İSTANBUL TECHNICAL UNIVERSITY ★ INSTITUTE OF SCIENCE AND TECHNOLOGY

A QUALITY MANAGEMENT MODEL IN MARITIME EDUCATION COMPLYING WITH STCW 95 CONVENTION AND INTERNATIONAL SAFETY MANAGEMENT CODE

PhD Thesis by

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ULUSLARARASI EMNİYET YÖNETİM KURALI VE STCW 95 KONVANSİYONUNA UYGUN DENİZCİLİK EĞİTİMİNDE KALİTE YÖNETİM MODELİ

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PREFACE

Quality in products and services is a universal concern in the modern industrial world. The great importance of quality assurance can easily be explained; only the question of how to achieve and to manage it proves rather difficult.

The management of quality must be based on interdisciplinary studies with emphasis on management and engineering. A broad range and integrative approach best leads to modern preventive quality assurance and ultimately to better quality of services in maritime training and education.

This thesis provides step-by step actions that improvement teams in maritime education can take to know their own organisations, clarify which of their underlying practices and processes are most in need of attention and learn how to improve the outcomes. It will guide to build a "reflection-action" cycle into their processes.

I wish to express my gratitude to Prof. Dr. Osman Kamil SAĞ for the opportunity to conduct research work, who is the supervisor of this study. Through both his advice and encouragement, I would like to express my appreciation to Prof. Dr. Yücel ODABAŞI who encouraged me to integrate the implementation of this study to Expert Systems.

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ABBREVIATIONS

ANSI	:	American National Standard Institute
ASL	:	Approved Supplier List
ASQ	:	American Society of Quality
BS	:	British Standard
CA	:	Corrective Action
CAR	:	Corrective Action Request
CD	:	Committee Draft
CQI	:	Continous Quality Improvement
CR	:	Contract Review
DDC	:	Document and Data Control
DIS	:	Draft International Standard
DOC	:	Document of Compliance
EMS	:	Environmental Management System
FDIS	:	Final Draft International Standard
FIT	:	Final Inspection and Testing
FUA	:	Follow Up Audit
GMDSS	:	Global Maritime Distress Safety System
H&MI	:	Hull and Machinery Insurance
IA	:	Internal Audit
ILO	:	International Labour Organisation
IMO	:	International Maritime Organisation
IMS	:	Integrated Management System
IMTE	:	Inspection, Measuring and Test Equipment
IP	:	Inspection Plan
IQA	:	Internal Quality Audit
ISM	:	International Safety Management
ISO	:	International Standard Organisation
İ.T.Ü	:	İstanbul Technical University
MARPOL	:	Marine Pollution
MNC	:	Major Non Conformity
MR	:	Management Representative
MRW	:	Management Review
MS	:	Management System
MSC	:	Marine Safety Committee
MSF	:	Management SystemForm
MSP	:	Management System Procedure
MSWI	:	Management System Work Instruction
NC	:	Non Conformity
NCMR	:	Non Conformity Material Report
NCR	:	Non Conformity Raised
NP	:	Non Conforming Product
OBS	:	Observation

OP	:	Operation Procedures
P&I	:	Protection and Indemnity
PA	:	Preventive Action
PAR	:	Preventive Action Request
PO	:	Purchase Order
Q-FAC	:	Quality Failure
QA	:	Quality Assurance
QFD	:	Quality Function Deployment
QIJ	:	Quality Improvement Journey
QM	:	Quality Management
QP	:	Quality Procedure
QS	:	Quality System
QSF	:	Quality System Form
QSP	:	Quality System Procedure
QSWI	:	Quality System Work Instruction
SMC	:	Safety Management Certificate
SMNV	:	Standard Maritime Navigational Vocabulary
SMS	:	Safety Management System
SOLAS	:	Safety of Life at Sea
ST	:	Statistical Techniques
STCW	:	Standards of Training, Certification and Wacthkeeping
TR	:	Technical Report
UPS	:	University Production System

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LIST OF SYMBOLS

a	:	Efficient integration time per each element
ABOL	:	Average back effort level
ACE	:	Average cost of effort
b	:	Integration capacity for each element
c	:	Integration efficiency per each element
CAR	:	Corrective Action Request
C(k)	:	Unit cost of each appointed employee
C(x)	:	Total cost of process
C_h	:	Term based covering cost of each effort
F	:	Fixed cost
I(i,j)	:	Term based defined effort rate for effort i and nature of effort j
R(x)	:	Total revenue associated with the integration of process
S	:	Active gain process volume of each element
TBNO	:	Term based number of orders
V(x)	:	Variable cost parameters
x	:	integrated process volume of each element

ULUSLARARASI EMNİYET YÖNETİM KURALI VE STCW 95 KONVANSİYONUNA UYGUN DENİZCİLİK EĞİTİMİNDE KALİTE YÖNETİM MODELİ

ÖZET

Kalite Yönetimi dünya çapında bir çok değişik iş kollarında başarısını ispatlamıştır. Mühendislik ve iş yönetimindeki uygulamaları özellikle savunma sanayi ürünlerinin dizayn ve imalatı, otomotiv endüstrisi ve tüketim mallarında ticari olarak açık bir avantaj sağlamaktadır. Kalite yönetimine karşı ilgi şimdi dünya çapındadır.

Eğitimciler, bu konuda yeni gelişmeleri ortaya atanların başında gelmesine rağmen, kendi aktivitelerinde çoğunlukla son uygulayanlar olarak gözükmektedirler. Bu sebepten dolayı yüksek öğrenimde kalite yönetimi konusu Amerika'da son onyıldır gündemdir.

ISO 9002 standardının genel olması, kalite teminatı modelini tarif etmesi, ve imalat ile servis sektörüne, sağlık sektörüne, küçük işletmelere ve eğitime uygulanabilir olmasına rağmen standardın içeriği ve standartdaki bir seri tarifler imalat endüstrisi kökenlidir. Bu durum organizasyonları, standardı; her bir maddesi için belirledikleri, amaçlarına uygun düzenlemeye zorlamaktadır.

Denizcilik eğitimi, insan, malzeme ve bilgiyi kapsayan; eğitim, öğrenme, araştırma ve kaynakların uygun olarak kullanılması ile hedeflenen amaçlara ulaşılacak bağımsız işlemler kümesidir. Bu husus bilgi, birikim, irade ve mesleki karakter olmak üzere dört kategoride incelenebilinir.

Bilgi, insanların mevcut dağarcıklarındaki ile öğrendikleri arasındaki bağıntıyı anlamalarını sağlar. Bilgiler teorik ve pratik olmak üzere iki çeşittir. Toerik bilgi insanların belirgin veri veya örneklerden genelleştirme yapabilmelerini sağlar. Teorik bilgilerle insanlar uzun yılların deneyimlerini elde etmiş olurlar. Birikim ise insanlara bilgilerin biraraya gelerek nasıl işler duruma geçmesi gerektiğini gösterir. Bu sebeple birikim bilgiden oldukça farklıdır. Birikimler diğer bir taraftan, bir çok değişik alanlardan elde edilen amaçlı organizasyon bilgilerini gerektirir. Birikimlerin büyük

başarılara ulaştırılması da, bir çok alanda bilgilerin genişletilmesini gerektirir. Birikimin öğretilmesinde onu çevreleyen bilgi sahasına sınırlama getirmek mümkün değildir.

İrade ise önemli olanı, önemsiz olandan ayırt etme yeteneğidir. İrade insanlara teşvik, zaman, enerji gibi kaynakların hangi öncelik sırasına göre konulmasını öğretir. Mesleki karakter ise bilgi, birikim ve iradenin motivasyon ile bir araya gelmesinden oluşur.

Bu söz konusu dört kategoride, hangi faaliyetlerin kapsanacağı veya nelerin dahil edileceği her bir eğitim kurumunun kendisi tarafından belirlenecektir. Bu durum denizcilik yüksek öğretiminde sadece birinci kategoriye özen gösterilmesi ve son iki kategorinin ise hiç telafuz edilmediğini göstermektedir. Denizcilik yüksek öğretiminde, eğitimciler genellikle üniversite seviyesinde kendilerinin tek sorumluluğunun bilgiyi geliştirmek ve onu sonraki kuşaklara aktarmak olduğunu düşünürler. Öğrencilerin mesleki karakterlerinin oluşturulmasının kendilerinin işi olmadığını düşünürler. Akreditasyon için gereken ve fakülte tarafından tahayyüt edilecek hususlar, öğrenciden beklenen ve mezuniyetinde elde edeceği birikimlerin bütünüdür. Genellikle akreditasyon makamları, denizcilik eğitimindeki hedeflere bağlı olarak, irade ve mesleki karakterlerin nasıl geliştirildiği üzerinde durmaktadırlar.

Kalite yönetim prensiplerinin denizcilik eğitimine entegrasyonu sırasında temel terminolojik tarifler olan ürün, müşteri ve tedarikçi kavramlarının tarif edilmesi gereklidir.

Temel olarak öğrenci bir ürün değildir. Ürün öğrenciye verilecek olan eğitimdir. Diğer ürünlerde olduğu gibi, bu ürünün dizaynı ve gerçeklenmesinde de öğrenci (çalışan) aktif bir katılımcı olacaktır. Öğrenme işlevi içerisinde uzun bir süre yer alan öğrencinin mezuniyetiyle birlikte kendi eğitiminin asıl idarecisi olacağını bilmesi gerekmektedir. Ürünün gerçeklenmesinde, sürekli gelişim işlevleri içerisinde öğrencinin bilinçli ve yeteneklerine uygun olarak dahil edilmesi, kalite yönetiminin temel prensibini oluşturur.

Verilen eğitimin müşterileri ise çeşitlidir. Önem sırasına göre müşteriler aşağıda tanımlanmaktadır.

1-) Öğrencinin, hayatı boyunca söz konusu ürünle (almış olduğu eğitimle) yaşaması gerektiği göz öünde bulundurulmalıdır. Öğrencinin daha sonra elde edeceği imkanları ile eğitiminin asıl idarecisi olacağı öncelikle dikkate alınarak eğitimde kalitenin tarif edilmesi gerekir.

2-) Öğrenci aileleri de, söz konusu ürüne para ödeyen ve daha sonraki yaşamlarında ürünün neticesi ile ilişkili olarak yaşayacak müşterilerdir.

3-) Öğrencileri mezun olduktan sonra istihdam edecek olan birimlerde müşteri olacaktır.

4-) Eğitim masrafının önemli bir bölümünü karşılayan ve daha sonra ilerideki yıllarda vatandaş olarak ürünün geleceğini paylaşacak, bununla beraber ileride vergi mükellefi olarak gelecek kuşakların eğitimini destekleyecek halkda sözkonusu ürünün müşterisi olacaktır.

Denizcilik eğitiminde kalite aktivitelerinin önemi, fakültelere aşağıdaki imkanları sağlayacaktır:

- Müşteri ihtiyaçlarına uygun hızlı hareket kabiliyeti. Müţteri memnuniyetinin belirlenmesi ve tatmin düzeyinin tesbiti ile, fakülteler ihtiyaçlara çok daha sorumlu müdahale edebileceklerdir.

- Sınırlı kaynaklar üzerinde yoğunlaşarak, müşterilerin gerçek ihtiyaçlarının karşılanması olacaktır. Müşterilerden elde edilecek veriler neticesinde, memnuniyete direk etkisi olmayan servislerin devre dışı bırakılabilinmesi sağlanacaktır.

- Sistematik olarak gelişim sağlanacaktır. Problem çözümündeki aşınalık, olayların analiz edilmesi ve uygulanan yöntemler, değerlendirme sonuçları, organizasyona verimlilik getirecektir.

Gemi işletmeciliği bütününde teknik ve ticari yönetim olarak düşünülebilinir. IMO tarafından geliştirilen yeni karar ve kuralların araştırma olarak ele alınması ve yeni

kuralların gereklerinin ilgili bölüm müfredatlarına etkin olarak işlenmesi gerekmektedir. Liman Devlet Kontrollerinin (LDK) kriterleri ve bu kriterlerin denizcilik çevreleri üzerindeki etkileri gemi işletmeciliğinin pozitif yönde gelişmesini sağlamaktadır. Sonuç olarak eğitimcilerin akademik araştırmaları liman devlet kontrolleri ve klas kuruluşlarının denetim gereklerine işaret edecek nitelikte olmalıdır. Ticari gemi işletmeciliğinde, kiracı şikayetleri, kira sözleşmesindeki maddelerin etkisi, hasar talebi ve bunun karşılanmasını etkiyecektir. Gemi kazaları veya yük hasarlarında, eğitim ihtiyacının öneminin dikkate alınması gerekmektedir. Müfredat geliştirme işlemlerinde Tekne-Makina Sigortası ve Klüp gereklilikleri dikkate alınmak zorundadır.

Yukarıda bahsedilen sınır şartları çerçevesinde bu çalışmada ISO 9000 standardı detaylı olarak incelenmiştir. Standardın her bir maddesi ile ilgili verimlilik kriterlerinin sağlanması için servis sektöründeki uygulamalar araştırılmıştır. Amerika'da 1990'lı yılların başında başlayan eğitim kurumlarında; özellikle yüksek öğretim kurumlarındaki kalite yönetim uygulamaları gözden geçirilmiştir. Daha sonra ISO 14001 (Çevresel Yönetim Sistemi) standartları incelenerek, ISO 9002 ve ISO 14001 standartlarının denizcilik eğitim kurumunda entegrasyonu sağlanmıştır. ISM kuralının grektirdiği eğitim ihtiyaçlarının IMO Model Kursları ve STCW Konvansiyonunda belirtilen gerekliliklerde göz önüne alınarak müfredatın geliştirilmesi sağlanmıştır.

2547 sayılı Yüksek Öğretim Kanunu, 2914 sayılı Akademik Personel Kanunu, 657 sayılı Devlet Memurları Kanunu, 2872 sayılı Çevre Kanunu, 1475 sayılı İş Kanunu ve 506 sayılı Sosyal Sigortalar Kanunu, 2886 sayılı Devlet İhale Kanunu genel yapısı incelenerek, uluslararası standardın ve IMO tarafından oluşturulan denizcilik konvansiyonlarına uygulamada aykırılık getirip, getirilmeyeceği incelenmiştir.

Sonuç olarak yukarıda bahsedilen gerekçeler ışığında İstanbul Teknik Üniversitesi Denizcilik Fakültesi kalite yönetim sistemi dökümantasyonu oluşturulmuştur. Bu çalışma ISO 9000, ISO 14000, ISM Kuralı ve STCW konvansiyonunun denizcilik eğitiminde gerekliliklerinin kurulması ve yürütülmesini içermektedir. Bu çalışma diğer denizcilik eğitim kuruluşları için, uluslararası ve denizcilik standartlarının kendi organizasyonel yapılarına entegre edilmesi için bir rehber olacaktır. Denizcilik

eğitiminde kalite yönetim sistemi, uzman sistemlerden biri olan CLIPS programında kurularak optimum entegrasyon aşamaları ve harcanacak emek düzeyleri belirlenmiştir. Bilgisayar programının her bir aşamasında lokal ve genel işlevlerde gerçekleştirilen yüzde oranları hesaplanmaktadır. Uluslararası standardın gerektirdiği her bir işlevin entegrasyon verimliliğinden faydalanılarak, standardın her bir maddesinin gerçekleşme maliyeti ve kalan optimum maliyet hesaplanmaktadır.

A QUALITY MANAGEMENT MODEL IN MARITIME EDUCATION COMPLYING WITH STCW 95 CONVENTION AND INTERNATIONAL SAFETY MANAGEMENT CODE

SUMMARY

Quality Management (QM) has been proven successful in many different enterprises around the world. Applications in engineering and business management have also been clearly advantageous in commerce, especially in the design and manufacture of defence industry based products, automobile industry and consumer products. The interest in quality management is now worldwide.

Although educators are among the first to write about new ideas, they are almost the lasts to apply them to their own activities. Thus it has happened that the quality movement in higher education has been active in United States for the last decade.

Although the ISO 9002 standard is generic and describes model for quality assurance 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. This situation enforces the organisations to interpret each clause of standard in specified objectives.

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. This content can be analysed in four categories as: knowledge, know-how, wisdom and the character.

Knowledge, which enables the people to understand what they learn in relation to what they already, knows. 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. Know-how enables people to put knowledge to work. Know-how differs significantly from

knowledge. 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 that will be encompassed.

Wisdom is the ability to distinguish what is important from what is not. Wisdom enables people to set priorities on how to use resources of time, energy, and emotion. Character is a combination of knowledge, know-how, and wisdom coupled with motivation.

It is up each educational organisation to identify what to include in each of these four categories. It appears that in maritime higher education, attention is given only to the first of the four categories, with the last two not even given lip service. In maritime higher 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 pay attention to the development of either wisdom or character in accordance with the goals of the maritime education.

While the integration of quality management principles into maritime education field, the basic terminology of quality management should be defined such as the product, customer and the supplier.

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. Organisations who are employing the students after graduation.

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 and as a taxpayer who will support the education of future generations of students.

The importance of quality activities in maritime education will enable faculties to:

- React quickly to customer needs. By determining customer expectations and surveying satisfaction, faculties can become more responsive to the needs of its customers.

- Focus limited resources on activities that truly satisfy customer needs. With data and information regarding customer satisfaction areas faculty can eliminate services that are not key drivers of customer satisfaction.

- Make improvements in a systematic way. Engaging in the problem solving process will enable faculty to analyse facts and base actions on facts and test results, thereby becoming more effective organisation.

In shipping business the management can be considered as the technical and the commercial management of ships. 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 (PSC) 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 statuary certification of vessels. 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. Curriculum development process has to include the Hull and Machinery (H&M) Insurance and the P&I Club requirements as well.

In this study considering the above mentioned boundary conditions, ISO 9000 Standards are examined in detail. Service industry applications are surveyed for ensuring the efficient criteria regarding with the each clause of standard. The quality management system implementations in training institutions especially higher education institutions are examined that was initiated in United Sates of America at the beginning of 1990. Then the ISO 14001 (Environmental Management System) standards are investigated for ensuring the combination of ISO 9002 and IS0 14001 together. The background of the ISM Code which requires training needs for the engine and deck cadets are defined clearly in the development stage of curriculum which coordinates the implementation of IMO Model Courses and the necessities required by STCW Convention.

2547-Higher Education Law, 2914-Academic Staff Law, 657-Government Staff Law, 2872-Environmental Law, 1475-Working Law, 506-Social Insurance Law, 2886-Government Bid Law are examined in order to clarify the significant aspects of these laws have any confusion between the international generic standards and the required Maritime Conventions that are established by IMO.

Finally the quality management system documentation is established for the Maritime Faculty of İstanbul Technical University in accordance with the above constraints. This study covers the integration and the implementation of ISO 9000 standard, ISO 14000 standard, ISM Code and the requirements of STCW Convention in Maritime Education.

This thesis can also be used as guidance for the other maritime training institutions who are decided to integrate the international and maritime standards into their

organisational structure. The quality management system in maritime education is also embedded in CLIPS that is the tool of expert systems, identifies both the optimum integration steps and the effort levels. In each step of the computer code, the realised percentages in the local process and the global process are calculated. The realised cost of each clause and the optimum remaining costs are also calculated for each routine by utilising the integration efficiency of each process required by the international standards.

1. INTRODUCTION

1.1. PURPOSE OF THESIS

In the maritime history, shipowners or operators, national governments and the international community most often established new safety measures in the wake of major catastrophes. This resulted in rules and regulations for ship construction, equipment, cargo and crew. With the introduction of more regulations and rules the international cooperation was intensified. Such as Radio communications and supervision of shipping in busy waterways where greatly improved. Concerted maritime safety and pollution prevention care is altogether a social achievement.

The analysis of cause and effect in shipping accidents or any kind of failure that results claims, has revealed that eighty percent of the incidents are caused by human failure as well as the poor trained crew members. Consequently, safety appears to be not only a question of facilities but also and even particularly one of the reducing risk of human errors. Viewed against this background, the IMO passed a resolution in November 1993, Res. A.741(18) - ISM Code, in order to arrive at an international code for integrating safety management care into the business operations of shipping companies and aboard ships. Regulating the nature of the STCW Convention means that there is no way that the maritime companies can avoid it. All these provisions concern maritime administration, training bodies and companies. Many of the direct responsibilities in the STCW 95 are largely derived from the relevant provisions in the International Safety Management Code. The difference, however is that whereas the ISM Code generally requires shipping companies to ensure that certain procedures related to personnel are established, the STCW Convention stipulates in detail that organisations must able to demonstrate that the relevant STCW provisions have been implemented, to ensure that the aims of the convention are met, ie. that seafarers employed on board are competent and qualified.

In today's highly competitive markets, companies of every size need to look at ways of generating new business, retaining existing business and marking their operations more efficient and cost-effective. An increasingly successful method of achieving these aims is through the introduction of a quality management system. Ship operators are finding that this not only improves the overall efficiency but also enhances status and customer confidence. For ship operators, a quality management system is likely to be based on the requirements of ISO 9002-1994. In this consideration, there are eleven shipping companies in Türkiye who are registered ISO 9002 certification.

As it is defined in quality management terminology, in accordance with the relationship between supplier and customer and taking into account the customer satisfaction principle, one of the major suppliers of the shipping companies are the Maritime Training Institutions that the ship operators employ these graduates both on board the vessels and in shore based offices.

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, training and education is no exception. The customer wants to be assured that training institutions provide quality service. This provides a platform for standardising degree programs. However increasing globalization especially in maritime field yields a need to assure customers, not only locally, but internationally of the quality of training and education services being provided.

Such standardisation efforts in the industrial sector have led to the introduction of ISO 9000 International Standards. The standards provide framework for emphasising the organisation's commitment to quality, as well as making quality efforts visible to customers. The impact of the standards world wide has been so extensive, that it is now virtually impossible to bid for international contracts if a company is not ISO 9000 registered. Considering the fact that ISO 9000 standards are generic in nature, they should be equally applicable to service organisations, such as software companies, health care, training and education organisations.

The following four questions are need to be considered for deciding the integration of Quality Management System in maritime training and education.

- Is training and education really a service?
- Does faculties have customers like other businesses?
- Does faculty customers express dissatisfaction?
- Can the quality process significantly improve customer services?

These four question should be answered with a resounding "yes." Maritime training is a service with customers like any other business and those customers do, indeed, express satisfaction and dissatisfaction about faculty services and instruction. The quality process in maritime training and education creates an awareness of customer needs and significantly improves the quality of services by meeting and exceeding expectations.

