. In general, the teaching, learning and researching processes are addressed by this requirement. The objective is to ensure proper identification and planning of these processes, and to ensure that they are carried out under controlled conditions.

Controlled conditions include:

- ◇ documents defining the manner in which the processes are carried out, such as course research project plans and

procedures;

- ◇ use of a suitable equipment and a suitable working environment;

- ◇ compliance with reference course and research project quality plans;

- ◇ monitoring and control of product quality characteristics and suitable process parameters;

- ◇ preventive and corrective maintenance of equipment used for teaching, teaming and research.

In the inspection and testing procedure, student knowledge, programs, courses and research must be inspected and tested against the requirements set in appropriate procedures and quality plans. Also, records of such activities must be kept. The ISO requirement 4.10 Inspection and Testing applies to the receiving, in-process and final inspection of: undergraduate students' knowledge and skills acquired in a particular course; student's academic status (program level inspection); graduate students, including course-work and thesis-related work; research projects against the requirements set out in the research contract and, or project plan.

After performing inspection and testing of its products, the institution must ensure that the products are properly identified, and that the inspection and test status indicates whether the products are conforming or nonconforming to specified requirements.

A logical path after the occurrence of nonconforming products is to look for and eliminate the causes of these nonconformities, if feasible is called corrective and preventive action. This is done by planning, designing, implementing and reviewing adequate corrective actions to prevent existing nonconformities from occurring again, and adequate actions to prevent the occurrence of potential nonconformities. Corrective and

preventive actions taken at all stages of planning, design and delivery of programs, courses and research in the faculty are included in this element. Existing and potential nonconformances are identified, for instance, by means of internal quality audits, statistical techniques, tests or personal observations.

Handling, storage, packaging, preservation and delivery, the material and equipment used in teaching, learning and research should be properly handled, stored and preserved in order to prevent damage or deterioration. Also, a safe and healthy environment should be provided. In case of any damage or deterioration of material, equipment or environment occurs, the objective is to ensure detecting and assessing such occurrences, and implementing corrective and preventive actions to eliminate causes of further damage or deterioration.

3.2 SUPPORTING ELEMENTS

Supporting elements of the ISO 9001 quality system address resources necessary for the quality system implementation, as well as resources and processes necessary for the improvement of quality.

Management responsibility is the overall objectives of the quality system are stated in a document called the quality policy. All members of the institution understand and follow this policy. Apart from clearly emphasising quality objectives, management responsibility facilitates that the interrelationships and authorities of all persons whose work influences quality of student knowledge, courses and research is defined. This includes responsibility and authority of the faculty departments administration, professors (instructors), research assistants, technicians and administrative support staff.

Organisational charts or responsibility matrices can serve in this mandate. The

executive management must also identify the need for appropriate resources (instructors, assistants, courses, laboratory equipment, library, video and computer equipment), as well as appoint an ISO 9000 Coordinator. The coordinator should be a faculty member with a thorough understanding of the ISO 9001 quality system and the educational and research processes in the faculty. His responsibilities include liaison with external parties, such as other faculties and universities, university administration, student records office and customers, subcontractors of the faculty.

At prescribed intervals, or when required, the executive management conducts management reviews. A management review includes: internal quality audits, overview and analysis of the quality policy and objectives, assessment of quality system effectiveness, analysis of customers requirements needs, interrelationship between customer requirements and policy and objectives.

While quality audits are performed against the departmental goals and objectives, management reviews are performed by the executive management against the quality policy. A management review may include the review of documentation emerging from the audits. Records of management reviews must be kept and evidence of actions arising from them must be available.

The requirement of quality system addresses the scope of the quality system, and the required documentation. If the faculty plans not to include certain products in the quality system, such as research, the range of products and services included in the quality system must be stated. A quality system must be documented with an appropriate quality manual, procedures, instructions and records. This allows proper communication, audits and verification activities. As a result the Quality System traceability related with the customer satisfaction of the MHE&TIPS can be illustrated in Figure 2.

Document and data control ensures that accurate, up-to-date documents are readily available when and where required. All documents and data pertaining to the quality system must be adequately identified, prepared, reviewed, revised, approved and maintained.

Product identification and traceability is a need to properly identify the product and provide means for the traceability of related quality problems to their causes. Therefore, adequate identification of all courses, research projects, students, faculty and staff, as well as the traceability of nonconformancies in student academic progress, courses, programs and research projects are very important.

The objective of Internal Quality Audit element is to verify that the quality system complies with planned arrangements, such as the ISO 9001 International Standard, and to verify whether these arrangements are implemented effectively and are suitable to achieve quality objectives. Internal quality audits serve to improve the quality system from the perspective of individual faculty and staff members, since they raise official attention to shortcomings and problems within the system. An effective internal quality audit system should be established on the basis of ISO 10011-II Guidelines for Quality Audit, with faculty members trained as internal quality auditors.

In order to control and improve the quality of education and research, statistical techniques should be used. This ISO 9001 element requires that the need for statistical techniques in learning, teaching and research is established, and that the identified techniques are implemented and controlled.

4 CONCLUSION

Quality process in maritime training institution provides the framework and systematic approach to examine all management and technical processes, services

and teaching activities. It has an accountability component that demands which the establishment of criteria (conforming requirements) be based on customer expectations. The goal is to continue to improve until customer expectations are met and exceeded. Conformity requirements, which provide the criteria for the quality elements, from the basis for self-analyses, reviews, audits, evaluations and other types of measurements.

In this approximation, Maritime Faculty of İstanbul Technical University's Quality and Environmental Management System has been established. Then the faculty was registered both ISO14001 and ISO 9002 by the international accreditation bodies.

This study covers the integration process of ISO 9001 standard, into the Maritime Higher Education and Training Institution taking into account the requirements of STCW 95 Convention. The Maritime Higher Education & Training Institution Production System (MHE&TIPS) has been presented. The relevance and the need of ISO 9000 in maritime education has been discussed, followed by the illustration of the path to ISO 9000 through the accreditation criterias. It is anticipated that after ISO 9001 registration, a maritime training institution will have effective quality system that will assist to reach never ending process of customer satisfaction.

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