The boundary conditions of the maritime training and education field that are mentioned above are clearly indicates the importance of quality management principles and the necessity of continual improvement facilities. So the aim of this thesis is to define an integration criteria and transforming the existing faculty's management to the quality management aspect in İ.T.Ü Maritime Faculty. In addition to that the relevant documentation and implementation principles are established in this study covering the ISO 9000 standard, ISO 14000 standard, ISM Code and the requirements of STCW Convention. This thesis can also be used as a guidance for the other maritime training institutions who are decided to integrate the International and Maritime Standards into their organisational structure.

1.2. METHOD

Firstly ISO 9000 Standards are examined in detail. Service industry applications are surveyed for ensuring the efficient criteria regarding with the each clause of standard. The quality management system implementations in training institutions especially higher education institutions are examined that was initiated in United Sates of America at the beginning of 1990.Then the ISO 14001 (Environmental Management System) standards are investigated for ensuring the combination of ISO 9002 and IS0 14001 together.

The background of the ISM Code which requires training needs for the engine and deck cadets are defined clearly in the development stage of curriculum which coordinates the implementation of IMO Model Courses and the necessities required by STCW Convention.

2547-Higher Education Law, 2914-Academic Staff Law, 657-Government Staff Law, 2872-Environmental Law, 1475-Working Law, 506-Social Insurance Law, 2886-Government Bid Law are examined in order to clarify the significant aspects of these laws have any confusion between the international generic standards and the required Maritime Conventions that are established by International Maritime Organisation.

The combination of the above three constraints are established and maintained in documented procedures and the implementation phase of the Quality Management System is embedded in CLIPS that is the tool of expert systems, identifies both the optimum integration cost criteria and the effort levels.

1.3. PLAN OF THESIS

The first section in this study is the Introduction. The second section describes the main terms of Management of Quality Assurance. It includes the concepts and definitions, assurance of quality, human aspect and management dimensions.

International Management Standards and Conventions are detailed in section three. It describes the following requirements which are essential conditions to establish a Quality Management Model for Maritime Training Institutions.

1-) The requirements of ISO 9000 standards.

2-) The requirements of ISO 14000 standards

3-) The requirements of STCW Convention

4-) The requirements of ISM Code

5-) Integration of ISO 14000 standard with in the requirements of ISO 9000 standard.

6-) The Interrelationship between the ISM Code, the STCW Convention and ISO Standards.

The ISO 9000 and ISO 14000 family is summarised in Appendix A. One of the major important item of the Quality Management System is the audit process. Principles and the implementation of the audit for Maritime Training Institution is developed separately and demonstrated in Appendix B. Sample Management Review activity record is developed for Maritime Training Institution and is given in Appendix C.

The Quality Management System in Maritime Training and Education is described in detail in section four by utilising the definitions that are mentioned in section two and the related requirements that are mentioned in section three. Section five identifies the modelling of quality management cycle in Maritime Training and Education Institute. The effort based cost model and the management involvement scheme are developed in accordance with the each clause of generic standards. The algorithm of the integration process and the solutions for the effort based cost model is separately demonstrated in Appendix D.

Section 6 includes the developed management model for İ.T.Ü Maritime Faculty including quality, safety and environmental protection. The developed management model consists the integrated management manual. The relevant management procedures and the work instructions of İ.T.Ü Maritime Faculty are demonstrated in Appendix E.

2. MANAGEMENT OF QUALITY ASSURANCE

2.1. CONCEPTS AND DEFINITIONS

2.1.1. THE QUALITY CONCEPTS BASE

To understand quality in more general terms seems to be easier, yet when explaining it to someone, generalities do not help much, if at all. General or abstract explanations of quality can be stated such as the following.

Quality is what people think it is, perceive it to be, or experience it to be. Quality perceived as high, low, or negative, describes its value in utility and usefulness [1] .

If something is of desirable value it does have a price. In a product, quality is the composite of individual attributes and measurements. A price is also paid for services, and these too have quality characteristics (or parameters) of physical (eg., length, weight, etc.), and non-physical (eg., courtesy, royalness, timeliness, etc.) nature. Therefore, attaining quality must involve broad responsibility for all parameters.

Quality is not always what the customer expects as fair and adequate. It is, moreover, what the producers create in production as added value, with the expectation that customers will be satisfied with the quality and pay a fair price. Given a product and its particular characteristics, the individual customer might find the quality good, fair, or bad.

Quality is also commonly understood as "excellence," which is better than a minimum standard [2]. Quality's conformance with specification and price is a responsibility a right of the customer. Quality means not just fitness for use but, in more specific terms, reliability, safety, maintainability, repairability, status, etc.

In a free-market economy, the customer is free to determine quality, but can do this only under conditions of what is called the "service" and when, at least in the short run, set the quality. Quality in business is expressed as specified standards against which actual performance and conformance can be measured.

Consequently, inspection and quality control are needed, with subsequent corrective action and preventive measures that can trace the causes of defects. Therefore, via use of standards, quality attainment maintains and improves itself over the long run.

Contracted quality establishes liabilities. A specified degree of quality, spelled out unambiguously in contracts, leads to effective and harmonious business transactions. Product or service integrity based on a provable history of satisfying adequate quality requirements offers the best and most convincing defence in liability cases.

Quality, understood as service characteristics that are specified, standardised, and contracted, has a relationship to quantity, time, and space. Often quantity and quality have certain positive and negative interrelationships. Moreover, the additional dimensions of time (eg., reliability, maintainability, etc.) and place (delivery) influence quality with regard to actual value for the customer.

Quality also is an expression of the people who contribute to service. Attaining quality is thus everybody's responsibility. Certainly a paid employee has the responsibility of meeting job performance standards, and thus, is participating in quality creation. The relation of organisation's service quality to workmanship, and high quality as the expression of good work, must not be forgotten irrespective of how impersonal and formal the work environment may be.

Quality is the totality of all attributes and characteristics of a service as specified, required, and expected. In conjunction with quality assurance, quality must be measurable and verifiable in technical respects by way of groupings of quality characteristics. The critical interface of the two parties that decide on quality is demonstrated in Figure 2.1. A satisfied customer is one who finds that the expected quality has been received.

Quality can also be realised in terms of several areas of quality characteristics of a service. These can be technically described as quality of design, quality of

conformance, and quality of performance. In response to large demands (guided by the purchasing power of customers), the organisation of goods and services intentionally evolve variations in quality.

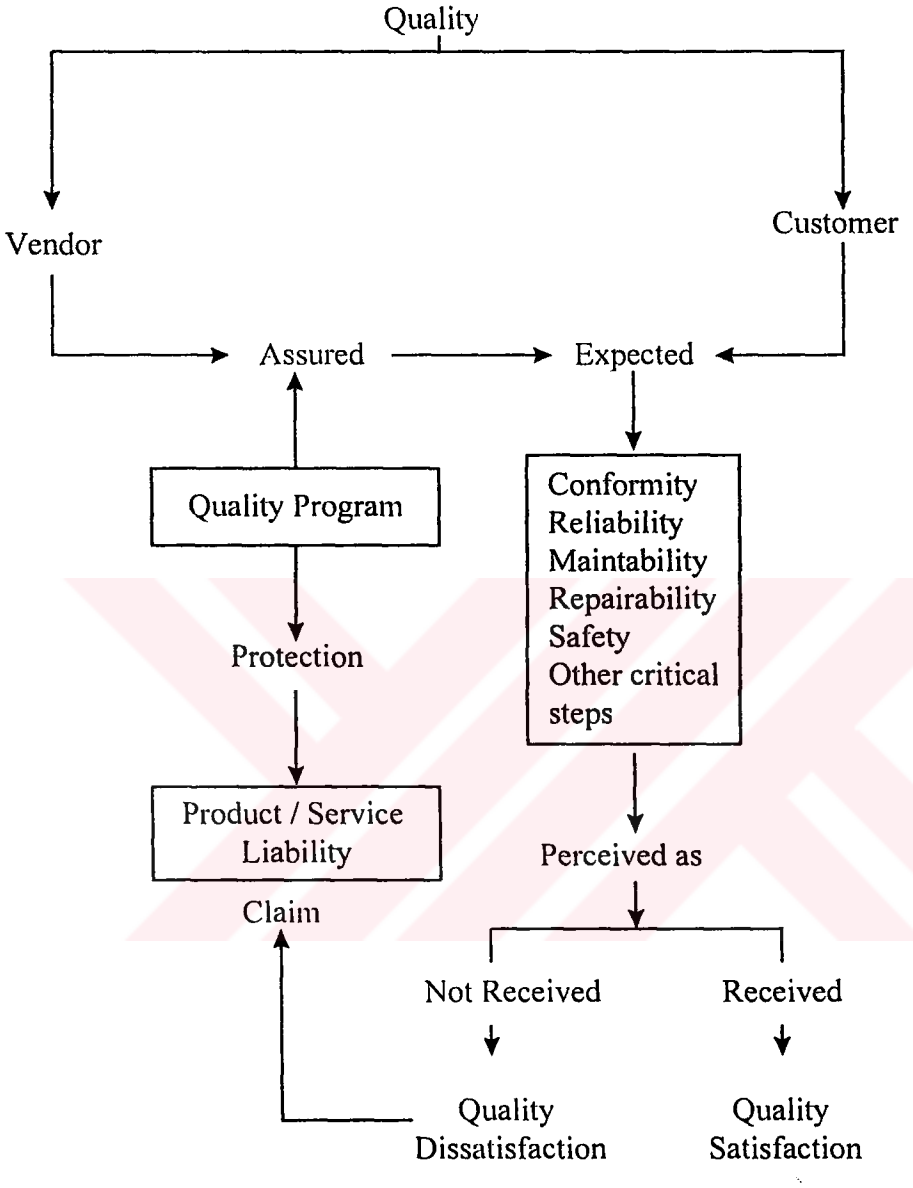


Figure 2.1 Critical interface of the two parties (vendor and customer) that decide on quality

"Quality is never an accident, it is always the result of intelligent effort [3]." It is used to think that service was an alternative to quality, but today's technology teaches how to make things quickly, cheaply and well. Quality isn't just for companies, either. Individuals can strive for excellence in their day-to-day life. It's a matter of

personal choice: People can easily slip into just doing the job, passing the course, playing the game at a sort of 'optimum' level, or they can make a commitment to meet self-imposed quality standards and refuse to accept anything less [1,2]. Individuals can commit themselves more easily than corporations can. This commitment is as important for everybody as it is for companies.

2.1.2. QUALITY AND DEFECTS

Numerous quality characteristics are specified either as nonmeasurable attributes or as measurements. With regard to the quality areas of a product, quality of service, and actual quality of performance interrelate.

Quality is indeed a most complex concept, but only when related to a service can the elementary characteristics be defined. Without a definition or specification, quality cannot be assured nor controlled. From a technical point of view, a given number of quality characteristics can be either functional or nonfunctional. On many occasions this forms the basis of whether or not they are critical to the service safety, marketability, or affordability. Controlling quality means to ascertain conformance with the service specification of major characteristics. For any required quality characteristic there is at least one defect, namely that the characteristic does not meet the specification. For attributes this means a go or non-go proposition, that is, the acceptance or rejection by an inspector.

2.1.3. CONCEPTS OF DEFECTS

The concept of defect has many meanings similar to the meaning and understanding of quality. Defects must be defined as much as the desired quality characteristics themselves. Defects must be controlled in order to control quality. This becomes one important prerequisite for quality assurance, namely that management must be able to prove that all due care was taken to avoid any or all defects. Defects, once anticipated during service and even later, are the effect of causes.

Defects provide an opportunity to improve. Defects create unnecessary costs. An organisation that only sorts out the scrap without probing into the reasons for defects, especially when the scrap is more than normal, foregoes a possible opportunity to

detect and eliminate the cause. Causes such as poor material, insufficiently skilled or unmotivated staffs, and so forth, not only create defects but also add on to unavoidable costs.

Since effective quality control involves prevention of defects, it becomes important to recognise when normal is normal and when tolerance limits are transgressed. In all defect prevention schemes, quality characteristics help to define defects. Defects reflect undesirable causes and allow successful corrections. It is one thing for the customers to accept a certain inferior quality of service or inferior service characteristics. Differences in level's of quality must be distinguished, from degrees of quality that are expressed in terms of defects. Quality characteristics, individually and jointly, present certain quality levels.

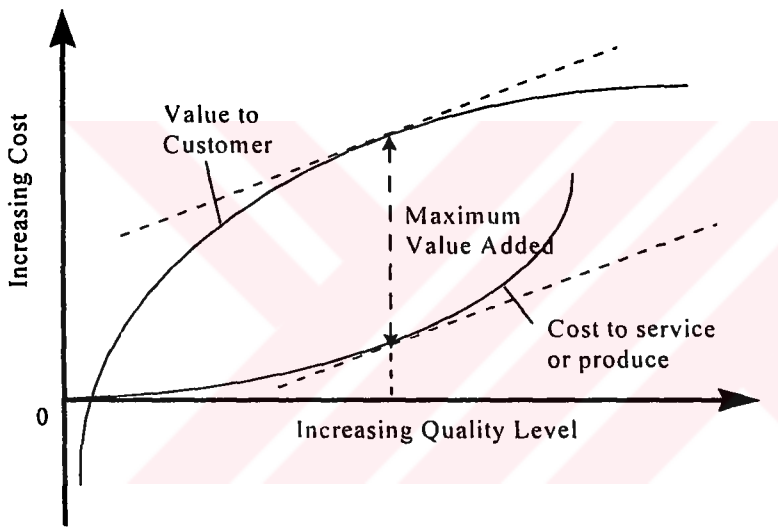


Figure 2.2 Cost and value of quality

Tracing the quality level and quality degree of a service to those of components and individual quality characteristics is rather difficult but is necessary, at least for the major characteristics. This then, is a main task of quality assurance and the various control and inspection functions. The concept of quality cost relates to quality assurance and defects. Quality costs are, foremost, the value of resources such as material and labor that are wasted through defects. Figure 2.2 shows the maximum difference between increasing quality cost and customer value occurs at the point where the slopes of the two curves are equal. The strategy "get it right the first time" helps to minimise quality costs which helps to avoid costly defects and subsequent

production or service problems [3]. This will then raise the quality level and the quality image upwards. Both lower quality costs and higher quality level contribute to profit, market share, job security, and customer loyalty.

Quality costs do not just include defect and failure costs. Costs for quality assurance, control, and inspection have to be added as well. However, in a well managed quality assurance program, the overall costs for assurance remain less than the costs of defects in the long run, so that total quality costs are minimised. This positive trade-off of defect and inspection costs is often overlooked by management when it considers quality control as a cost, and not as a profit centre. Reducing costs constitutes a profit increase. When quality is seen as subject to change in the life of an item's reliability, then, logically, such change affects major quality characteristics. This is in accordance with the definition of quality of service, and performance that encompasses the total quality life span and quality assurance of an item. Modern understanding of the life-cycle concept, quality costs, quality assurance, consumers, producers and suppliers all play their role in preventing causes of defects. Therefore, total quality assurance means more than just inspection.

2.1.4. DEFINITIONS

Quality is understood as the characteristics of a product or service that are designed to meet certain needs under specified conditions. Customers perceive quality as satisfactory or unsatisfactory. Quality is associated with all service stages, that is, with high performance. Quality has value not only in terms of "fitness for intended use," but also in the market, where quality is expressed as price [4].

Specifications describe required and expected quality. Tolerance is a permissible variation from a nominal value and specification. Standards describe normal specifications. The degree of quality measures relative attainment of specification. The level of quality is comparative in relation to similar items, brands, and processes. Price differences normally also reflect the quality levels. Excellence is a relatively high quality level, or degree.

Quality characteristics are individuate attributes and variables (measurements) subject to planning (specification) and control (conformance, performance). Quality can also be understood as the totality of quality characteristics of a service in reference to intended use and application.

A defect is an unacceptable deviation from an expected, required, or specified quality characteristic. Different defects have different impacts on customer dissatisfaction, safety, and quality of life, with respective differences in costs. Defects are effects of causes that can be prevented by quality assurance.

Failure is a kind of defect related to reliability, which is a measure of failure-free performance. A defect that is an unacceptable deviation from a quality standard is called nonconforming. Defective relates to an item or service that has one or more defects. Quality cost, simply put, is the total cost caused by defects and the cost for preventing and correcting defects. Quality assurance must be cost-effective in the long term.

2.2. ASSURANCE OF QUALITY

2.2.1. NATURE OF ASSURANCE

Quality assurance, by the service organisation means promise, conformance with quality specification, and to meet other understood requirements. Thus, quality assurance means to create confidence not only in the integrity of the service, but customer; to create confidence in relationships and communications, organisations and management and, above all, to create a prosperous service or business future [4]. This confidence and mutual trust more and more substitutes for direct testing and evaluation of items, particularly those of an advanced technical nature, by the customer. Quality assurance also mean that the service foundation takes every measure to ensure positive quailing for the physical as well as nonphysical characteristics attached to its services. Even when a customer does not demand and expect such assurances, a prudent self-assurance of quality on the part of the service foundation is a very wise precautionary measure. Quality assurance means to inform the customer about the quality of the service and to provide sufficient help and

guidance, as well as service for proper and safe usage and application. Implied in the term "quality assurance" is care in the servicing. However, "quality control" or "service inspection" mean that the service foundation has observed more restricted controls, which nevertheless might be absolutely sufficient. In fact, the service foundation assures is best defined not only on the basis of service specification, but also with reference to control programs and respective standards.

Quality assurance normally requires documented evidence for respective procedures and measures in servicing, for overall attainment of quality. Customers must be able to rely on such programs when the actual service quality cannot be readily determined by them. The vendor is beware principle underlying modern quality assurance acceptable. Quality program standards assist and customer alike to outline in contractual terms what quality assurance is to mean in each case.

Quality assurance is the most desired goal in quality management. Obviously, both quality and quality assurance establish customer satisfaction and confidence. If quality assurance remains a mere lip service, it soon will undermine, rather than promote, future projects. The service company ought to know what to expect and rely on, and then act on what and how to organise and implement service in accordance with extending quality assurance to the customer.

Quality assurance does not end with management that contracts with the customer. Rather, it is an ongoing commitment that requires concern from everyone involved: staff, suppliers, governments, and, in a way, the customer. Total quality assurance comprehensively and continuously orients work towards quality goals. Maintaining assurance becomes a matter of decency and fairness. The benefits come not only in higher revenues, market shares, and growth, but also in the form of job security and job satisfaction. Quality assurance thus creates a quality image, not only of a service but also of its organisation, staff, and society as a whole. Totality in quality assurance cannot mean total avoidance of defects and failure. Basic uncertainty, lingering unknowns, and unexpected events can still cause unavoidable defects. This is why quality assurance means to comply convincingly with established standards related to production of products or services as understood in a contract.

2.2.2. QUALITY CONTROL

Quality Control, as the core activity in any quality management program, refers to the process through which actual quality performance can be measured, compared against a qualified standard, and acted upon to prevent deficiencies. Defects will occur either randomly or not randomly. Quality degree measured in terms of defects, must be distinguished from quality level, which is the market value of an item. When compared with quality control, quality assurance is a more comprehensive management function that includes service and performance.

Service organisation assure those quality characteristics that are specified in advertisements, orders, and contracts, and about which both customer and service organisation have arrived at an understanding. As indicated in Figure 2.3, consumers have indefinite desires for services and for individual quality characteristics. Further, depending upon customer's standard of living and disposable income, only certain service and quality levels are affordable, attainable, and thus demanded. Customer quality expectations are not entirely definable by the service organisation's, nor even by the customers, and the extent of quality assurance expected beyond the specified quality characteristics remains largely unsubstantiated. The general quality image and experienced quality assurance stays in the mind of the public, (partly influenced by customer reports) and substitutes for guarantees of mere compliance to what has been assured. In their efforts to attract customers and satisfy them more than other competitors, service foundation will assure more than just compliance with specifications. They will also account for the nonspecific but attainable, recommended and appreciated quality attributes.

In Figure 2.3 the quality assurance management strategy in perspective of a never-ending goal of improvement until the two areas match. (a) Consumer's quality expectations. (b) Supplier's quality capability. Figure 2.3 also demonstrates that the feasible quality assurance, a supplier can extend to a consumer is limited by the existing capacity to create the required quality. Even when the supplier has ascertained that the capacity is in line with the state of nature and that the quality assurance program is effective, the potential of staff and equipment to produce the required and competitive quality might be further improved.

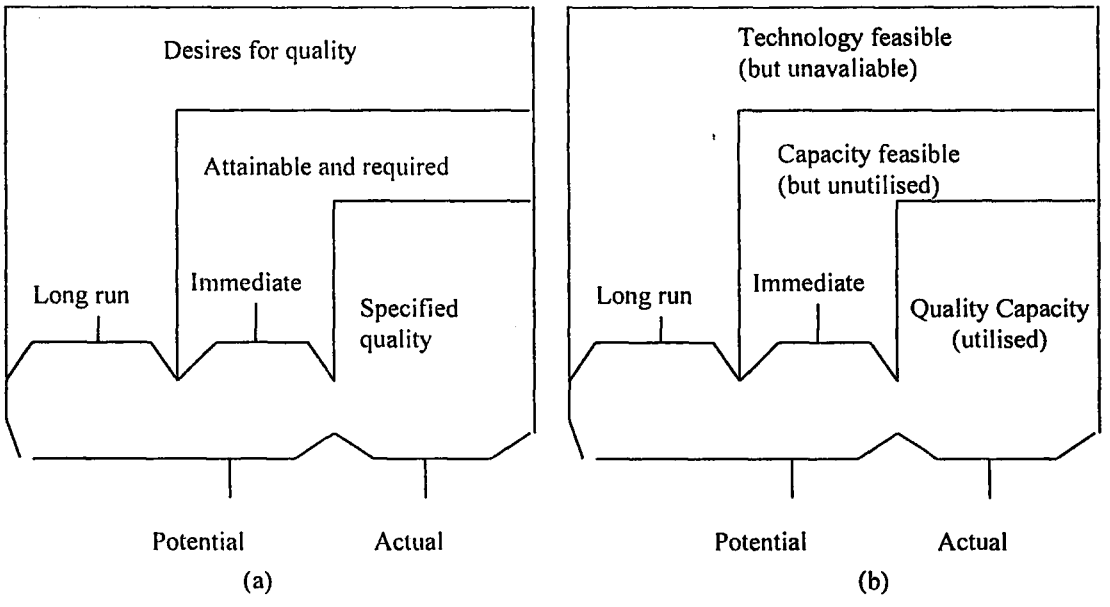


Figure 2.3 The quality assurance strategy in perspective of a never-ending goal of improvement

This is only possible by utilising, that is, motivating staff and using available equipment and organisation better for the creation of quality. This aspect of effort is termed the quality improvement program of the organisation. Quality assurance then means that supplier dynamically use every means at their disposal to create as high a level of satisfaction in the mind of the consumer as possible.

2.2.3. TOTAL QUALITY ASSURANCE

The concept of total quality assurance seeks commitment of all those connected with a product or service. Management of the producing organisation must decide whether quality is inspected-in or built-in. Quality assurance policies and systems must range from those where defects are left for the customer to detect, to those where management takes every reasonable step to prevent them. Quality costs at both extremes can be relatively high or low. For instance, in a simple product with defective items that do not cause any harm to the customer (or in which defects occur only occasionally) and that can be rectified by the customer without much difficulty, quality has extremely low costs. In this case, the customer would not want to pay for a very costly quality assurance system. At the other end of the spectrum, a defect can

cost irreparable harm to the customer, such as in an air disaster caused by a defective bolt and anchoring device, or a plane carrying passengers running out of gas in mid-air. These examples may sound impossible, but both have actually happened in this century [4]. The most costly quality assurance system is absolutely warranted and paid for by the customer. Thus, it is the cost of defects that really decides on a reasonable, affordable, and optimal quality assurance system.

Figure 2.4 shows three different basic kinds of quality assurance systems. The most comprehensive system (therefore called quality planning and control) prevents or hunts down defects during the, service, control, and performance stages. It stretches over the entire product life. The modest inspection system on the other hand, provides moderate verifications and testings, either by the worker or the independent inspector, at crucial points in actual production and performance. This simple inspection system attempts to rectify defects when they occur, rather than to also trace these to their causes and clarify prevention. The quality control system incorporates more sophisticated inspection and control techniques, such as statistical sampling, and is designed more for prevention rather than only for failure correction. The quality assurance system also called quality planning and control system, has to be preventive, and built-in, with audit programs to measure its effectiveness. Obviously, these are only three basic types and, in each instance, possibly for individual major quality characteristics, special assurance procedures will have to be established that might fall between the basic types.

Total quality assurance or total quality control does not usually mean a system with regard only to the product life. The total involvement of all staff in an organisation together with suppliers, distributors, and even customers, in bringing about quality and satisfaction has become the more recent understanding of these terms. General technological progress, advancing specialisation in the work force, and generally higher levels of training, skills, and workplace expectations suggest a greater delegation for quality from within the organisation. Quality circles, job enrichment, and participatory management, are some of the current approaches for a broader and more effective quality assurance system. The importance of the quality assurance function, as it has evolved from inspection to quality control engineering, now lies in the design, planning, service and control of all activities related to quality attainment.

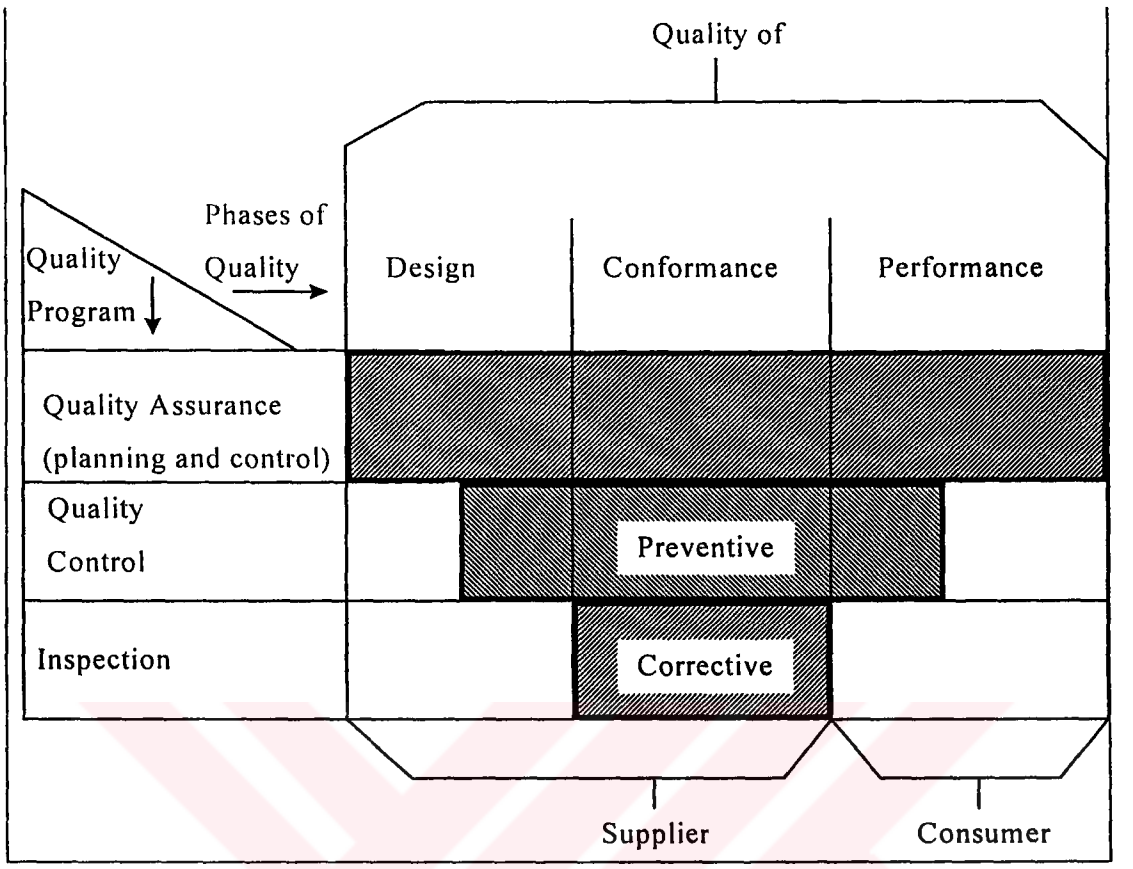


Figure 2.4 Three different basic kinds of assurance systems.

2.2.4. THE SYSTEMS CONCEPT

System is also a term widely used in conjunction with quality assurance. Today such terms as management systems, systems analysis, production systems, marketing systems, information systems, and so on are confronted. There is also a theory of systems and practitioners in the field are systems engineers. In the most general sense, a system is the phenomenon or idea of an interacting of interdependent elementary components that form a unified whole with a common goal and purpose [5]. Information systems, for instance, can be understood as the regulated, systematic allocation of data or information and systematic processing (arranging, interpreting, transforming) of these inputs. The output of the processed data constitutes a whole, in the sense that it serves its predetermined and pre-designed purpose and objective. The input, processing, and output that take place in a system is systematic and

systematised. Wherever an unsystematic interaction of parts prevails, a common purpose or goal can only be achieved in a random fashion, rather than by an orderly and systematic approach. In such a chaotic situation a system is nonexistent, and in the area of information it would mean that data are compiled in a more or less unplanned, irregular, fashion and are processed, communicated, and used in a way that accomplishes its purpose only by chance.

Input, process, and output, are coherent and elementary components of any system. By internal and external forces that are at work within and outside a system, systems or sub-systems are created, changed, or dissolved. Any system will show some kind of dynamic inherent equilibrium and operational flow. When the boundaries are clearly defined, then system can be separated from other sub-systems or parallel systems. Almost all systems are part, in one way or another, of other systems, and are linked to them in many ways. The concept of a total system describes a complex of inter-lined and well-aligned systems.

By its nature, a system can be cast in a highly abstract language and mathematical model, or it can take the form of a very tangible, physical entity. Often systems in their first phase of existence are conceptual, and are then transformed into an operational and concrete form. Any system must have an inherent logic or rationality which reflects itself in the particular input, output, and objective relation. The objectives for a system normally also determine and influence the underlying principles upon which the system service and operates, such as principles of efficiency, economy, or adequacy. Figure 2.5 gives an outline of an education system viewed from a teacher's point of view.

Management is the planning, organising, initiating, and controlling of operations. As the decision-making force, management is an essential part or function in any organisation. Both management and organisation can be conceived, described, and established as systems. Management is one of the sub-systems of an organisation. Conceived as a system, management is composed of many interacting and interrelated parts, mainly personalities and rules that concertedly perform the function of directing the organisation at all levels and phases. The most typical and important output of such a management system are decisions and rules. The input

into management systems can be thought of as organisational problems that demand solutions. The intermediate link between input and output in this system, namely the processing unit, consists of the various decision-making processes.

A management system is open, in the sense that it has to account for environmental factors and developments, as well as various internal forces and disturbances. It is hierarchical with top, middle, and lower managerial levels. Also, it can be distinguished different special areas of management and their respective management systems, such as the functional areas of finance, marketing, and production. In this perspective a management system presents itself as being composed of various sub-systems. All management sub-systems have in common that their main output takes the form of decisions which are correlated within the entire organisation.

Management systems in accordance with general definition of systems, the term management system carries many different meanings within the jungle of managerial semantics. The term is sometimes used to describe the system of authority and responsibility of members within an organisation. Sometimes it is used to typify and classify styles of management such as conventional management systems or modern management systems.

The concept and explanation of management systems, however, focuses on the common purpose of management within an organisation as the decision-making force and helps the people to orient the study and practice of management towards the systematic solution of problems. It also provides with a logical framework of reference and an efficient basis for analysis.

The general significance of the system concept lies basically in the fact that it guides the thinking and, therefore, the action taken towards optimal and effective goal achievement. For the theory or practice of management, this concept must be useful, simply because managing and organising means to allocate, arrange, direct, and control various resources systematically in a continuously changing competitive environment in such a way that the organisation becomes viable, effective, and competitive. The ever-increasing complexity and multitude of problems demand rational decisions and solutions based on a systematic, scientific approach (a systems approach).

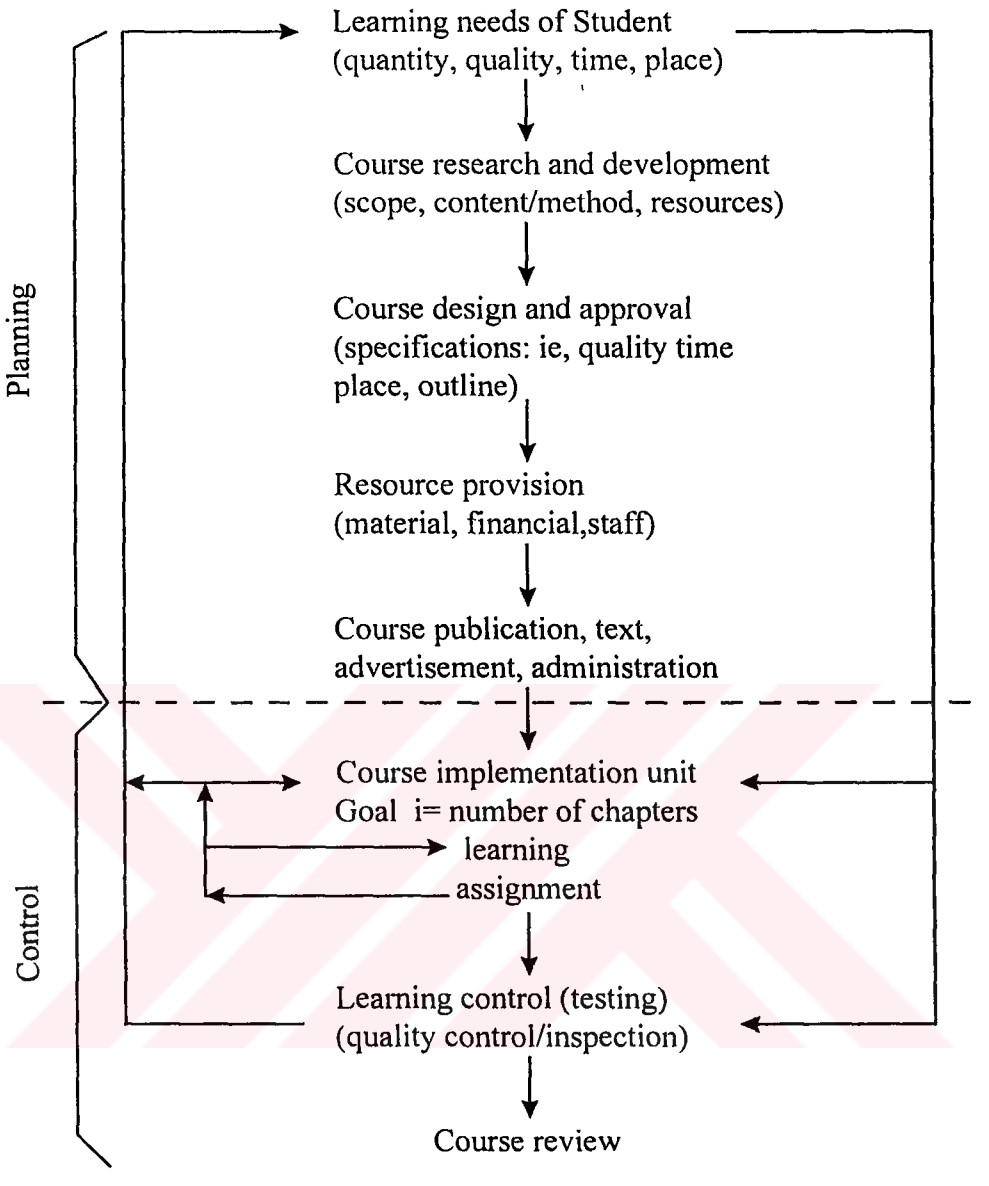


Figure 2.5 Systems approach applicable to a course on quality assurance

Applying the definition of systems to an organisation results in a clear definition and a continuous redefinition of specific and general objectives for the organisation as a whole and for its integrated parts. These goals, which link any organisation with its environment, initiate and direct the various activities or processes within the organisation and call for the allocation and input of various resources. Thus the systems concept not only leads managers to recognise their organisation as a sub-system within a wider web of all kinds of overriding systems, but also leads them to consider the organisation each having its specific and well-coordinated objectives.

The system concept leads managers or directors to make better decisions for the organisation as a whole, rather than simply for the manager's department. Short-term departmental goals receive less emphasis. The systems concept, in the form of a systems approach to problems, will result in an optimal solution, because the problem is not only recognised in its proper context but carefully and scientifically analysed to determine the processes that cause the problem. Here the systems concept leads management to apply the various analytical and statistical methods of quality control, operations research, and management science that help discover the root cause of the problem. The systematic and scientific decision making which is based on the systems concept and systems approach to problems, is the most efficient and often the most simple method for solving problems and complexes of problems. Thus the systems concept not only helps managers to clarify, understand, and master their responsibilities and tasks, but at the same time it also helps to overcome all problems due to the complexity and difficulty of the tasks themselves. The systems concept allows for the establishment of predetermined decisions or rules and makes it possible for more and more procedures and operations to be better understood in terms of their faults. Structuring organisation according to the systems concept does not eliminate the need for the basic functions of planning, organisation, control, and communication, yet it provides the basis, the challenge, and the methods for improving these toward the goals of more specific managerial functions and improved performance. Under the systems concept, modern management is transformed to systems management. Managers and their expert consultants analyse existing systems and design, and redesign all sub-systems within the context of improving the system for which they are responsible. If faults in the sub-systems are corrected for rapid adaptation, the atmosphere of blame within the organisation diminishes. The systems concept has particular significance and usefulness, not only for top management or systems experts. Any work that is to be performed in an enterprise constitutes an essential operating part of the whole entity and must contribute towards the smooth effective functioning of the entire system. Certainly there exist limitations of the theoretical systems concept within practical systems management. While the systems concept stands for utmost rationality, regularity, and order, in performance and goal achievement, management must look after the system itself. As long as management plays an essential part within a system, irrational

actions and disturbances must be expected in order to be realistic in problem diagnosis. Also, due to the fact that an organisation such as a business enterprise and its individual parts are human-made and based on decisions made by humans, the systems approach can never become the only approach for management. Other approaches, based on a more empirical, historical, psychological, or technical perspective, have their particular value in the study and practice of management. However, the systems concept will, in an essential way, supplement and partly change conventional management into a more scientifically oriented and data-based mode. The idea of systems and management systems has not only helped to clarify prevailing concepts and practices but has also provided the groundwork for more rational and efficient management of organisation in the modern environment.

2.2.5. APPLICATION TO QUALITY ASSURANCE

The quality assurance specialists, who have various titles, such as quality coordinator, inspector, quality control manager, quality auditor, and so on, need to develop an acceptable quality system in each case that is most effective in minimising quality costs, maximising positive quality motivation, and creating highest confidence in product integrity. The underlying concept of a quality system facilitates quality assurance integration and coordination as it envelops the entire organisation.

Figure 2.6 displays this system approach from which a close relation of quality assurance with process planning and control becomes obvious. While the scheme shows the flow of assurance activities over the whole life cycle of a process, the interdependencies and links between quality assurance, other functions, and the staff in the individual sections can also be visualised. Thus, the management, as the planning and controlling function, not only reorients itself to quality goal attainment; in a well managed organisation, it can take on a leadership role.

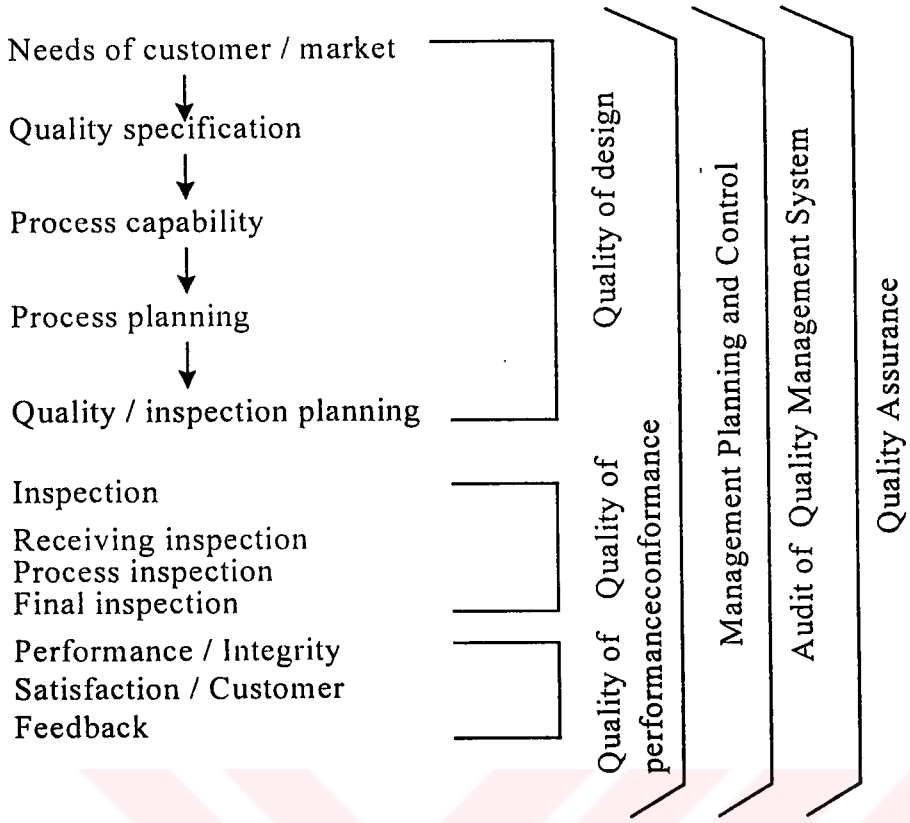


Figure 2.6 Essentials of systems approach to quality assurance

In a summary the following definitions can be given for the key terms of quality [4-7]. Quality assurance includes all decisions and actions explicitly purporting the satisfactory attainment of quality in products and services. Form and degree of assurance, as well as its proven effectiveness, influences the confidence of customers and the quality of products and services. The level of quality assurance also depends on quality costs, as it must be cost-effective. Quality control is an essential element of the wider concept and function of quality assurance, the main purpose of which is to verify conformance to specification. Inspection relates to the verification of specific quality characteristics by means of independent tests and predetermined decision criteria. Statistical quality control accounts for the detection of variations in quality, and applies statistical techniques to control variation and help find its causes. Quality and reliability management plans and controls programs and procedures designed to attain desired and specified quality and reliability of a product. Total quality assurance is the composite of all decisions and activities involving the producer, suppliers, distributors, and customers, directed toward attainment of

quality. System is a complex of interacting components that are all directed towards attainment of the same goal and that all share the same environment and resource base. An example is a quality assurance system. Figure 2.7 illustrates of organisation's views its quality assurance in the framework of a system.

2.3. HUMAN ASPECT

2.3.1. HUMAN BASED CRITERIA

Quality of products and services is created or originated by people, or for the usage process of people. Quality assurance induces confidence in the customer that the producer will be able and willing to meet quality requirements and specifications. Quality assurance can be found as an inter-human understanding and commitment. However, quality assurance can also mean that the producer has ascertained the expected quality. It is thus a self-assurance that people individually and collectively start the process right, keep it on the right way, and finish the work right. This implies that the organisation is convinced that the principle of right the first time has been observed. Satisfaction from a job well done is also a reassurance that people seek in the work place. The essence of modern quality assurance lies in the fact that the producer must beware as much, if not more than, the customer do.

Quality assurance is a human bond and a contracting arrangement that can make harmonious and mutually beneficial relationships. The effective motivation of individuals is needed to keep the human bond strong and vibrant [7].

In order to achieve organisation goals, management's fundamental objectives in developing good human relations centre around the creation of an environment that makes the satisfaction of human needs compatible with organisation goals.

The human relationship in work and its result on quality have become more emphasised, or re-emphasised. There is again a great awareness of the need to motivate and support employees, entrepreneurs, teachers, servants, and other workers to meet traditional performance standards and to strive for better results.

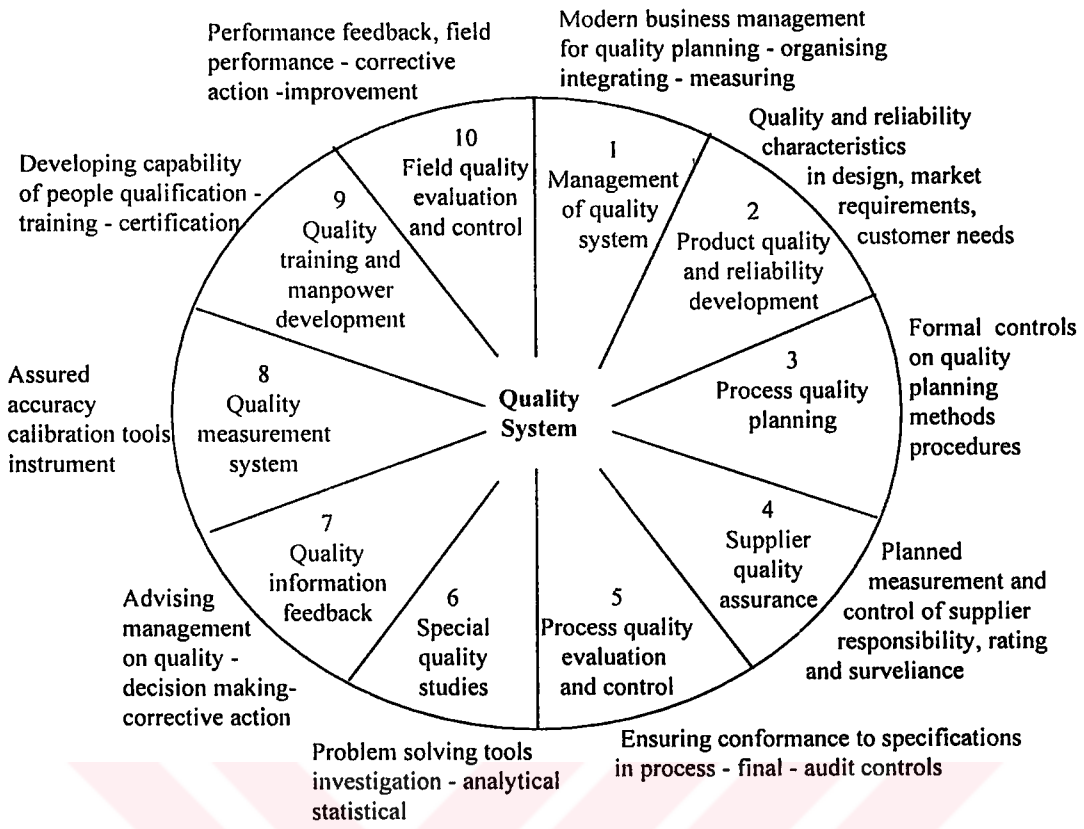


Figure 2.7 Major elements of total quality assurance

Quality of work performed at the individual level must be seen as a top priority. However, quality cannot be separated from quantity. Quality and quantity together make up efficiency. One thing is clear that poor quality means more and more rework, scrap, and poor productivity, and that in turn means poor presentation or profile, a bad reputation and the rest of the miseries that follow.

2.3.2. STAFF COORDINATION FOR QUALITY ATTAINMENT

Organisation for quality means two things: First, the consideration of quality goals and responsibilities for the entire organisation, and secondly, the sub-units of the organisation in charge of quality assurance procedures and programs. The entire organisation as a team carries the obligation for quality and the individual members share in this responsibility on the job assigned to them. Quality responsibilities thus permeate the organisation, ideally from top to bottom.

An organisation chart, with its work division and job assignment functions, constitutes a formal arrangement of jobs. These jobs become interrelated in a hierarchical order, with an executive on top and the various levels of responsibility subordinated. Normally, only the lowest level jobs do not entail responsibility for the performance of others. Each jobs however, carries with it a defined task, responsibility, respective authorities, reporting lines, qualifications, and remunerations. In a job description performance standards are quality related. The extent to which the job holder meets this expectation decides, individually and collectively, the overall attainment of quality in services. Obviously, the quality of job design, the coordination and integration within the organisation, the workplace, equipment, and the qualification of the job holder determine actual quality of performance. Quality of supervision, training, work directives, quality systems, and procedures are other factors that set the quality capacity and the motivation for quality assurance. The personality of the job holder does play a role in quality performance. However, a well managed and effective organisation would tend to minimise anti-motivational personality traits. The manner in which all these contributing factors interplay determines the quality of an organisation. All of these are primarily managerial tasks.

Reorganisation can lead to better quality attainment only when reorientation of staff is associated with such measures. Thus, any team or organisation can have a unique set up, with sufficient orientation and flexibility geared towards quality. Changes for the better require several forms of reorganisation:

1. Coordination between various functions (permanent and temporary).

2. Procedure and rule setting.

3. Concept of project teams for quality improvement.

4. Committees and subcommittees.

5. Continual training of all levels of management.

2.3.3. INTEGRATING QUALITY CIRCLES INTO PROJECT TEAMS

Quality goals to be achieved by the entire organisation and by the individual team members require respective approaches and resource deployment. These goal and approach relationships, when understood as quality systems have several facets.

1. Quality systems and their procedures complement an organisation and drive the organisation forward.

2. Through implementation in the form of quality programs, a quality system mobilises and energises an organisation and its people. The individual employee becomes directed toward quality performance in the context of the organisation.

3. Under the systems viewpoint, people external to the organisation, such as customers, suppliers, and government representatives, also enter the team and movement for quality.

A quality program normally precedes the formation of quality circles because management initiates and leads. Workers or operators cannot form quality circles on their own. The point is that both quality programs and quality circles link the various levels in an organisation, ensuring that the program is prepared with everyone in mind. The real effectiveness of quality circles thus hinges on the suitability of quality programs and vice versa. While quality circles and respective problem solving efforts remain restricted to small groups, quality programs are organisational wide, in all departments and in every function. Informality, independence, and voluntary participation in quality circles not only need to be maintained, but need to be reconciled with formality, and with management imposed and enforced quality programs. Quality cannot be attain by the existence of quality circles alone, or, for that matter, only through management-imposed programs.

Establishing project teams and committees have been extensive in American business experience since World War II, when industries were trying to increase military output in the face of shortages of labor, materials, and energy [8]. Senior management has always appointed project teams and the project leader for various purposes and missions, in an effort to analyse, design, and revise chronic problems

and to get concrete answers. However, a relatively high degree of specialisation has often blocked communication between management and quality specialists. It is the removal of this barrier and the creation of a participatory style. The real benefit of project teams is that the group work remains task oriented under strong leadership and enjoys adequate managerial and technical support. On a finer scale, both quality circles and project teams encompass project management.

Table 2.1 compares different aspects of quality circles and project teams. In spite of obvious differences, their similarity rests in the grouping of people to solve quality problems and accomplish a common task in which every member has interest, stake.

2.3.4. PARTICIPATORY MANAGEMENT

The main concern here is the influx of participation within all levels of management, not simply between supervisors and the work force. Participatory Management establishes 10 step approach for incorporating the formation of quality circles and project teams, integrated together as a permanent feature, for any management committed to either reviewing its current quality status or studying to establish a better one [9]. Considering each step on a project-by-project basis to get the most out of this integration looks at the closing of the quality gap. This 10-step approach can result in an effective integrated quality assurance program, such as is needed by any organisation today.

Table 2.1 Comparison of quality circles and project team approaches to problem solving

Feature	Quality Circle Approach	Project Team Approach
Main Purpose	Quality motivation, participation	Attainment of goals, taskforce
Setting of objectives	By group members	By senior management with team's participation
Scope	Depends on group ability / capacity	Determined with objectives by senior management

Need for aids (management)	High	Relatively low
Expertise	Practical, limited	Predetermined for task
Staffing	Volunteer	Appointed, qualifying
Technical approach	Innovative/ experimental	Traditional established
Management Involvement	Indirect, relatively little	Direct delegation of authority and responsibility
Organisational status	Without formal line function	Within formal organisational structure
Size of group	Small	Varying, task-dependent
Performance standard	None	Normally preceding task assignment
Performance control	Little	Usually undertaken
Qualification requirements	Little	Qualification required
Accountability	Little	Qualification required
Termination	Not without group approval	Decision by senior management

STEP 1: Determine existing practices for assuring quality. No matter at what stage an organisation is in its quality improvement program, it has to be considered to know where an organisation stands with regard to practices as opposed to procedures. Taking into consideration that, the two differ from one another in procedures are documented while practices are not. Such processes need to be done for all departments, not just for the one officially assigned with quality assurance responsibilities. If the chain of the quality system is broken in any one area, the effect will be felt in the end result.

STEP 2: Formulating the practices in writing and verify these with the persons concerned. Many department heads discover, often the hard way, that a quality system will not function if too rigidly enforced. This is mainly because they do not

dedicate themselves to a vision of the future. Many things can and do change. Judging by an organisation's instability, conditions such as new product design, new markets, new customers, changed supply sources, technological changes, inexperienced staff, and other similar factors always contribute to the flexibility that a system is required to have. People in an organisation usually hold many conflicting views about the best method of reaching a goal. Verifying with concerned personnel in early stages makes it easier to discover the facts, whatever the basis of people's conflicting perspective may be.

STEP 3: Form a quality circle for review, and finalise the procedures. Everything is accomplished through people. Building a long-term relationship with the people in quality control, in other departments, is important to restore confidence in quality. Before a project is approved, early involvement of employees avoids conflicts and delays. The best rule, in experience, is to choose a project that is virtually certain to be approved by the employer and to choose one that can be experimented with and has all chances of success in the end. If one project in one department is successful and people are simultaneously trained, and become receptive to quality circles, an attempt should be made to repeat the exercise in every department, one after another. At first, however, efforts should be focused on the ability to do well only those limited things that are of utmost importance to quality attainment.

STEP 4: Document generally approved practices as formal quality assurance procedures. Remembering that the project began by gathering information, looking for facts, building up a coalition, building confidence, and, most of all, agreeing upon what each party sought as an objective behind the objective. It is important to document the approved procedures.

STEP 5: Comparing procedures with applicable quality program standards; determine voids, major deviations and making corrections. Quality programs, as described in the respective program standards, have a broad effect on an organisation. The way an organisation's system measures up and reports performances must be understood and guided by the standards. If it is not consistent with those standards, it should go back to the drawing board.

STEP 6: Bringing together the formalised organisation-wide quality assurance program in the form of a quality manual. Many organisations have their quality policies and procedures scattered among an amorphous collection of individuals, groups, and departments. The lack of a clear cut, unified document, is an impediment to progress. Responsible managers must remember that a quality manual is, in effect, a user's manual. If imposed from high up, without full knowledge and participation of all, it is almost sure to be unworkable.

STEP 7: Preparing special quality circle principles and operating procedures in conjunction with Step 3. There is no substitute for assured continuity of participation. This is a positive and challenging way of looking at the success of all quality programs. If management fails to recognise circle activities, management's responsibility becomes suspect. When an organisation prepares plans for circles operation, the potential of quality circles is put in proper perspective.

STEP 8: Establishing a project team in support of and in cooperation with quality circles. Even though the principle of quality circles is to retain voluntary participation, its success or effectiveness depends upon whether it is built-in with or loose from the overall system. The idea of a project team at this stage is to provide guidance, help, and necessary training for all circle activities.

Earlier, in Step 3, quality circles were being formed and gaining experience. The circles become positively ready for useful recommendations to feed the project teams. The basic thrust is to keep reinforcing effective participation. The scope of involvement of any number of employees in a given project team should depend on the nature of the problem, from mere consultation to participation, then moving on towards self-control qualifications.

STEP 9: Audit planning. Audits are particularly important for examining ongoing operations and assessing necessary improvements. In short, an audit's purpose is to review progress against goals. Executives will want to review a system so that they know one exists. Nevertheless preparation of an audit program is a task by itself. During this phase, like the others, consultations with quality circles and other project teams is vital to maintain momentum and continuity.

STEP 10: Conducting the audit with a mandate to follow up with the audit reports. Beginning audits should be conducted as projects in conjunction with other quality programs. Having a meaningful statement of objectives and a long-range plan is essential to this function. The audit is best done annually and should be conducted first by an internal team and then ensured through some external third party for objectivity. By integrating internal quality audits into a comprehensive management audit program that extends the entire quality system becomes linked.

2.4. MANAGEMENT DIMENSIONS

2.4.1. QUALITY MANAGEMENT PROCESS

Management means planning and controlling of work. This role implies decision making, leading, supervising, administering, risk taking. In terms of quality, management concerns one's own work and the combination work of others. A director has to manage his or her own work well first before it can be expected that others on the team and in the organisation will accept that director's leadership and follow his or her example. If management establishes poor, unworkable, policies and procedures on quality assurance, which are supposed to direct all activities relating to quality attainment, then even highly motivated staff cannot function effectively.

Quality assurance, as an inherent element of processes, is an essential component in each job. After all, processes divide into individual jobs; a job is a small integrated part of a system and thus a sub system, that is, a micro part of the process. This means that quality assurance must come from the top in the form of procedures, policies, directives, and leadership. When quality planning and control responsibilities are shared by everyone in an organisation, quality awareness and motivation must permeate down from the top in the organisation.

All work being planned and controlled for quality attainment must also meet deadlines and quantity standards. A job plan strikes a balance between quality and quantity standards. Quality attainment requires sufficient time for the job. Tight time standards may cause poor quality of workmanship. However, quality of work depends also on the quality of the workplace, of teamwork, and on the quality of

others work. A proficient director has to design processes, plant layouts, workplaces, and work methods with more than the required quality of the process in mind. Proper consideration must be given to the employee's qualifications and personality. It stands to reason that prudent management seeks wide-ranging participation of operators, and their collective representation in the planning and controlling of work.

Quality can also emerge from the bottom of the organisational hierarchy. Defects may be controllable by management, but poor workmanship and disregard of work procedures do cause many failures. Policies and procedures by themselves do not suffice to bring about the proper quality of products and services. Many special processes need skill, talent, and high motivation of the operator to assure the desired quality. Thus, with the help of the operator's influence on procedures, and possibly even on policies, communication should work in both directions, from the top to the operator level, and in the reverse.

2.4.2. MANAGEMENT PRINCIPLES IN QUALITY ASSURANCE

In order to attain quality goals, operations and performances must be planned, monitored, and controlled, so that deviations are recognised in time and corrections made to prevent their recurrence. This fundamental planning and control activity, as it is to be carried out by management, implies the use of some principles.

1. Determining goals on a long, medium, and short-term basis that are strong in depth and commitment.

2. Correlating quality assurance objectives, in addition to the time perspective, with other goals that might possibly conflict, be neutral, or even aid in quality assurance. Assigning a budget.

3. Ensuring that goals are valid regarding the need and realistic regarding the organisation's immediate and long term capacities for quality assurance.

4. Assigning the proper people with sufficient training and experience tasks in the planning and implementing of quality assurance procedures and programs.

5. Seeking the broadest possible participation of staff in the design and implementation of quality assurance programs.

6. Designing systems and programs that are to create better quality in process and services, in the form of small projects that then become assignable to project teams.

7. Communicating objectives and plans as widely and clearly as possible, so that people are informed.

One of the most fundamental managerial principles is to know where one stands and then where one wants to go. If the quality assurance goal appears promising and worthwhile in light of what is needed and what one can do, then plans and actions will be forthcoming from an energetic individual and a strong team. In principle this means that applying both standard and some innovative management ideas to a relatively new field of management activity. For the many quality professionals, these innovative ideas and practices belong, as follows [10] :

1. Quality program standards, as a guide to management.

2. Quality projects, as task and action oriented packages for quality attainment.

3. Auditing of quality assurance systems as a tool to review progress and achievement.

4. Quality circles, as a form of participatory management.

5. Quality systems management, where a total approach in quality assurance is envisioned and understood, for the actual designing and implementing of quality programs.

Quality assurance management should be considered as a unified whole, consisting of the above items. Quality assurance projects and programs both involve planning and control. Projects have a particular well-defined task and objective, while programs are more for general procedures and activities. Projects are carried out by teams; programs are administered by functions of departments. Effective quality management depends on the ability of those who manage an understanding of the essentials of modern management concepts and methods. The tasks quality

performance, keeping customers satisfied and making work productive by maintaining a balance between the attainable limits and available resources-are what basically make up the profile of management representative. Table 2.2 describes the major quality management system activities with regard to quality programs considered through project management steps. At each stage of a specific activity, such as setting objectives or determining an approach, a coordinate task for the quality program of quality assurance activity can be defined.

Functions and jobs designed to assure quality through respective planning and programming constitute an integral part in the wider concept of the organisation. One major organisational question is whether quality assurance at the inspector level should come under the supervision of the employee or another supervisor. Both direct supervision by the third party supervisor or by the independent quality assurance manager have advantages and disadvantages. Program standards suggest there should be independence of the inspector from employee, and direct reporting to the management representative. A recent trend promotes self inspection of the operators, and quality audits through the quality assurance function as inspection control. Another important trend is keeping the management representative on an equal level in the organisation hierarchy with the department heads and similar other executives. A management representative, or the quality department that reports directly to top management, is clearly in a better position to remain unbiased and is able to fulfil its quality assurance function more effectively.

Table 2.2 Four general categories of steps essential to the preparation of a master plan (Quality assurance through project management).

Preparation Phase	Determination of Quality Policy Establishment of Quality Assurance Program Formulation of Procedures Establishment of Quality Assurance Information System
Organisational	Management presentation of need, goals and approaches Formation of quality improvement projects or teams

Phase	Execution of approved projects on a pilot basis Establishment of training and advisory services
Implementation Phase	Management presentation of results of pilot projects Conducting of Quality Assurance Training Initiation, Supervision and Coordination of projects Preparation and Dissemination of progress reports Submission of final reports Presentation of total project results Establishment and Announcement of new objectives and projects
Control Phase	Establishment of control procedures Establishment of quality audit teams Planning and execution of audits Analysis of audit reports, followed by corrective action and performance control Review total quality program (annually)

Any organisation chart must be complemented with adequate job descriptions or position guides. These provide information about specific duties, responsibilities, authorities, supervisory and lateral relationships, accountability, performance standards, and required qualifications.

2.4.3. MANAGEMENT TOOLS AND TECHNIQUES

Quantitative methods developed in the general discipline and practice of management facilitate rational decision making. These methods are applicable and important in quality assurance management as well. Quantitative methods and models interrelate numerical data and variables pertaining to a problem and inform organisations about factual conditions.

As not every determinant and element in a problem, decision, and action can be quantified, these models and techniques help abstract facts from reality. In quality assurance, customer dissatisfaction can be measured in terms of complaints and by details of such feedback, but emotional factors often escape quantification.

The frequency of such complaints, when analysed with statistical techniques, bear important messages for management. The compilation, analysis, presentation, and communication of these statistics and pieces of information, help to monitor, observe, and detect problems and to take remedial actions. Without any data there cannot be a real basis for problem solving.

These methods and models of quality control are traditionally of the statistical type in the quality assurance field. In fact, quality control has introduced modern quantitative methodology of decision making in many organisations, and in particular in the production, service and operation function. A process control chart, for example, exemplifies quantitative planning and control, because control limits, usually based on performance data, serve as a standard for future process behaviour, and thus can predict future process performance.

If the data from an ongoing process is properly and continually retrieved and analysed, conclusions on process behaviour can be readily drawn by operators and non-statistical experts. Thus, the method allows its user to predict whether the process will remain in control for a given condition. There are other kinds of models that demonstrate relationships such as histograms, checklists, graphs, Pareto Analysis, and cause-and-effect diagrams. These too are abstract, and reveal fact. Use of many of these models of various kinds can become an integrated element in any complex decision-making process.

Most of the other methods and models used in management science serve equally well in quality assurance management. These are listed in the context of a general decision-making process in Figure 2.8. The individual quantitative tools for organisations vary with regard to, for instance, their predictive power; that is, whether they use fixed (deterministic) or random (statistical) variable inputs, whether they produce an optimum alternative (ie., linear programming), or a feasible one (ie., heuristic programs). In part five such important quantitative methods and models are discussed in detail. Their potential use for answering questions regarding quality assurance matters will be shown.

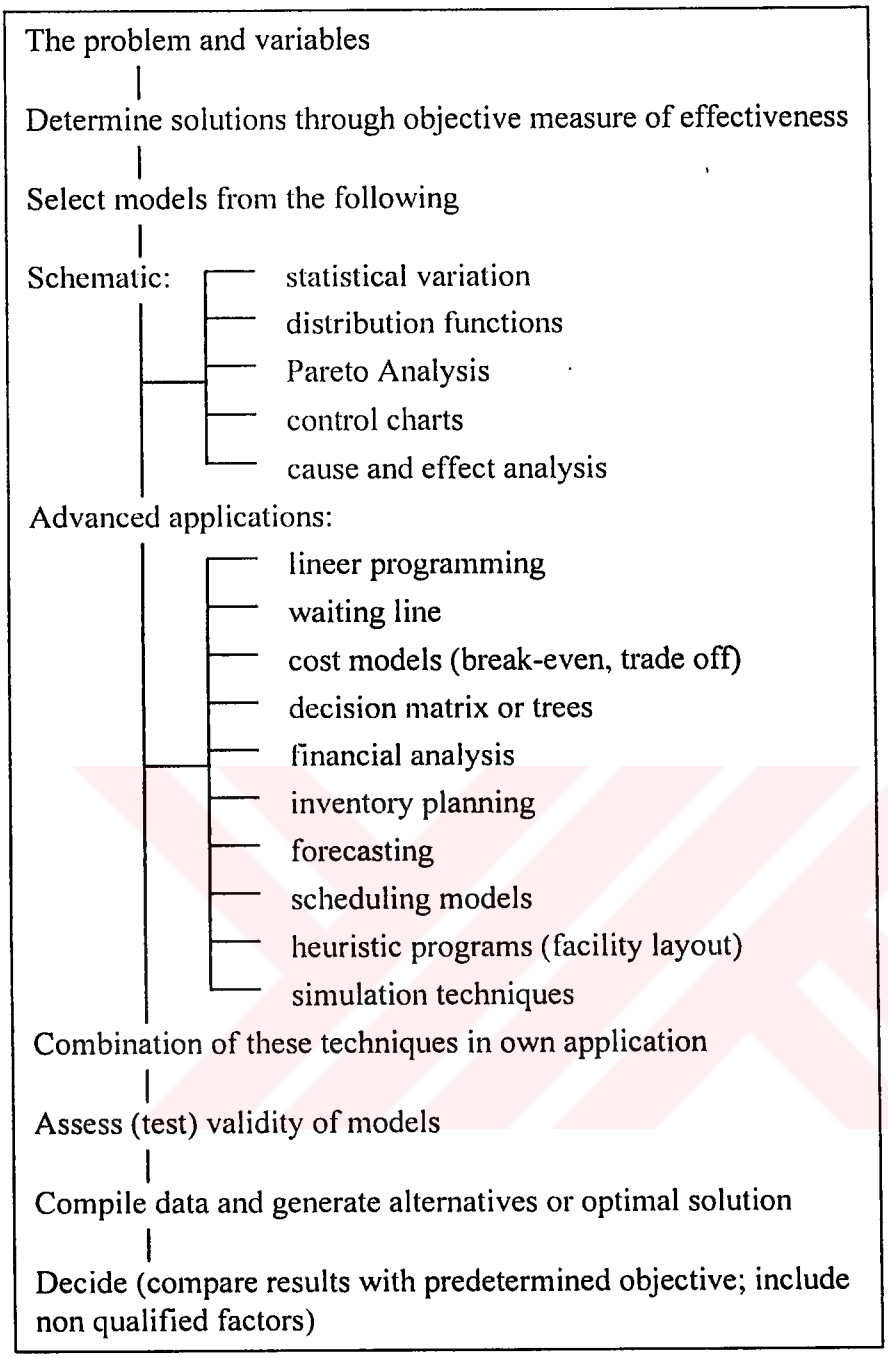


Figure 2.8 Summary of management tools and techniques available to handle quality problems.

3. INTERNATIONAL MANAGEMENT STANDARDS AND CONVENTIONS

3.1. OVERVIEW OF INTERNATIONAL ORGANISATION FOR STANDARDISATION

ISO is the International Organisation for Standardisation. It is made up of national standards institutes from countries large and small, industrialised and developing, in all regions of the world. ISO develops voluntary technical standards, which add value to all types of operations. They contribute to making the development, manufacturing and supply of products and services more efficient, safer and cleaner. ISO standards also serve to safeguard consumers and users in general. Experts on loan from industrial, technical and business sectors which have asked for the standards, and which subsequently put them to use carry out this work. Others may join these experts with relevant knowledge, such as representatives of government agencies and testing laboratories [11].

3.2. QUALITY MANAGEMENT AND QUALITY ASSURANCE

ISO/TC 176 is the ISO technical committee responsible for developing and maintaining the ISO 9000 family of standards [12]. Its scope is standardisation in the field of generic quality management, including quality systems, quality assurance and generic supporting technologies, such as standards which provide guidance on the selection and use of these standards.

The ISO 9000 family is a set of international quality standards and guidelines, which has earned a global reputation as the basis for establishing quality management systems. It presents an overview of these standards and demonstrates how, collectively, they can form a basis for continuous improvement and operational or business excellence. The frequent use of the three specific standards ISO 9001, ISO 9002 and ISO 9003 as a basis for quality system certification schemes has in the past

focused attention on the external quality assurance aspects of the ISO 9000 family of standards [12]. From a management viewpoint, enterprises in all sectors stand to gain the greatest value from ISO 9000 when they use the entire set of standards in an integrated manner. Using the standards in this way will also enable to relate them to other management systems (eg. environmental), other quality management strategies (such as Quality Awards and Total Quality Management) and sector specific requirements (such as QS-9000 in the automotive industry).

3.3. ISO 9000 FAMILY

The ISO 9000 standards, guidelines and the purpose of these standards and guidelines are demonstrated in Appendix A. There are many different ways to apply and combine the standards of the ISO 9000 family. The nature of the process, operation or business and in accordance with the specific demands, one can determine the relevant standards for his or her own organisation.

3.4. THE MEANING OF BEING "REGISTERED"

Organisations may be registered to ISO 9000 by applying to a registrar and passing a registration audit. A registrar is an organisation that will audit organisation's quality system to see if it is meeting all the necessary requirements [12,13]. If so, organisation will be registered to ISO 9000. This process is also referred to as third party registration because the registrar is an independent, outside party accountable to neither the customer nor the supplier.

A major reason that most organisations want to become registered is that their customers are demanding it, in some cases setting deadlines for their suppliers to become registered to ISO 9000. Registration to ISO 9000 reassures organisation's customers that the organisation have a quality system with the capability to provide quality products and/or services on time. Some of the other benefits an organisation might expect to see include [13]:

- Competitive advantages in marketing through an improved quality image

- Improved consistency in internal operations (less scrap/ rework)
- Improved quality in supplied products and services
- A reduction in the number of customer audits
- Increased focus on continuous improvement
- Better communication organisation wide
- Reduced costs and facility performance improvements
- Better documentation

And all of the above changes can lead to higher levels of financial advantage for the organisation and its employees.

3.5. THE DOCUMENTATION SYSTEM

One of the major changes in the organisation is going through to expand and improve its documentation system. ISO 9000 requires that organisations have a quality manual, quality procedures (and work instructions), and quality records. Each type of document serves a different purpose. The quality manual describes organisation's structure, it's approach to meeting customer's needs, its documentation structure, and the policy and responsibilities of management for meeting the requirements of ISO 9000. There's usually one section in the manual for each element of ISO 9000. Top management usually writes it with input from all levels of the organisation.

Quality procedures describe the steps each person or department must follow to meet the policies described in the quality manual. Procedures specify who does, what, when (and possibly where) it is done and which documentation is used or produced as a result of the activity. Quality procedures are usually written with the help of the process owners (those who are most involved in performing the task). Work instructions (often referred to as job instructions) differ from procedures in that they cover the very specific how-to instructions for certain tasks specified in the much broader procedures. Work instructions contain detailed instructions in the form of

written statements, diagrams, checklists, etc., and are also usually written with quite a bit of help from the process owners. Prints, customer job specifications, and control plans are a few examples of work instructions. Records provide evidence that the required process, product or service quality was achieved, or that the organisation's quality system was implemented correctly.

It can be visualised the structure of quality system documentation as a pyramid with four levels. The documentation structure is given in figure 3.1. The pyramid gives an idea of how much documentation there is at each level.



Level 1

Addresses Quality Policy, Organisational Structure, Management Responsibilities

Level 2

Give Activity Steps and Assigned Responsibilities Addressing WHO does WHAT, WHEN and WHAT documentation

Level 3

Details Methods and Guidelines Addressing How to Perform The Task

Level 4

Contain Evidence and Control Mechanism to Show Compliance and Results

Figure 3.1 Documentation Structure

Thinking of the documentation structure as a pyramid will also help to understand how the different levels relate to each other. The level 2 quality procedures are referenced in the level 1 quality manual, and detail the steps required to carry out the quality policies given in the quality manual. Likewise, the level 3 work instructions link to the procedures, and give even more detailed descriptions on how to carry out specific steps in the procedures. Quality records, at the bottom of the pyramid, might be referenced in any of the documents from the levels above, and provide detailed accounts of the results of activities.

The figure 3.2 is an example of the relationships between the different levels of documentation for nonconforming product or service activities.

Standard	ISO 9000 element 4.13
	↑
Level 1	quality manual section 13
	↓
Level 2	nonconforming product or service review and disposition procedure QP 13.01
	↓
Level 3	work instruction on using the nonconforming report (NCR) QWI 13.01
Level 4	NCR (record) (QF 13.01)

Figure 3.2 Example signifying different levels of documentation

In this case, the documents are numbered in a way that makes it easy to trace the flow of information from the manual to the procedures to the work instructions and so on. Section 13 of the quality manual (level 1) cover the organisation's general policy for handling nonconforming product or service (element 4.13 of ISO 9000). The manual references QP 13.01, the quality procedure (level 2) with the steps that organisation personnel will follow whenever nonconforming product or service is found the procedure then references QWI 13.01, the work instruction (level 3) that details how to fill out and process a nonconformity report (NCR). Finally, the NCR (once it's been filled out) becomes a record (level 4).

There are many ways in which improved documentation can help an organisation to function better. A good documentation system should [13]:

- Removing uncertainty and making job easier to do. It should not restrict new and better ways to perform.
- Ensuring that key tasks can be carried out even when the personnel who normally do them are absent.
- Increasing quality awareness.
- Reducing the costs of poor quality
- Improving communication within and between departments.
- Aid in the training of personnel
- Providing correct, complete and consistent ways to perform work and maintaining high levels of quality.
- Provide assurance of adequate control in meeting customer's need

Some of the roles that almost every employee can expect to take on as part of ISO 9000 implementation are to [14]:

- Be familiar with the documentation that affects them.
- Consistently adhere to the quality system documentation once it is approved and implemented.
- Maintain complete and accurate records when necessary.
- Educate and guide others to use the ISO 9000 quality system correctly.
- Identify ways to improve the quality system.
- Participate in audits-as an auditee, an observer, or even an internal auditor.

Ultimately, the changes to organisation's quality system should make user job easier especially if user is helpful in finding and fixing the weak points during internal quality audits. The ISO 9000 documentation will not limit user in finding better ways to do job, or reduce the unnecessary value as an employee.

3.6. THE REQUIREMENTS OF ISO 9000

Each element starts with a "4" (for example, 4.1, 4.2, etc.) because the requirement clauses are the fourth section in the ISO 9001 standard (the first few sections cover references, definitions, etc.). The elements of ISO 9001 is given in table 3.1.

Table 3.1 The elements of ISO 9001

Element 4.1	Management Responsibility
Element 4.2	Quality System
Element 4.3	Contract Review
Element 4.4	Design Control
Element 4.5	Document and Data Control
Element 4.6	Purchasing
Element 4.7	Control of Customer-Supplied Product
Element 4.8	Product Identification and Traceability
Element 4.9	Process Control
Element 4.10	Inspection and Testing
Element 4.11	Control of Inspection, Measuring, and Test Equipment
Element 4.12	Inspection and test status
Element 4.13	Control of Nonconforming Product
Element 4.14	Corrective and Preventive action
Element 4.15	Handling, Storage, Packaging, Preservation, and Delivery
Element 4.16	Control of Quality Records
Element 4.17	Internal Quality Audits
Element 4.18	Training
Element 4.19	Servicing

Element 4.20	Statistical Techniques

Element 4.1 Management Responsibility:

Essence of the element: The responsibility for maintaining an effective quality system falls on management's shoulders. This includes dedicating sufficient resources to all quality activities. This first element is one of the heftiest in the whole set of requirements, and is considered by many to be the most critical requirement of ISO 9000. It focuses on management's roles and responsibilities for defining, implementing, and maintaining the quality system. The tasks involved include: documenting organisation's objectives for quality and commitment to quality (in the quality manual), and making sure everyone in the organisation understands this quality policy and applies it in their jobs. Defining the structure of organisation (how everyone's jobs interrelate), as well as who has authority and responsibility for all activities affecting quality in the organisation (often covered in job descriptions or procedures). Ensuring that there are adequate resources and trained personnel for all activities that affect or verify quality (inspection, testing, etc.)

Assigning a management representative whom has the responsibility and authority to implement the requirements of ISO 9000, and report back to management on the performance of the quality system. Establishing systems to ensure management of product/ service development activities, with input from all relevant parties (including the customer and vendors). Performing management reviews regularly to see how well the system is working and find ways to improve it. Developing and implementing a business plan that is based upon the analyses of quality and other performance data gathered from within the organisation, customer satisfaction data, and through benchmarking with other organisations both inside and outside industry [14-16].

Element 4.2 Quality System

Essence of the element: Organisation must document and maintain its quality system and the system has to be good enough to consistently ensure a quality product or service. In addition, process part approvals must be obtained as defined in the process reference manual. Techniques for continuous improvement must also be

applied throughout the organisation to provide better quality, service, and prices for customers, and the entire process system should be optimised through effective planning and review.

This element states that organisation has to implement and maintain a documented quality system (as described in figure 3.1) that ensures a quality product or service. It also requires that quality procedures be detailed enough for the type of work they describe and the skill levels of people who use them. Furthermore, a set of requirements is given for the product or service quality planning teams' responsibilities, including:

- Developing and finalising special characteristics. (special characteristics are those that need extra attention during the process because they're especially critical to safety, function, or quality)

- Performing feasibility reviews and defect prevention activities (as defined in the advanced product or service quality planning and control plan and potential failure mode and effects analysis) [17]. Ensuring due care and safety is addressed during design (element 4.4) and process design (element 4.9). Designing features into products or services and processes that prevent nonconforming product or services from occurring (a process known as mistake-proofing).

- Developing control plans. Control plans are a form of work or job instructions. They provide descriptions of the systems for controlling parts and processes, such as the tests, process settings and controls, acceptance criteria, measurement systems etc., Used in producing a product or service at a given quality level.

- Ensuring customers' special characteristic symbols are shown in control plans and other appropriate documents to highlight process steps that affect those special characteristics.

Organisation is also expected to be actively involved in applying continuous improvement techniques in all areas of the process. To prove that, organisation must be able to show that it:

- Identifies key processes characteristics.

- Develops and implements improvement plans for these processes characteristics.
- Tracks progress toward the improvement goals.

Finally this element states requirements for planning and evaluating the activities environment (including the processes, facilities, equipment, and tooling used), such as:

- Using cross-functional teams for planning.
- Ensuring that review of the system includes: the layout and work flow, automation, human factors issues, operator and line balancing, inventory management, and overall workplace and staffing design.
- Using adequate resources and qualified personnel for decision making and management (including maintenance, storage, and set-up).
- Monitoring any subcontracted tooling design, fabrication, and management to ensure that the vendor is also meeting the requirements of ISO 9000 for these activities.

Element 4.3 Contract Review

Essence of the element: When an order is taken or a quotation is given both organisation and the customer must know exactly what they are agreeing to. This element requires organisation to have written procedures for reviewing contracts (or orders for products or services) from customers and quotations to customers. These procedures must ensure that:

- The requirements for all orders are documented and records are kept.
- The information in the order or quote is clear and specific.
- If a quote was issued to a customer, the actual order received agrees with the quote.
- For all orders accepted, organisation has the capacity and capability to produce the right product or service at the required level of quality, and on time.

- If customer needs to change the contract or order, this information gets communicated to all the right people in organisation.

Element 4.4 Design Control

Essence of the element: Organisation must have a well planned, consistent design process, and the records to prove it. Organisation (if it performs design activities) must have written procedures for controlling the process of designing and verifying new or changed products. This includes:

- Ensuring information from previous design projects is applied to similar current and future projects.
- Having documented and up-to-date plans that cover design activities and assigned personnel.
- Having qualified design personnel and adequate resources, including computer-aided design and a prototype program, where required by the customer.
- Applying techniques for simplifying and optimising designs.
- Making sure all appropriate groups in organisation (as well as the customer in many cases) are involved in the design process.
- Documenting and reviewing design input specifications and requirements.
- Documenting design outputs and making sure they meet the input requirements.
- Identifying key product characteristics that are critical to the functioning and safety of the product.
- Planing and conducting design reviews and final product testing
- Reviewing and communicating design changes, and receiving written customer approval prior to implementing the changes.
- Ensuring the confidentiality of design and product information.

Element 4.5 Document and Data Control

Essence of the element: Organisation must keep track of all quality documents and data, and make sure the right people review and have access to their latest versions. Organisation must have written procedures to control all the documents and data in the organisation that affect quality. The procedures need to cover:

- Reviewing and approving all documents and data prior to use, and in a timely manner.
- Keeping master document lists that show that has copies of a document and what the most current version of the document is.
- Removing obsolete documents to avoid accidental use.
- Keeping documents and data accessible to the people who need them.
- Making sure document changes are reviewed and approved in a timely manner, and that the right people are involved.
- Ensuring new production or service part approvals and related documents are updated when design, production or service conditions changed.

Element 4.6 Purchasing

Essence of the element: Organisation must have a system for selecting vendors (subcontractors), organisation can not simply buy based on cost. It must also be sure that purchase orders are complete and accurate before they are sent to vendors. This element is similar to element 4.3, contract review only instead of covering orders and contracts for what goes out to customers, it covers purchase orders and contracts for what comes in from vendors.

Organisation must have written procedures for making sure that products and services purchased from vendors meet all requirements (correct product, quantity, quality, etc.) This element is not about inspection of purchased items. Instead it focuses on:

- How to select vendors (is it on the basis of their ability to meet all quality requirements? Are they on customers' approved subcontractor lists, when appropriate?)

- How to tell the vendors what is needed (are all requirements clearly stated in purchasing documents?)

- How the performance of vendors is monitored (has an assessment process been defined? Is vendor performance regularly reviewed?)

- How to help the key vendors develop a quality system based on the requirements of ISO 9000?

Purchasing procedures must describe how the organisation evaluates vendors and review or approve purchasing documents.

Element 4.7 Control of Customer-Supplied Product

Essence of the element: If customer gives the product, returnable packaging, or tooling to work with, organisation have to take good care of it. This short elements requires documented procedures to ensure that any material customer supplies to organisation (that will somehow be used in making, testing or shipping their product) will be verified as meeting requirements and stored and maintained properly.

Element 4.8 Product Identification and Traceability

Essence of the element: All products have to be identified from the time it enters organisation to the time it's no longer the organisation's responsibility. Organisation must have documented procedures to ensure that product is identified throughout the entire time it's in the organisation's responsibility. There is also a requirement for traceability or the ability to go back and identify the particular processing. It is only necessary to meet this requirement if customer requires it or if it is necessary for safety reasons, or if government or industry regulations apply.

Element 4.9 Process Control

Essence of the element: Organisation must be able to show that all processes in the organisation, which affect quality, are under control. Organisation must be able to show that all processes (production, installation and servicing) are under an appropriate level of control. It includes:

- Appropriate documenting of process (procedures, work instructions, records, etc.) including meeting customers' special characteristics requirements.
- Comprehensive equipment maintenance program including preventive maintenance.
- Monitoring of critical process parameters that impact product or service quality and performance.
- Suitable equipment and working environment, including a clean and orderly premises.
- Having contingency plans for power outages, equipment failure, etc., to protect a continuing supply of product to the customer
- Evaluating and approving processes and equipment as capable prior to use.
- Providing clear criteria to operators for verifying the quality of work.
- Using qualified personnel
- Verifying job set-ups as capable of producing parts at the required quality levels
- Providing appropriate conditions for the production and inspection of appearance items.
- Obtaining customer approval for changes to processes when required.
- Meeting any customer requirements for process performance levels.

Element 4.10 Inspection and Testing

Essence of the element: Organisation must have a well defined system for verifying product or service as conforming throughout all stages of processing. This element requires documented procedures and control plans for ensuring that all products or services conform to requirements. It is separated into requirements for receiving, in-process, and final inspection and testing, but they all basically require that the organisation define:

- The points in the process where inspection is required.
- How (methods and equipment needed) to carry out inspections/testing?
- Who is responsible for inspecting and releasing process to the next stage?
- Clear criteria for accepting process (which meet any stated customer requirements).
- These activities should emphasise preventing defects rather that simply detecting them.
- Customers may also have requirements that must be followed for the frequency of performing layout inspections and functional testing.
- In addition audits must be performed periodically to ensure that all process requirements are met.

This element also requires organisation to keep records detailing the results of all inspections, including documenting the name of the person responsible for process or product release.

If organisation has an in-house laboratory for testing or calibration, several more requirements apply, including:

- Defining and documenting the tests, evaluations, and calibrations, the laboratory is able to perform.

- Documenting the policies, methods, procedures, instructions, and standards the laboratory uses.
- Using qualified personnel.
- Controlling and recording environmental conditions in the lab, where required.
- Using appropriate testing and calibration methods.
- Evaluating and approving processes and equipment as capable prior to use.
- Using appropriate statistical techniques.

Finally organisation may be required by some customers to use accredited laboratory facilities for inspection and testing.

Element 4.11 Control of Inspection, Measuring, and Test Equipment

Essence of the element: A very detailed system for keeping inspection equipment accurate and in good operating condition must be maintained. This element covers all inspection equipment that is used to verify the quality of products, including equipment that may be owned by employees. All such equipment must be kept identified, calibrated, and in good condition-and all these activities must be performed according to documented procedures and work instructions. Organisation must also keep records that detail all calibration activities and rules. In addition, this element requires that organisation use instruments with appropriate accuracy and precision for the type of measurements they will be taking.

Element 4.12 Inspection and Test Status

Essence of the element: For any given product at any point in processing, it must be clear what inspections or tests it has been through and what the results were. The inspection and test status (whether a product is conforming or nonconforming) must be clearly identified on all products at the organisation. This includes making it clear whether the product has been through all required inspections and tests up to that point in processing.

Element 4.13 Control of Nonconforming Product

Essence of the element: A documented and effective system must be used for dealing with any product (material) that does not conform to requirements. Organisation must have documented procedures that prevent nonconforming product from being used. Procedures for control of nonconforming product must cover:

Identifying and segregating (where possible) all nonconforming product to prevent it from being used or shipped unintentionally.

A well defined process for evaluating and determining the nonconforming product (for example, rework it, scrap it, etc.) can be listed as:

- Documenting of actual product conditions and all actions taken
- Getting the customer's permission to make repairs, where necessary.
- Notifying other personnel or departments as necessary if the nonconforming product might affect delivery times, production schedules, and so forth.

Element 4.14 Corrective and Preventive Action

Essence of the element: A Corrective and Preventive Action system must be used to analyse, prevent, and correct problems, and continuously improve the quality system. This element requires organisation to have a documented system (procedures, records, etc.) for corrective and preventive action. These actions are intended to eliminate the causes of nonconformities by making corrections to the quality system. In particular, corrective action deals with actual problems and preventive action deals with potential problems.

The difference between elements 4.13 and 4.14 control of nonconforming product is about putting defective product right, corrective and preventive action are about putting the quality system right. Element 4.13 and 4.14 are, however typically closely linked in the quality system. The data generated from the nonconforming product system (along with other quality-related data) is use as a driver or the corrective or preventive action system. A database system can be used to organise the data and provide statistical analyses that will highlight the most common defects

(or defect causes, locations, etc.) of nonconforming product. Efforts for improvement (using the corrective and preventive action system) can thus be focused on the biggest or most costly problems.

In general, Corrective and Preventive Actions may be triggered by:

- Findings from internal or third party quality audits
- Management review results
- The analysis of nonconforming product data, including scrap or rework reports
- Information on return product
- Reviews of service report or customer complaints
- Other sources of information on nonconformities.

Element 4.14 is a key requirement in ISO 9000 because it is a major driver for continuous improvement [17].

Element 4.15 Handling, Storage, Packaging, Preservation and Delivery

Essence of the element: From the time material comes until it is no longer organisation's responsibility, organisation must protect it from any kind of damage. Organisation must have documented procedures that prevent damage or deterioration of product throughout all handling, storage, packaging, and delivery activities which basically means that as long as product is organisation's responsibility, organisation must protect it.

This element also requires the followings:

- Efficiently manage inventory
- Ensure packaging and labelling meet customer requirements
- Develop a delivery system that supports on time deliveries and advance shipment notification to customers.

- Develop an order-driven production schedule (not based on a sales forecast)

Element 4.16 Control of Quality Records

Essence of the element: All records related to organisation's quality system must be handled and maintained according to documented procedures. Organisation may have noticed that most of the other elements in ISO 9000 mention the need for records to be maintained. Records are kept as proof that activities occurred and as evidence that can be analysed later. This element requires that organisation have documented procedures that detail:

- How records are identified?
- How records are stored so that they are easy to find and not lost or damaged?
- Who's responsible for maintaining records?
- How long the different types of records are maintained?

Element 4.17 Internal Quality Audits

Essence of the element: Organisation must perform regular and through checkups to identify any problems in adhering to the quality system, and to check if the system is really effective in providing quality products and services. Documented procedures that describe how internal quality are planned and conducted at organisation are required by this element. This element basically requires that:

- Audits are conducted frequently enough to keep all activities in control
- The personnel who conduct audits are not directly responsible for the activities, they audit
- Audit results are recorded and communicated to relevant personnel
- Corrective and Preventive Actions are triggered by all nonconformities or potential problems found during the audit.

Element 4.17 is a key requirement in ISO 9000 since it is the basis for finding ways to improve quality system. The detailed audit process is given under Section 3.7

Element 4.18 Training

Essence of the element: All personnel at the organisation must get the training they need, and organisation must have the records to prove it. This brief element requires documented procedures that define how training needs are identified and met for personnel at the organisation. The effectiveness of this training must be assessed. It also requires training records to be kept for all personnel.

Element 4.19 Servicing

Essence of the element: If organisation perform servicing under a customer order, it must be controlled with documented procedures. The shortest element in ISO 9001, element 4.19 says that if organisation provide servicing of product, organisation must have documented procedures that describe how service is performed, verified, ad recorded, and how results are communicated to applicable functions throughout the organisation.

Element 4.20 Statistical Techniques

Essence of the element: If organisation needs statistical techniques to get a quality product, then organisation must have documented procedures for these activities. The final element of ISO 9001 requires that organisations identify the key areas where statistical methods are needed to ensure the quality of the product, and then document procedures for these areas. The statistical techniques to be used for a given product must be identified and documented in the control plan.

3.7. THE QUALITY AUDIT PROCESS

Registration to ISO 9000 requires that organisation go through two types of audits periodically: These are third party quality audits (audits by registrar) and internal quality audits (self-audits by organisation). The general purpose of both types of audits is to determine whether organisation has developed and implemented a quality

system that meets the requirements of ISO 9000 and system is effective in providing a quality product or service.

There are some key differences between the two types of audits however the third party audit has a pass or fail result, the registrar's auditors are there to determine whether organisation should become (or stay) registered to ISO 9000. These auditors will tell what's wrong with the system, but they are not there as consultants. They will not really tell how to fix the problems. The internal audit looks for ways to make the quality system work better for everyone and tries to catch problems before customer or registrar does. In the internal audit situation, employees should feel free to ask the auditors for help and to point out areas that may have problems. It is important to understand the internal quality audits are trying to find problems with the quality system, not with the people who are carrying it out. They are not intended to place blame on anyone. If someone is not carrying out a procedure correctly, it should be viewed as a system problem (such as lack of proper training, incomplete documentation, incorrect documentation, etc.).

On each audit, auditors will only be looking at a sample of the quality system. They obviously will not have time to look at everything in the organisation that affects quality, so the auditors will try to pick out what they feel are the more important activities. They will also check up on areas that have had problems in the past to see how they are improving.

In general, auditors are looking for:

- Evidence that the system (as documented) meets the requirements stated in ISO 9000.
- Evidence that the system (as implemented) works according to planned arrangements (such as the instructions stated in quality system documentation or in agreements with customers).
- Evidence that employees understand the documentation that affects them.
- Evidence that the system is effective in providing quality products and services.

In order to find such evidence, auditors will be looking at a lot of documents at speaking to people about how they use the documentation and carry out their work. The type of evidence an auditor finds might be in the form of: out of date documentation, records missing signatures or incorrectly filled out, inspection equipment without calibration stickers nonconforming material or service that has not been identified, operator's actions that do not meet the requirements stated in the work instructions, something the auditor is told by a Management Representative as being organisation practice that does not meet defined requirements, something the auditor is told by an employee as being his or her understanding of organisation practice that does not meet requirements.

Auditors tend to ask open-ended questions (that can not be answered with a simple yes or no) because it gives them a better feeling for the depth of understanding. The people in the organisation may hear questions such as:

- How do you know how to perform this activity?
- How do you know that what you are doing meets quality requirements?
- Who is responsible for...?
- What do you do if...?
- What quality documentation covers this activity?
- Could you please show me....?

Organisation's main responsibility in preparing for quality audits is to know and follow own job requirements well. This means being familiar with the documentation in own area and how to use it. This does not mean memorising the information in documentation. The other thing is to navigate through the documentation system. Organisation should be able to find the procedures or work instructions that would be needed for different situations that might occur in process.

There are basically three things that can happen in a registration audit:

1- Organisation may pass the audit (organisation will be recommended for registration) in which case the organisation will receive its official registration within a couple of months.

2- Organisation may be told that a follow up visit must be scheduled and that if corrective action on all non-conformities found during the audit is successfully completed by that visit, registration will be issued.

3- Registrar may find that organisation has quite a bit of work to do before it will be ready for registration, and another registration audit will have to be scheduled.

In all cases, the registration auditor will report all findings to the management before she or he leaves, so that organisation knows where it stands.

Each type of audit will have its own schedule. Often organisations will have more frequent internal quality audits than third-party audits, especially during the early stages of ISO 9001, ISO 9002 or ISO 9003 implementation. These early audits help employees become more comfortable with the audit process, eliminate problems in the quality system, and thus help ensure the organisation will pass the registration audit. ISO 9000 requires that internal audits are scheduled based on the status and importance of the quality system element, but most organisations audit each of their quality activities at least once per year [18]. The duration of internal audit takes from one-half to three days, depending on the size of organisation and how organisation decides to conduct audits. Third-party audits (by the registrar) are typically conducted every six to 12 months once organisation has passed the registration audit. Many organisations have their registrar first come in to do a pre-registration audit , a check up to see if the organisation will be ready for the actual registration audit in a few months. This practice also allows the organisation to get to know the auditors and how they conduct business prior to the more formal registration audit. The duration of third party audits is between one and five days, depending on the size of organisation and the status of quality system.

The audits performed by the registrar after registration are known as surveillance audits [19]. While the registration audit usually lasts several days and covers all the elements of ISO 9000, the surveillance audits are shorter, covering only certain key

elements of quality system per audit. Typically, every three years, the registrar will perform a full audit of the system in order to determine whether the registration should be renewed. Continues auditing to be an important way of life for the organisation, essentially closing the loop of the quality system and providing a means of ongoing improvement. The preparedness for the internal audit in Maritime Training and Education is given in detail, in Appendix B.

3.8. ENVIRONMENTAL MANAGEMENT

ISO/TC 207 is the ISO technical committee responsible for developing and maintaining the ISO 14000 family of standards [20]. Published documents and ongoing work address the following areas: Environmental management systems, Environmental auditing and other related environmental investigations, environmental performance evaluation, environmental labelling, Life Cycle Assessment and environmental aspects in product standards. The ISO 14000 family of International Standards on environmental management is a relative newcomer to ISO's portfolio. The ISO 14000 family of standards is demonstrated in Appendix A. ISO has a two pronged approach to meeting the needs of business, industry, governments, non-governmental organisations and consumers in the field of the environment [21]. On the one hand, it offers a wide-ranging portfolio of standardised sampling, testing and analytical methods to deal with specific environmental challenges. It has developed more than 350 International Standards for the monitoring of such aspects as the quality of air, water and soil etc. These standards are a means of providing business and government with scientifically valid data on the environmental effects of economic activity. They also serve in a number of countries as the technical basis for environmental regulations. On the other hand, ISO is leading a strategic approach by developing environmental management system standards that can be implemented in any type of organisation in either public or private sectors (companies, administrations, and public utilities). To spearhead this strategic approach, ISO established a new technical committee, ISO/TC 207, Environmental management, in 1993 [20,21]. This followed ISO's pioneering experience in management system standardisation with the ISO 9000 series for quality management.

ISO's direct involvement in environmental management stemmed from an intensive consultation process, carried out within the framework of a Strategic Advisory Group on Environment (SAGE), set up in 1991, in which 20 countries, 11 international organisations and more than 100 environmental experts participated in defining the basic requirements of a new approach to environment related standards [22]. Today, delegations of business and government experts from 55 countries participate actively within TC 207, and another 16 countries have observer status. The national standards institute concerned chooses these delegations and they are required to bring to TC 207 a national consensus on issues being addressed by the committee. This national consensus is derived from a process of consultation with interested parties.

3.9. ISO 14000 STANDARDS

ISO 14000 is a term that people use when referring to what is actually a series of international standards developed to manage the environmental impact of organisations. These standards can be applied to almost any organisation from product manufacturers to service providers; they are not specific to any product or industry. The ISO 14000 series of standards contains requirements and guidelines for establishing and maintaining an organisation's environmental management system. An organisation's Environmental Management System is the structure of policies, procedures, documentation, etc and it has in place to control the impact of its products, services, and processes on the environment. The only standard that contains requirements and thus the only standard those organisations can actually be registered to, be ISO 14001. ISO 14001 requires a documented system for controlling the environmental effects of the processes that the organisation use to develop and produce products. The basic premise behind ISO 14001 is that there are certain elements every management system must have in place in order to ensure that organisation's negative effects on the environment are minimised.

The requirements of ISO 14001 are described in five main clauses, each of which covers the requirements for a different segment of organisation's environmental management system. These are environmental policy, planning of the Environmental Management System, implementation and operation of the Environmental

Management System, checking and corrective action within the Environmental Management System and management review of the Environmental Management System.

Registration to ISO 14001 reassures customers that organisation have an Environmental Management System with the capability to provide products or services while minimising any negative effects on the environment. Some of the other benefits an organisation might expect to see include [23]:

- Competitive advantages in marketing an improved environmental kind image.
- Improved performance with regard to environmental legislation and regulations.
- Savings due to reduction of waste.
- Improved community support and employee loyalty due to the Environmental Policy.
- A greater focus on continuous improvement.
- Better communication organisation wide.
- Reduced operational costs and facility performance improvements.
- Better documentation.

And, all of the above changes can lead to higher levels of financial security for the organisation and its employees.

3.10. INTEGRATION OF ISO 14000 STANDARD WITH IN THE REQUIREMENTS OF ISO 9000

ISO 9000 is a series of standards that contain requirements for establishing and maintaining an organisation's quality system. If organisation has shown that it has a Quality Assurance System that ensures, it can meet customer's requirements for quality. Organisation now needs to prove that its systems can also meet requirements for the environment. Implementing ISO 14001 does not mean that organisation will

now have twice as much documentation, two manuals, two sets of procedures, etc. and two separate managements system (for quality and the environment). When applied together, the standards become a model for an Integrated Management System that addresses requirements for both quality and the environment. If organisation is familiar with ISO 9000, it will be found that there are many similarities in the requirements of the standards. Certain elements of management system (such as internal audits, corrective and preventive action, document control, training, management review and records) may remain essentially the same, while other areas (such as management responsibility and process control) may need to be expanded considerably to incorporate environmental requirements. In any case, the standards do not contradict each other in any way, and with some work, can be applied by organisation to produce an effective management system with through and efficient documentation.

3.11. THE REQUIREMENTS OF 14001 STANDARD

Each clause starts with a "4" (for example, 4.1, 4.2, etc.) because the requirement clauses are the fourth section in the ISO 14001 standard (the first few sections cover references, definitions, etc.).

Clause 4.1 General Requirements

Essence of the clause: Organisation must have an Environmental Management System as further detailed in clauses 4.2 through 4.6

Clause 4.2 Environmental Policy

Essence of the clause: Management must make a public, documented commitment to protect the environment. This clause requires that organisation's management take responsibility for defining, implementing, and maintaining an environmental policy. An environmental policy will describe organisation's commitment to:

- Protecting the environmental and preventing pollution,
- Meeting the requirements of environmental regulations, and

- Continuously improving

Organisation's environmental policy will be different, depending on its potential impact on the environmental. Based on its stated policy, organisation will develop environmental objectives or fairly broad goals that support the environmental policy. More specific environmental performance targets are then set based on the environmental objectives, and progress towards both types of goals is tracked.

Clause 4.3 Planning

Essence of the clause: Organisation's Environmental Management System must have a fairly detailed, systematic, and well-documented planning aspect. The planning clause is broken up into subclauses to address different segments of planning:

4.3.1 Environmental Aspects: Organisation must have a procedure implemented for identifying those aspects of its products, services, and other activities that could have significant impacts on the environment (known as environmental aspects). This information is then an important input to the development of environmental objectives and targets.

4.3.2 Legal and Other Requirements: There must also be a procedure implemented to ensure that all environmental requirements (legal and otherwise) are identified, and that information on these requirements remains accessible to those who need it for planning and other activities.

4.3.3 Objectives and Targets: Documented environmental objectives and targets must be developed, reviewed, and tracked at all appropriate levels of the organisation. These goals must support the organisation's environmental policy.

4.3.4 Environmental Management Program(s): An organisational plan or environment management program for achieving the environmental objectives and targets must then be in place. This program details who is responsible for ensuring each goal is met, how they will achieve that goal, and how long it will take to complete different phases of the task. The program must be updated as appropriate for new or revised products, services, and organisational activities.

Clause 4.4 Implementation and Operation

Essence of the clause: The implementation of Environmental Management System must be documented and controlled. Also, all activities that may affect the environment must be maintained in a manner that supports the environmental policy, objectives, and targets. This clause states requirements or the structure and implementation of organisation's Environmental Management System as follows:

4.4.1 Structure and Responsibility: Management must define the structure of the organisation (how everyone's jobs interrelate) as well as who has authority and responsibility for all activities affecting the environment (often covered in the management system manual and procedures). Adequate resources and trained personnel must be provided for all activities that affect or verify environmental activities. Also, a management representative must be assigned and given the authority to implement the requirements of the standard, and report back to management on the performance of the Environmental Management System.

4.4.2 Training, Awareness, and Competence: Organisation must be able to show how training needs for personnel who can significantly impact the environment are identified and met. Procedures must be implemented to ensure all employees are aware of:

- Their roles in the Environmental Management System
- The effects of their actions on the environment
- The importance of following requirements
- The possible results when they fail to follow requirements

4.4.3 Communication: Procedures for communicating important information about the Environmental Management System and environmental aspects must be implemented. These procedures must cover both internal (within the organisation) and external communications.

4.4.4 Environmental Management System Documentation: The Environmental Management System must be supported by a documentation system that describes its core elements and their interrelations, and references related documentation.

4.4.5 Documentation Control: Organisation must have procedures for document control that keep Environmental Management System documents available, identifiable, and up-to-date. The procedures must cover review and approval processes, obsolete documents (and how they are prevented from use), and requirements for development and revision of documents.

4.4.6 Operational Control: Once the organisation has identified the different ways that it can affect the environment, it must identify and control the associated processes to minimise their impact on the environment. This includes documenting procedures, stating operating criteria, and maintaining these key operations in a manner that supports the environmental policy and goals. Where appropriate, the procedures need to be communicated to organisation's suppliers.

4.4.7 Emergency Preparedness and Response: Organisation must develop and implement procedures to prevent and respond to environmental emergency situations, and minimise the effects of such accidents on the environment. These procedures need to be tested with periodic drills when possible and must be kept current. When a procedure has been implemented to deal with an emergency, it is to be reviewed and revised to improve response.

Clause 4.5 Checking and Corrective Action

Essence of the clause: For an Environmental Management System to be truly effective, it must include elements that:

1. Find, analyse, and correct deficiencies in the system.

2. Track, review, and improve performance of the Environmental Management System.

In order to ensure that problems are found and corrected, and that the system continuously improves, Environmental Management System must have the following aspects.

4.5.1 Monitoring and Measurement: Organisation must have procedures to ensure that key measures of process performance are tracked and recorded-especially those characteristics that are related to environmental impacts. Procedures must also track compliance with any environmental requirements. Any monitoring or measurement equipment that's used in these activities needs to be kept calibrated and maintained (and records of calibration must be kept).

4.5.2 Nonconformance and Corrective and Preventive Action: A system for handling nonconformities must be implemented and maintained at the organisation. Procedures that describe how nonconformities are identified, investigated, and recorded are required. The actions that are then taken to correct the Environmental Management System (to eliminate the cause of the nonconformities), and to prevent future nonconformities, are also key parts of this system.

Corrective and preventive actions may be triggered by:

- Findings from internal or third party audits,
- Management review results,
- The analysis of nonconforming product data,
- Reviews of service reports or customer complaints,
- Other sources of information on nonconformance.

4.5.3 Records: Records are kept as proof that activities occurred and as evidence that can be analysed later. This clause requires organisation to have procedures that cover:

- How records are identified?
- How records are stored so that they are easily found and not lost or damaged?

- Traceability of records to the activity, product, or service involved?

- How long records are maintained?

4.5.4 Environmental Management System Audit: This clause basically requires that organisation have procedures that detail how internal Environmental Management System audits are planned and conducted in the organisation. Auditing system must be thorough and effective. How often or how intensely any activity is audited must depend on how great an impact it may have on the environment and how it has done during past audits.

Clause 4.6 Management Review

Essence of the clause: Management must perform periodic reviews of the Environmental Management System to ensure it remains effective and appropriate over time. To meet the requirements of this clause, organisation's management must be able to show that documented reviews of the environmental management system are performed to evaluate such items as:

- Are the Environmental Management System effective in meeting the requirements of ISO 14000 and other environmental regulations?

- How well is it helping to meet organisation objectives and satisfy organisation policy?

- Are the organisation's environmental policy and objectives still suitable?

Information about the performance of the Environmental Management System is collected prior to the review from many sources, such as;

- Internal audits and third-party audits,

- The corrective and preventive action system,

- Reviews or reports of nonconformance,

- Customer complaints and service reports, etc.

Management to determine if changes to the environmental management system are needed then assesses this information.

3.12. GENERIC MANAGEMENT SYSTEM STANDARDS

The vast majority of ISO standards are highly specific to a particular product, material, or process. However, both ISO 9000 and ISO 14000 are known as generic management system standards. Generic means that the same standards can be applied to any organisation, large or small, whatever its product – including whether its product is actually a service in any sector of activity, and whether it is a business enterprise, a public administration, or a government department.

The organisation can manage its way of doing things by systemising it in order to be really efficient and effective. This ensures that nothing important is left out and that everyone is clear about who is responsible for doing what, when, how, when, why and where. Management system standards provide the organisation with a model to follow in setting up and operating the management system. Organisations, or ones with complicated processes, could not function well without management systems although they may have been called by some other name. Companies in such fields as aerospace, automobiles, defence, or health products have been operating management systems for years. ISO's management system standards make these successful practices available for all organisations.

Both ISO 9000 and ISO 14000 are actually families of standards, which are referred to under these generic titles for convenience. Both families consist of standards and guidelines relating to management systems, and related supporting standards on terminology and specific tools, such as auditing (the process of checking that the management system conforms to the standard).

ISO 9000 is primarily concerned with quality management. Like beauty, everyone may have his or her idea of what quality is. The standardised definition of quality in ISO 9000 refers to all those features of a product or service, which are required by the customer. Quality management means what the organisation does to ensure that its products or service conform to the customer's requirements.

ISO 14000 is primarily concerned with environmental management. This means what the organisation does to minimise harmful effects on the environment caused by its activities.

Both ISO 9000 and ISO 14000 concern the way an organisation goes about its work, and not directly the result of this work. They both concern processes, and not products at least, not directly. Nevertheless, the way in which the organisation manages its processes is obviously going to affect its final product. In the case of ISO 9000, it is going to affect whether or not everything has been done to ensure that the product meets the customer's requirements. In the case of ISO 14000, it is going to affect whether or not everything has been done to ensure a product will have the least harmful impact on the environment, either during production or disposal, either by pollution or by depleting natural resources. Neither ISO 9000 nor ISO 14000 are product standards. The management system standards in these families state requirements for what the organisation must do to manage processes influencing quality (ISO 9000) or the processes influencing the impact of the organisation's activities on the environment (ISO 14000).

In both cases, the philosophy is that these requirements are generic. No matter what the organisation is or does, if it wants to establish a quality management system or an environmental management system, then such a system has a number of essential features which are mentioned in ISO 9000 or ISO 14000.

The assessment of a quality system against the requirements of one of the ISO 9000 standards and the subsequent issuing of a certificate to confirm that it is in conformance with the standard's requirements is variously referred as certification or registration. However, in the ISO 9000 context, certification and registration are used interchangeably in some countries. A practice which reflects different national, or business culture preferences. Likewise, the bodies which issue ISO 9000 certificates certification bodies are referred to in some countries as registration bodies, or registrars. Again, these different appellations refer to the same type of body.

The above remarks also apply to the certification of environmental management systems, which have been assessed as conforming to ISO 14000. Accreditation is another term which, in the ISO 9000 or ISO 14000 context, is also sometimes used

wrongly. Accreditation is the procedure by which an authoritative body gives formal recognition that a body or person is competent to carry out specific tasks. In the ISO 9000 or ISO 14000 context, it relates to the work of national accreditation bodies which have been set up in a number of countries to provide some measure of control over the activities of quality system or environmental management system certification bodies. An accreditation body will accredit or in simpler language, approve a certification body as competent to carry out ISO 9000 certification of quality management systems, or ISO 14000 certification of environmental management systems, in specified sectors.

A final point on terminology concerns ISO 9000 certification and ISO 14000 certification. In actual fact, ISO 9000 certification means certification against ISO 9001, ISO 9002 or ISO 9003. In the case of the ISO 14000 family, there is only one standard of which the intended use is as a model for environmental management system certification (ISO 14001). An organisation, which seeks certification of an environmental management system which it, operates, as conforming to the standard will therefore be issued with an ISO 14001 certificate.

3.13. STCW CONVENTION

3.13.1. BACKGROUND OF STCW CONVENTION

Since its inception in 1959 International Maritime Organisation (IMO) has endeavoured not only to improve the safety of ships and their equipment but also to raise the standards of the seafarers which man them [24]. Among the many resolutions adopted in 1960 at the International Conference on the Safety of Life at Sea was one which called upon Governments to take all practicable steps to ensure that the education and training of seafarers in the use of aids to navigation, ships' equipment and devices was sufficiently comprehensive and was kept satisfactorily up to date. It also recommended that IMO and the International Labour Organisation should cooperate with each other and with interested Governments in achieving these ends [24,25].

In response to this recommendation, the Governing Body of ILO and IMO's Maritime Safety Committee (MSC) established a Joint Committee on Training. This Committee had its first meeting in 1964 and prepared the Document for Guidance 1964 [25]. This Document gave guidance on the education and training of masters, officers and seamen in the use and operation of aids to navigation, life-saving appliances, devices for the prevention, detection and extinction of fires and ship's equipment contributing to safety at sea.

The Document was subsequently amended, expanded and supplemented by the Joint Committee in 1975, 1977 and 1985 [25]. Despite the success of this Document, the IMO Council in 1971 decided that still further measures were needed to strengthen and improve standards and it requested the MSC to give urgent consideration to international standards of watchkeeping, training and certification.

The IMO Assembly, which also met in 1971, decided to convene a conference to adopt a convention on the subject [26]. Preparatory work was carried out by the IMO Sub-Committee on Standards of Training and Watchkeeping, which prepared the text of a draft convention, an annex containing requirements for watchkeeping, training and certification and a number of draft recommendations.

3.13.2. 1978 STCW CONVENTION

The Convention was the first attempt to establish global minimum professional standards for seafarers. Previously the standards of training, certification and watchkeeping of officers and ratings were established by individual governments, usually without reference to practices in other countries. As a result standards and procedures varied widely, even though shipping is the most international of all industries. The Convention prescribes minimum standards which countries are obliged to meet or exceed. In the majority of established maritime countries, standards are often higher than those stipulated in the Convention. In some countries, however, standards are not so high and by ratifying or accepting the Convention Governments undertake to implement and enforce its requirements. The effect of the Convention's entry into force was therefore to raise standards in the world as a whole.

The Convention does not deal with manning levels: IMO provisions in this area are covered by regulation 13 of chapter V of the International Convention for the Safety of Life at Sea (SOLAS), 1974, whose requirements are backed up by resolution A.481 (XII) which was adopted by the IMO Assembly in 1981 [27]. The requirement for entry into force of the Convention was the same as for the International Convention for the Safety of Life at Sea: acceptance by 25 countries whose combined fleets of merchant shipping represent at least 50 percent of world tonnage. This target was reached on 27 April 1983 and the Convention entered into force one year later, on 28 April 1984. The Convention has been accepted by 114 States with fleets aggregating 94.99% of the world merchant shipping tonnage [27]. When the Convention entered into force, it was expected that its requirements would ensure the competence of masters, officers and ratings of all seagoing ships and their safe operation through efficient watchkeeping.

Despite its broad global acceptance, it was realised by the late eighties that the Convention was not achieving its purpose. Instead it was gradually losing credibility as its acceptance widened. The main cause for this appeared to be the general lack of precision in its standards, the interpretation of which was left to the satisfaction of the Administration [28]. This resulted in widely varying interpretation of standards and many Parties failed to effectively administer and enforce Convention requirements. STCW certificates could no longer be relied upon as evidence of competence. Other factors had reduced the effectiveness of the 1978 Convention such as the reliance placed on seafaring skills and competence being acquired through service on board ship or in machine shops. The Convention had prescribed minimum periods of seagoing or other appropriate service and specified knowledge requirements without defining the skills and competence required. Crew reductions, faster turn-rounds, more frequent crew changes and the mix of differing education and training backgrounds resulting from multinational manning, undermined the effectiveness of this on-board training. Management response to emerging safety, efficiency and career development needs and expectations had become hampered by the traditional departmental structure upon which the 1978 Convention had been exclusively based [24,28]. Within the industry, the need for greater flexibility in the

training and certification of seafarers became a significant force in the demand for change.

Having consultants prepare a revised text under the direction of the Sub-Committee on Standards of Training and Watchkeeping (STW) accelerated the comprehensive review. The original date for completing the revision at sub-committee level was 1996, meaning that the revision conference would probably not have been held until 1998. Under the accelerated program the conference was brought forward to June-July 1995 [28].

The main aims of the revision were:

1. To transfer all detailed technical requirements to an associated Code;

2. To clarify the skills and competence required;

3. To require Administrations to maintain direct control over and endorse the qualifications of those masters, officers and radio personnel they authorise to serve on their ships;

4. To make Parties to the Convention accountable to each other, through IMO, for their proper implementation of the Convention and the quality of their training and certification activities and

5. To have the amendments enter into force for all Parties to the Convention with the least possible delay.

Although the 1995 amendments represent a complete rewrite of the technical aspects of the STCW Convention, the original 1978 text will continue to apply to many of the world's ships and seafarers until the year 2002. The Annex contains the technical provisions of the Convention. It is divided into six chapters, which deal with the following subjects: I. General provisions; II. Master-deck department; III. Engine department; IV. Radio department; V. Special requirements for tankers; VI. Proficiency in survival craft.

Chapter I-General provisions: This starts with a list of definitions of terms used in the annex. Regulation I/2 deals with the content of the certificate and the

endorsement form, which is required to be placed on the certificate by, article VI [29]. All certificates must include a translation into English, if that is not the official language of the issuing country. In some parts of the annex, relaxation in the requirements are provided for seafarers on ships engaged on near coastal voyages; that is to say voyages in the vicinity of a Party as defined by that Party. Principles governing near-coastal voyages are set out in regulation I/3. Regulation I/4 deals with control procedures and elaborates on article X [29]. Control is limited to checking the certificates of personnel and assessing the ability of seafarers to maintain convention standards in certain eventualities, such as the ship's involvement in a collision or grounding, the discharge of an illegal substance or unsafe manoeuvring. Failure of seafarers to hold a certificate required by the Convention, to have an appropriate valid certificate or valid dispensation, if not corrected, result in the Party carrying out the control having to take steps to ensure that the ship will not sail unless and until these requirements are met to the extent that the danger has been removed.

However, certificates must be accepted unless there are clear grounds for believing a certificate has been fraudulently obtained or that the holder is not the person to whom it was issued. The officer carrying out the control is also required to give written notification of the grounds on which it has been determined that any deficiencies found pose a danger to persons, property or the environment. This procedure permits the Flag State Administration to take appropriate corrective action through the Party carrying out the control or by sending their own surveyor or representative to the port concerned. If the deficiency, the existence of which has been clearly established by the control officer, is not corrected by the master, owner or Administration concerned, and such deficiency poses a danger to persons, property or the environment, the Party carrying out the control is required to take steps to ensure that the ship will not sail. However, paragraph (4) of article X requires all possible efforts to be made to avoid unduly detaining or delaying the ship [29]. This is a more onerous requirement than having to make all practical efforts or best efforts. A Party exercising control thus has to ensure that all necessary officials are accessible at all times and that all necessary communications can be passed without delay.

Chapter II-Master-deck department: This chapter establishes the basic principles to be observed in keeping a navigational watch, covering such matters as watch arrangements, fitness for duty, navigation, navigational equipment, navigational duties and responsibilities, the duties of the look-out, navigation with a pilot on board and protection of the marine environment.

Regulation II/2 establishes mandatory minimum requirements for certificating masters and chief mates of ships of 200 gross tons to 1,600 gross tons and for ships of 1,600 gt and more. Candidates must meet the requirements for certification as an officer in charge of a navigational watch on ships of 200 gt or more and have approved sea-going service in that capacity. Candidates must also have passed an appropriate examination covering not only navigational aspects and ship-handling but ship stability, construction and damage control; power plants; cargo handling and stowage; fire prevention; medical care; maritime law (including SOLAS and other IMO conventions); personnel management and training; communications; life-saving; search and rescue; and methods for demonstrating proficiency. The examination may be varied for officers and masters of ships engaged on near-coastal voyages [29].

Regulation II/3 sets out mandatory minimum requirements for certification of officers in charge of a navigational watch and masters of ships of less than 200 gt. For ships of less than 200 gt which are not engaged on near-coastal voyages, appropriate certificates for ships of 200 gt to 1,600 gt must be held (in the case of masters) and above 200 gt in the case of officers. For ships of less than 200 gt engaged on near-coastal voyages, masters must hold an appropriate certificate; be not less than 20 years of age; have approved sea-going service of not less than 12 months as officer in charge of a navigational watch; and satisfy the Administration that they possess adequate knowledge, including knowledge of the subjects listed in an appendix to the regulation. Officers must have an appropriate certificate; be not less than 18 years old; be medically fit; have undergone special training; have completed three years' service in the deck department; and possess adequate knowledge, including knowledge of the subjects listed in an appendix to the regulation [29].

The mandatory minimum requirements for certification of officers in charge of a navigational watch on ships of 200 gt or more are contained in regulation II/4. The age limit is 18 and the three years' sea-going service must include at least six months of bridge watchkeeping duties under the supervision of a qualified officer. Candidates must also pass an examination based upon the subjects listed in an appendix which includes many of the subjects appended to regulation II/2 [29]. Among the additional requirements is one for an adequate knowledge of the English language including ability to use the IMO SMNV [29,30].

In an era when technology and other factors are changing rapidly, it is necessary that masters and officers keep up to date. This aspect is covered in regulation II/5 [29]. Officers and masters are required at regular intervals not exceeding five years to satisfy their Administration as to their fitness and professional competence. To ensure that this can be done, Administrations are required to formulate a structure of refresher courses, especially for re-entrance to sea-going service. They must also ensure that all ships under their jurisdiction are provided with texts of changes in international regulations concerning safety at sea and marine environment protection. Requirements for deck ratings forming part of a navigational watch form the subject matter of regulation II/6 [29]. Ratings who comply with this regulation must be not less than 16 years old. They should have completed at least six months sea-going service or undergone special training in a prescribed number of subjects. Service of at least one year during the five years prior to the entry into force of the Convention for their Administration may be regarded as equivalent. The last two regulations in this chapter deal with basic principles to be observed in keeping watch in port and mandatory minimum requirements for a watch in port on ships carrying hazardous cargo. In both cases, note or full account must be taken of the provisions of two recommendations adopted by the 1978 conference. These are respectively the Recommendation on principles and operational guidance for deck officers in charge of a watch in port and Recommendations on principles and operational guidance for engineer officers in charge of an engineering watch in port [31].

The Convention requirements and associated recommendations concerning navigational watchkeeping are essentially the same as those contained in Assembly

resolution A.285(VIII), adopted in 1973 [32]. The provisions concerning watchkeeping in port are based on Assembly resolution A.337 (IX), adopted in 1975 [33].

Chapter III-Engine department: This follows a similar format to Chapter II and begins with a regulation, which outlines basic principles to be observed in keeping an engineering watch. While requirements for deck officers vary according to the tonnage of the ship, for engineer officers the determining factor is the power of the engine. Regulation III/2 for example deals with mandatory minimum requirements for certification of chief engineer officers and second engineer officers of ships powered by main propulsion machinery of 3,000 kW propulsion power or more. Candidates for certification as second engineers must have not less than 12 months sea-going experience as engineer officers or assistants. Candidates as chief engineers must have at least 36 months sea-going experience, including at least 12 months as an engineer officer in a position of responsibility while qualified to serve as second engineer officer. They must have attended an approved fire-fighting course and have passed an examination-covering subjects listed in an appendix to the regulation [29].

Regulation III/3 contains similar requirements for ships with main propulsion machinery between 750 kW and 3,000 kW. The difference between this and the previous regulation is that the requirement for previous service for candidates as chief engineers is reduced from 36 months to 24. Officers qualified to serve as second engineers on ships of 3,000 kW or more may serve as chief engineers of ships of lesser power may, provided that not less than 12 months approved sea-going service shall have been served as an engineer officer in a position of responsibility.

Regulation III/4 contains mandatory minimum requirements for certification of engineer officers in charge of a watch in a traditionally manned engine room or designated duty officers in a periodically unmanned engine room. The minimum age requirement is 18 and candidates must also have not less than three years approved training or education and have completed an adequate period of sea-going service. Candidates must have knowledge of the operation and maintenance of marine machinery, together with knowledge of watchkeeping routines; main and auxiliary machinery; pumping systems; generating plant safety and emergency procedures;

anti-pollution procedures; and first aid. The next regulation includes requirements to ensure the continued proficiency and updating of knowledge for engineer officers. The final regulation in the chapter (III/6) contains mandatory minimum requirements for ratings forming part of an engine room watch. The minimum age permitted is 16 [29].

Although the regulations in this chapter are not based on earlier resolutions of the IMO Assembly they reflect standard good practice. So far they have not caused any difficulties with regard to implementation.

Chapter IV-Radio department : An explanatory note points out that mandatory provisions relating to radio watchkeeping are set forth in the ITU Radio Regulations and safety radio watchkeeping and maintenance provisions are included in the same regulations and in SOLAS [34]. Regulation IV/1 (mandatory minimum requirements for certification of radio officers) states that radio officers must hold a certificate issued under the provisions of the Radio Regulations and have adequate qualifying service. Radio officers must also be over 18 and have passed an examination, which takes into account subjects listed in an appendix, particularly concerned with safety and emergencies. The next regulation contains provisions, which are designed to ensure the continued proficiency, and updating of knowledge of radio officers and the final regulation establishes minimum requirements for certification of radiotelephone operators. This latter regulation is also linked with the provisions of the Radio Regulations and candidates are additionally required to pass an examination and to meet requirements listed in appendix [29].

Chapter V-Special requirements for tankers: The importance of tankers in world shipping today is recognised by the inclusion of this chapter [29]. Its intention is to ensure that officers and ratings who are to have specific duties related to the cargo and cargo equipment of tankers shall have completed an appropriate shore-based fire-fighting course; and have completed either an appropriate period of shipboard service or an approved familiarisation course. Requirements are more stringent for masters and senior officers. Attention is paid not only to safety aspects but also to pollution prevention. The chapter contains three regulations dealing with oil tankers, chemical tankers and liquefied gas tankers, respectively.

Chapter VI-Proficiency in survival craft: This chapter establishes requirements governing the issuing of certificates of proficiency in survival craft. These include approved sea-going service of not less than 12 months or nine months if the candidate has attended an approved training course. There is provision for testing by examination or continuous assessment during an approved training course.

In some regulations of the Convention the language is fairly general, with much detail being incorporated in resolutions adopted by the conference. Resolution 1 for example, is related to regulation II/1 (basic principles to be observed in keeping a navigational watch). An annex contains a recommendation on operational guidance for officers in charge of a navigational watch. A resolution is not, of course, a mandatory instrument. A Government in any way it sees fit, in whole, in part or not at all can use it. For this reason, therefore, resolutions are not as important as conventions, whose observance is mandatory on all Contracting Parties. Nevertheless, the resolutions adopted by the STCW Conference are mostly closely linked to the Convention and are designed to back up the Convention itself.

3.13.3. 1995 STCW CONVENTION

It was decided not to amend the articles of the Convention for procedural reasons. This can only be done by the positive acceptance procedure, meaning that any amendments adopted would require the acceptance of two-thirds of parties (one third of parties or parties whose combined merchant fleets constitute not less than 50% of world tonnage) before entering into force, a process which would have taken many years [35]. By concentrating simply on the technical annex, it was possible to make use of the Convention's tacit acceptance provisions, under which amendments adopted by the Conference can enter into force within a minimum of one year (and a maximum of two years) unless they are rejected in the meantime by sufficient Parties [35].

It is expected that the amendments will enter into force under this procedure on 1 February 1997. Until 1 February 2002, however, parties may continue to issue, recognise and endorse certificates, which applied before that date in respect of seafarers that began training or seagoing service before 1 August 1998.

The articles contain the legal provisions of the Convention while the technical content is incorporated in the annex. The articles deal with entry into force provisions, amendment procedures, denunciation and various other matters. One especially important feature of the Convention is that it applies to ships of non-party States when visiting ports of States, which are Parties to the Convention. Article X requires Parties to apply the control measures to ships of all flags to the extent necessary to ensure that no more favourable treatment is given to ships entitled to fly the flag of a State which is not a Party than is given to ships entitled to fly the flag of a State that is a Party [35]. The difficulties, which could arise for ships of States, which are not Parties to the Convention, are one reason why the Convention has received such wide acceptance.

Certificates, each authorising the holder to serve in a stated capacity, are the basic control provision of the Convention and article VI requires that they be issued only to those who meet the requirements of the Convention [29]. Article X states that ships (with some exceptions, such as warships and fishing vessels) are subject, while in the ports of a Party, to control by officers duly authorised to verify that personnel on board hold the required certificates. Deficiencies are required to be reported to the master and to the authorities of the Flag State. If the deficiencies are such that they are judged to pose a danger to persons, property or the environment, the Party carrying out the control shall take steps to ensure that the ship will not sail unless and until the Convention requirements are met to the extent that the danger has been removed.

Although one aim of the Convention is that in future all certificates shall ultimately be issued in accordance with its requirements, the need for transitional provisions is recognised in article VII. It states that certificates issued before entry into force of the Convention for a Party shall remain valid, no matter what the standards may have been. After the entry into force of the Convention for a Party, its Administration may continue to issue certificates of competence in accordance with its previous practices for a period not exceeding five years [29]. This provision will enable the requirements of certificates to be updated in line with technical and other changes.

Article VIII describes how, in circumstances of exceptional necessity, dispensations may be granted to enable seafarers to serve in capacities for which they do not hold appropriate certificates, but no such dispensation is permitted in the case of a radio officer or operator [29]. The Convention also incorporates in article XII a 'tacit acceptance' procedure similar to that included in the 1974 SOLAS Convention. Under this procedure IMO's Maritime Safety Committee, expanded to include all Contracting Parties, some of who may not be members of the Organisation, may adopt amendments to the STCW Convention or its annex. Amendments to the STCW annex will normally enter into force one and a half years after being communicated to all Parties unless, in the meantime, they are rejected by one-third of the Parties or by Parties whose combined fleets represent 50 per cent of world tonnage. Article XI of the Convention deals with technical cooperation and it requires Parties to promote support for Parties, which request technical assistance in such matters as training.

3.13.4. THE REGULATIONS STCW CONVENTION

One of the major features of the revision is the adoption of a new STCW Code, to which many technical regulations have been transferred. Part A of the Code is mandatory while Part B is recommended. Dividing the regulations up in this way makes administration easier and it will also make the task of revising and updating them more simple, for procedural and legal reasons there is no need to call a full conference to make changes to Codes. Another important change means that for the first time IMO itself is given some authority over individual Parties. Under Chapter I, regulation I/7 Parties will be required to provide detailed information to IMO concerning administrative measures taken to ensure compliance with the Convention, education and training courses, certification procedures and other factors relevant to implementation. This information will be used by the Maritime Safety Committee (MSC), IMO's senior technical body, to identify Parties that are able to demonstrate that they can give full and complete effect to the Convention [29].

This regulation is regarded as particularly important because it means that Governments will have to establish that they have the administrative, training and certification resources necessary to implement the Convention. No such proof was required in the original Convention (or in any other IMO instrument), leading to

complaints that standards differed widely from country to country and certificates could therefore not always be relied on. The regulation is backed up by section A-I/7 of the STCW Code, which requires the information to be submitted to IMO by 1 August 1998, and says that it must include the following [36]:

1. The name, postal address and telephone and facsimile numbers and organisation chart of the ministry, department or governmental agency responsible for administering the Convention;

2. A concise explanation of the legal and administrative measures provided and taken to ensure compliance, particularly with regulations I/6 (training and assessment) and I/9 (medical standards and the issue and registration of certificates);

3. A clear statement of the education, training, examination, competency assessment and certification policies adopted;

4. A concise summary of the courses, training programs, examinations and assessments provided for each certificate issued pursuant to the Convention;

5. A concise outline of the procedures followed to authorise, accredit or approve training and examinations, medical fitness and competency assessments, required by the Convention, the conditions attaching there and a list of the authorisations, accreditations and approvals granted;

6. A concise summary of the procedures followed in granting any dispensation under article VIII of the Convention; and

7. The results of the comparison carried out pursuant to regulation I/11 and a concise outline of the refresher and upgrading training mandated [29].

Section A-I/7 also requires the Secretary-General to maintain a list of competent persons approved by the MSC who may be called upon to assist in the preparation of the report required by regulation I/ 7. Meetings of those on the list may be held at the discretion of the Secretary-General and their views shall be taken into account in the report submitted to the MSC.

Regulation I/8 of the Convention requires a quality standards system to be used where training, assessment of competence, certification, endorsement and revalidation activities are carried out. Further provisions covering this point are contained in Section A-I/8 of the Code.

Other important amendments to Chapter I (General Provisions) include the following:

- Enhanced procedures concerning the exercise of port State control under Article X of the Convention [37] have been developed to allow the competence of seafarers in carrying out watchkeeping to be assessed and to permit intervention in the case of deficiencies deemed to pose a danger to persons, property or the environment (regulation I/4). This can take place if certificates are not in order or if the ship is involved in a collision or grounding, if there is an illegal discharge of substances (causing pollution) or if the ship is manoeuvred in an erratic or unsafe manner, etc.

- Parties are required to establish procedures for investigating acts by persons to whom they have issued certificates that endanger safety or the environment. Penalties and other disciplinary measures must be prescribed and enforced where the Convention is not complied.

- Technical innovations, such as the use of simulators for training and assessment purposes have been recognised. Simulators will become mandatory for training in the use of radar and automatic radar plotting aids (ARPA).

- Parties will be required to ensure that training, certification and other procedures are continuously monitored by means of a quality assurance system (regulation I/8).

- Every master, officer and radio operator shall be required at intervals not exceeding five years to meet the fitness standards and the levels of professional competence contained in Section A-I/11 of the STCW Code.

- In order to assess the need for revalidation of certificates after 1 February 2002, Parties must compare the standards of competence previously required with those specified in the appropriate certificate in part A of the STCW Code. If necessary, the

holders of certificates may be required to undergo training of refresher courses (regulation I/11).

- Provisions covering the use of simulators, in particular radar and automatic radar plotting aids equipment are contained in regulation I/12 (and section A-I/12 of the STCW Code).

The remaining chapters are as follows:

Chapter II: Master and deck department

Chapter III: Engine department

Chapter IV: Radiocommunication and radio personnel

Chapter V: Special training requirements for personnel on certain types of ships. Special requirements have been introduced concerning the training and qualifications of personnel on board ro-ro passenger ships. Previously the only special requirements in the Convention concerned crews on tankers. This change was made in response to proposals made by the Panel of Experts set up to look into ro-ro safety following the capsize and sinking of the ferry Estonia in September 1994 [38]. Crews on ro-ro ferries will have to receive training in technical aspects and also in crowd and crisis management and human behaviour.

Chapter VI: Emergency, occupational safety, medical care and survival functions.

Chapter VII: Alternative certification. Regulations regarding alternative certification (also known as the functional approach) have been included in a new Chapter VII. This involves enabling crews to gain training and certification in various departments of seafaring rather than being confined to one branch (such as deck or engine room) for their entire career. Although it is a relatively new concept, the Conference was anxious not to prevent its development. At the same time, the new Chapter is intended to ensure that safety and the environment are not threatened in any way. The use of equivalent educational and training arrangements is permitted under article IX.

Chapter VIII: Watchkeeping. Measures have been introduced for watchkeeping personnel to prevent fatigue. Administrations are required to establish and enforce rest periods for watchkeeping personnel and to ensure that watch systems are so arranged that the efficiency of watchkeeping personnel is not impaired by fatigue.

Sections in the STCW Code support the regulations contained in the Convention. Generally speaking, the Convention contains basic requirements, which are then enlarged upon and explained in the Code. Part A of the Code is mandatory. The minimum standards of competence required for seagoing personnel are given in detail in a series of tables. Chapter II of the Code, for example, deals with standards regarding the master and deck department. Part B of the Code contains recommended guidance, which is intended to help Parties implement the Convention. The measures suggested are not mandatory and the examples given are only intended to illustrate how certain Convention requirements may be complied with. However, the recommendations in general represent an approach that has been harmonised by discussions within IMO and consultation with other international organisations.

3.13.5. RESOLUTIONS

It is expected that the need to provide information to IMO and the powers given to the Marine Safety Committee to assess the actions of national Governments will greatly strengthen the effectiveness of the Convention but it is also recognised that it will be difficult for some Governments to comply with the amendments without assistance.

One of the resolutions adopted by the Conference recognises the importance of education, training and appropriate experience for all seafarers. It also recognises that in some cases, there may be limited facilities for obtaining the required experience and providing specialised training programs, particularly in developing countries. It says that "the promotion of technical co-operation at an inter-governmental level will assist those States not yet having adequate expertise or facilities for providing such training and experience to implement the revised STCW Convention requirements."

Other resolutions adopted by the Conference dealt with:

- training in crisis management and human behaviour for personnel on board ro-ro passenger ships and training of personnel on passenger ships
- monitoring the implications of alternative certification
- development of international standards of medical fitness for seafarers
- Promotion of the participation of women in the maritime industry.

3.13.6. INTERNATIONAL CONVENTION ON STANDARDS OF TRAINING, CERTIFICATION AND WATCHKEEPING FOR FISHING VESSEL PERSONNEL (STCW-F)

While the amendments to the STCW Convention were being considered, a separate conference running concurrently adopted a new International Convention on Standards of Training, Certification and Watchkeeping for Fishing Vessel Personnel (STCW-F). The nature of the fishing industry it is extremely difficult to develop regulations for other sections of the shipping industry, which can be applied without modification to fishing vessels as well. The Convention will apply to crews of seagoing fishing vessels, generally of 24 metres in length and above. Delegates attended the Conference from 74 countries.

It was originally intended that requirements for crews on fishing vessels should be developed as a Protocol to the main STCW Convention, but after careful consideration it was agreed that it would be better to adopt a completely separate Convention [39]. The Convention is the first attempt to make standards of safety for crews of fishing vessels mandatory. The STCW-F Convention is comparatively short and consists of 16 Articles and several chapters contained in an annex. Chapter I contain General Provisions and Chapter II deals with Certification of Skippers, Officers, Engineer Officers and Radio Operators.

Previously efforts to improve the training, certification and watchkeeping standards of fishing vessels' personnel have been adopted as recommendations in Assembly resolutions and the Document for Guidance on Fishermens' Training and

Certification produced jointly by IMO and the Food and Agriculture Organisation (FAO) and the International Labour Organisation (ILO) [39].

3.14. ISM CODE

3.14.1. ISM CODE BACKGROUND

In 1989, IMO adopted Guidelines on management for the safe operation of ships and for pollution prevention to provide those responsible for the operation of ships with a framework for the proper development, implementation and assessment of safety and pollution prevention management in accordance with good practice. These guidelines were revised in November 1991 and the ISM Code itself was adopted as a recommendation in 1993 [40]. However, after several years of practical experience, it was felt that the Code was so important that it should be mandatory. It was decided that the best way of achieving this would be through the SOLAS Convention [41]. This was done by means of amendments adopted on 24 May 1994, which added a new Chapter IX to the Convention entitled Management for the safe operation of ships. The Code itself is not actually included in the Convention, but is made mandatory by means of a reference in Chapter IX.

The Code requires a safety management system (SMS) to be established by the Company, which is described as the shipowner or any person, such as the manager or bareboat charterer, who has assumed responsibility for operating the ship. The safety management system in turn should include a number of functional requirements [42]:

- a safety and environmental protection policy;
- instructions and procedures to ensure safety and environmental protection;
- defined levels of authority and lines of communication between and amongst shore and shipboard personnel;
- procedures for reporting accidents, etc.;
- procedures for responding to emergencies;

- Procedures for internal audits and management reviews.

The Company is then required to establish and implement a policy for achieving these objectives. This includes providing the necessary resources and shore-based support. After outlining the responsibilities of the company, the Code stresses that the responsibility for verifying that the Code is implemented rests with the Flag State. SOLAS has been accepted by 137 countries whose combined merchant shipping fleets represent more than 98% of world tonnage.

The ISM Code will have a major impact on management and will require some shipping companies to make considerable changes to their company structures. It emphasises the role of management in safety and pollution prevention and will compel the operators of substandard ships to improve their ships and management systems. Many Governments have already announced that they will implement the Code rigorously, which means that ships, which do not carry the necessary certification, could be barred from entry into foreign ports [43]. Many protection and indemnity clubs have said that they will regard compliance with the Code as a condition of cover [44].

3.14.2. THE REQUIREMENTS OF ISM CODE

Clause 1 GENERAL

1.1 Definitions:

1.1.1 International Safety Management (ISM) Code means the International Management Code for the Safe Operation of Ships and for Pollution Prevention as adopted by the Assembly, as may be amended by the Organisation.

1.1.2 Company means the owner of the ship or any other organisation or person such as the manager, or the bareboat charterer, who has assumed the responsibility for operation of the ship from the shipowner and who, on assuming such responsibility, has agreed to take over all duties and responsibility imposed by the Code.

1.1.3 Administration means the Government of the State whose flag the ship is entitled to fly.

1.2 Objectives:

1.2.1The objectives of the Code are to ensure safety at sea, prevention of human injury or loss of life, and avoidance of damage to the environment, in particular to the marine environment and to property.

1.2.2 Safety management objectives of the Company should, inter-alia:

1- Provide for safe practices in ship operation and a safe working environment;

2- Establish safeguards against all identified risks; and

3- Continuously improves safety management skills of personnel ashore and aboard ships, including preparation for emergencies related both to safety and environmental protection.

1.2.3 The safety management system should ensure:

1□ Compliance with mandatory rules and regulations; and

2- That applicable codes, guidelines and standards recommended by the Organisation, Administrations, and classification societies maritime industry organisations are taken into account.

1.3 Application: The requirements of this Code may be applied to all ships.

1.4 Functional requirements for a safety management system

Every Company should develop, implement and maintain a safety-management system (SMS) which includes the following functional requirements that is mentioned in 3.14.1.

Clause 2 SAFETY AND ENVIRONMENT PROTECTION POLICY

2.1 The Company should establish a safety and environmental protection policy, which describes how the objectives given in paragraph 1.2 will be achieved.

2.2 The Company should ensure that the policy is implemented and maintained at all levels of the organisation both, ship based and shore based.

Clause 3 COMPANY RESPONSIBILITIES AND AUTHORITY

3.1 If the entity that is responsible for the operation of the ship is other than the owner, the owner must report the full name and details of such entity to the Administration.

3.2 The Company should define and document the responsibility, authority and interrelation of all personnel who manage, perform and verify work relating to and affecting safety and pollution prevention.

3.3 The Company is responsible for ensuring that adequate resources and shore-based support are provided to enable the designated person or persons to carry out their functions.

Clause 4 DESIGNATED PERSON (S)

To ensure the safe operation of each ship and to provide a link between the Company and those on board, every Company, as appropriate, should designate a person or persons ashore having direct access to the highest level of management. The responsibility and authority of the designated person or persons should include monitoring the safety and pollution prevention aspects of the operation of each ship and ensuring that adequate resources and shore based support are applied, as required.

Clause 5 MASTER'S RESPONSIBILITY AND AUTHORITY

5.1 The Company should clearly define and document the master's responsibility with regard to:

1- Implementing the safety and environmental protection of the Company;

2- Motivating the crew in the observation of that policy;

3- Issuing appropriate orders and instructions in a clear and simple manner;

4- Verifying that specified requirements are observed; and

5- Reviewing the SMS and reporting its deficiencies to the shore based management.

5.2 The Company should ensure that the SMS operating on board the ship contains a clear statement emphasising the master's authority. The Company should establish in the SMS that the master has the overriding authority and the responsibility to make decisions with respect to safety and pollution prevention and to request the Company's assistance as may be necessary.

Clause 6 RESOURCES AND PERSONNEL

6.1 The Company should ensure that the master is:

1- Properly qualified for command;

2- Fully conversant with the Company's SMS; and

3- Given the necessary support so that the master's duties can be safely performed.

6.2 The Company should ensure that each ship is manned with qualified, certificated and medically fit seafarers in accordance with national and international requirements.

6.3 The Company should establish procedures to ensure those new personnel and personnel transferred to new assignments related to safety and protection of the environment are given proper familiarisation with their duties. Instructions, which are essential to be provided prior to sailing, should be identified, documented and given.

6.4 The Company should ensure that all personnel involved in the Company's SMS have an adequate understanding of relevant rules, regulations, codes and guidelines.

6.5 The Company should establish and maintain procedures for identifying any training, which may be required in support of the SMS and ensure that such training is provided for all personnel concerned.

6.6 The Company should establish procedures by which the ship's personnel receive relevant information on the SMS in a working language or languages understood by them.

6.7 The Company should ensure that the ship's personnel are able to communicate effectively in the execution of their duties related to the SMS.

Clause 7 DEVELOPMENT OF PLANS FOR SHIPBOARD OPERATIONS

The Company should establish procedures for the preparation of plans and instructions for key shipboard operations concerning the safety of the ship and the prevention of pollution. The various tasks involved should be defined and assigned to qualified personnel.

Clause 8 EMERCENCY PREPAREDNESS

8.1 The Company should establish procedures to identify, describe and respond to potential emergency shipboard situations.

8.2 The Company should establish programs for drills and exercises to prepare for emergency actions.

8.3 The SMS should provide for measures ensuring that the Company's organisation can respond at any time to hazards, accidents and emergency situations involving its ships.

Clause 9 REPORTS AND ANALYSIS OF NON-CONFORMITIES, ACCIDENTS AND HAZARDOUS OCCURRENCES

9.1 The SMS should include procedures ensuring that nonconformities, accidents and hazardous situations are reported to the Company, investigated and analysed with the objective of improving safety and pollution prevention.

9.2 The Company should establish procedures for the implementation of corrective action.

Clause 10 MAINTENANCE OF THE SHIP AND EQUIPMENT

10.1 The Company should establish procedures to ensure that the ship is maintained in conformity with the provisions of the relevant rules and regulations and with any additional requirements, which may be established by the Company.

10.2 In meeting these requirements the Company should ensure that:

1- Inspections are held at appropriate intervals;

2- Any non-conformity is reported, with its possible cause, if known;

3- Appropriate corrective action is taken; and

4- Records of these activities are maintained.

10.3 The Company should establish procedures in its SMS to identify equipment and technical systems the sudden operational failure of which may result in hazardous situations. The SMS should provide for specific measures aimed at promoting the reliability of such equipment or systems. These measures should include the regular testing of stand-by arrangements and equipment or technical systems that are not in continuous use.

10.4 The inspections mentioned in 10.2 as well as the measures referred to in 10.3 should be integrated into the ship's operational maintenance routine.

Clause 11 DOCUMENTATION

11.1The Company should establish and maintain procedures to control all documents and data, which are relevant to the SMS.

11.2 The Company should ensure that:

1-Valid documents are available at all relevant locations;

2- Changes to documents are reviewed and approved by authorised personnel; and

3- obsolete documents are promptly removed.

11.3 The documents used to describe and implement the SMS may be referred to as the Safety Management Manual. Documentation should be kept in a form that the Company considers most effective. Each ship should carry on board all documentation relevant to that ship.

Clause 12 COMPANY VERIFICATION, REVIEW AND EVALUATION

12.1The Company should carry out internal safety audits to verify whether safety and pollution prevention activities comply with the SMS.

12.2 The Company should periodically evaluate the efficiency and, when needed, review the SMS in accordance with procedures established by the Company.

12.3 The audits and possible corrective actions should be carried out in accordance with documented procedures.

12.4 Personnel carrying out audits should be independent of the areas being audited unless this is impracticable due to the size and the nature of the Company.

12.5 The results of the audits and reviews should be brought to the attention of all personnel having responsibility in the area involved.

12.6 The management personnel responsible for the area involved should take timely corrective action on deficiencies found.

Clause 13 CERTIFICATION, VERIFICATION AND CONTROL

13.1The ship should be operated by a Company, which is issued a Document of Compliance relevant to that ship.

13.2 A Document of Compliance should be issued for every Company complying with the requirements of the ISM Code by the Administration, by an organisation recognised by the Administration or by the Government of the country, acting on behalf of the Administration in which the Company has chosen to conduct its business. This document should be accepted as evidence that the Company is capable of complying with the requirements of the Code.

13.3 A copy of such a document should be placed on board in order that the master, if so asked, may produce it for the verification of the Administration or organisations recognised by it.

13.4 A certificate, called a Safety Management Certificate, should be issued to a ship by the Administration or organisation recognised by the Administration. The

Administration should, when issuing the certificate, verify that the Company and its shipboard management operate in accordance with the approved SMS.

13.5 The Administration or an organisation recognised by the Administration should periodically verify the proper functioning of the ship's SMS as approved.

3.15. THE INTERRELATIONSHIP BETWEEN THE ISM CODE, THE STCW CONVENTION, ISO STANDARDS

The ISM Code covers safety and prevention risks while the STCW Convention covers the competence of shipboard personnel, the ISO 9002 covers the quality of service [45]. There are many links between the ISM Code and ISO 9002 standard. Management Responsibility is defined in ISO 9002, clause 4.1. The authors of the ISM Code found it more practical to define such responsibilities in separate sections like safety and environmental protection policy (clause 2), company responsibility and authority (clause 3), designated person(s) (clause 4), master's responsibility and authority (clause 5), resources and personnel (clause 6), verification review and evaluation (clause 12). Clauses 7 and 8 of the ISM Code corresponds the following paragraphs of ISO 9002 such as process control (clause 4.9), identification and traceability (clause 4.8) and training (clause 4.18). Clause 9 of the ISM Code, although it covers a wider field than ISO 9002, covers the control of non conforming product (clause 4.13), corrective and preventive actions (clause 4.14) in ISO 9002. The concerns of clause 10 of the ISM Code are divided the following paragraphs as inspection and testing (clause 4.10), inspection and test status (clause 4.12), identification and traceability (clause 4.8).

There are also clauses in ISO 9002 which are not covered explicitly by the ISM Code, because they are the certification requirements such as, contract review (clause 4.3), purchasing (clause 4.6), control of client-supplied products (clause 4.7), control of inspection, measuring and test equipment (clause 4.10), handling, storage, packaging, preservation and delivery (clause 4.15) and statistical techniques (clause 4.20). The comparison between ISM Code, STCW Convention and ISO 9002 Standard is given in table 3.2.

Table 3.2 Comparison of ISM Code, STCW Convention and ISO 9002 Standard

	ISM Code	STCW Convention	ISO 9002 Standard
Field of Application	Safety at sea and pollution prevention	Training, certification and wacthkeeping	Quality assurance of services
Applicable to	Ship Management	Administrations, training services, maritime faculties, ship management, shipboard operations	Contractual relationship between customer and supplier
Purpose : Demonstrate compliance with	The safety and pollution prevention requirements	Training, certification and wacthkeeping requirements	The customers quality requirements
Means: Implementation of	Safety Management System	Training Management System	Quality Management System
Scheme of certification	Shore based audit and shipboard audit	Organisation's audit	Quality System Audit
Validity	5 years subject to audit	5 years subject to audit	3 years subject to audit
Compliance	Mandatory	Mandatory	Voluntary

3.16. ISO 9000 HORIZON 2000

3.16.1. GENERAL

The ISO 9000 standards have achieved a truly impressive international consensus, in particular the standards on requirements for quality assurance. This readily is illustrated by some facts:

- they have been adopted by more than 80 countries as national standards

- they are used by hundreds of thousands of organisations, with many actually certified by a third party
- they are used for a variety of purposes, such as contractual, regulatory, and improvement
- they have paved the way for a new way of looking at management systems, which has directly contributed to the emergence of the ISO 14000 standards on environmental management

The most widely known of these standards, ISO 9001, ISO 9002, and ISO 9003 were published for the first time in 1987. After seven years in the field, they were revised and reissued in 1994. Many rightly point out that the ISO 9000 standards must provide continuity, but, just as importantly, they have to provide relevance. This can only come from listening to the "voice of customers" in the many countries and industry/ economic sectors that are active participants in this international effort. Some of the reported needs are to improve :

- confidence in outcomes and value relative to the implementation effort
- applicability to a broad range of organisational sizes, business processes and methods, and types of products
- flexibility of use and user friendliness

Also, important developments have to be taken into account, such as

- the emergence of the ISO 14000 family, the first five key standards having been published in 1996,
- the emergence of quality documents in specific industries, most notably the automotive specification QS-9000 and the medical devices standards ISO 13485:96 and ISO 13488:96.

3.16.2. ISO/TC 176 MISSION AND VISION

At the 1995 meeting, ISO/TC 176 renewed its sense of focus and direction and expressed and emerging consensus on [46]:

- a new vision and a revised mission,
- the products and services needed to support and maintain the integrity of the 1994 editions,
- the Year 2000 family of standards (the "product line").

The new vision is that, through its worldwide acceptance and use, the ISO 9000 family of standards will provide an effective means for improving the performance of individual organisations and providing confidence to people and organisations that products (goods and services) will meet their expectations, thereby enhancing trade, global prosperity, and individual well-being.

ISO/TC 176 understands its mission as being to [46]:

- identify and understand user needs in the field of quality management,
- develop standards that respond effectively to the expectations of users,
- support implementation of these standards,
- facilitate meaningful evaluation of the resulting implementations.

This has to be achieved by using the ISO process for attaining not only international consensus but also compatibility with other ISO/IEC management system standards. This point is also apparent in the key strategies that were agreed upon, which indicate a commitment to a joint and cooperative approach with the other Technical Committees concerned [46].

3.16.3. ISO 9000 FAMILY IN THE YEAR 2000

The Year 2000 product line recognises the need to minimise proliferation within the ISO 9000 family of standards, and to encourage the same for standardisation the field of quality management as a whole. The product line is centred on the following:

- ISO 9000 : Concepts and terminology,
- ISO 9001 : Requirements for quality assurance,
- ISO 9004 : Guidelines for quality management,
- ISO 10011: Guidelines for auditing quality management systems,
- TR 1000X : Technical report or brochure on "Selection and Use",
- TR 1000Y : Technical report or brochure on "Quality management" principles and their application to management practices.

It is intended that this product line will be supported by additional documents, as the need arises. The numbers 9002 and 9003 are being held as placeholders for contractual requirements that have a more focused scope than ISO 9001. One of the key aspects of this product line is that the revised ISO 9001 and ISO 9004 will form a consistent pair of International Standards.

A preliminary agreement was reached on "standards that do not conflict, that fit well together, and that can be readily implemented within the same quality management system." The important feature is to look at this from a user's point of view in the field of quality management [46]. The current schedule indicates that the new revisions will be published in the year 2000.

3.16.4. QUALITY ASSURANCE AND QUALITY MANAGEMENT: 2000

The different focus of the revised standards is summarised in Table 3.3, Table 3.4 and Table 3.5 for the future ISO 9000. It is important to remember that this simply suggests the overall direction of the revision process.

Table 3.3 ISO 9001 Now and in the Year 2000

Focus of QA: **ISO 9001 shall address**	**Focus of QM:** **ISO 9001 shall not address**
Prevent customer dissatisfaction through meeting customer requirements (including product meeting customer requirements)	Achieve competitive advantage through exceeding customer requirements (including product meeting enhanced expectations)
Effectiveness	Efficiency
Minimum QA requirements	The best practice
Compliance to the requirements in the standard	Guidance, not requirements
Requirements either have or have not been met	Degrees of excellence
Ability to achieve customer requirements and improve processes by reducing risks and preventing failure	Ability to achieve superior performance and delighted customers

Table 3.4 Comparison of Present and Future Editions of ISO 9001

ISO 9001: 1994 Edition	**ISO 9001: Year 2000 Edition**
Language oriented towards "hardware" product	Clearly addresses all categories of products
Effectiveness	Efficiency
Limited to manufacturing – style product cycle	More generic approach addressing all functions of the organisation directly affecting product quality
Structure of 20 quality system elements	Logical structure of linked processes
Has led to mainly subjective measurements of compliance?	Will emphasise that it is important to evaluate and improve the effectiveness of the quality management system based on objective measures?
Offers no linkage to ISO 9004 to identify the QA/QM relationship	Will have structured alignment to ISO 9004 to the extent necessary?

Table 3.5 Comparison of Present and Future Editions of ISO 9004

ISO 9004-1: 1994 Edition	ISO 9004: Year 2000 Edition
Limited linkage to business management systems	Improved linkage to business management systems
Limited linkage to ISO 9001	Appropriate and effective linkage to ISO 9001
Limited linkage to quality management principles	Directly based on quality management principles
Oriented toward manufacturing processes	Process model applicable to all generic product categories
No intended for self-evaluation	Method for self-evaluation and establishing degree of excellence
Limited quality management content	Expanded quality management content, eg, measurements of performance, quality improvement, human resources, customer satisfaction, system flexibility

One major work item over the last few years in ISO/TC 176 has been developing a consensus on Quality Management Principles. A quote from an approved ISO Technical Report clearly identifies the importance of these principles as an integral part of the business framework of an organisation [46]: The Quality Management Principles will be contained in the new ISO 9004 document. The ISO 9000 family of standards will be based on these Quality Management Principles. With growing global competition, quality management is becoming increasingly important to the leadership and management of all organisations. The Quality Management Principles apply universally to all user groups. By applying the following eight Quality Management Principles, that is mentioned Table 3.6, organisations will produce benefits for customers, owners, people, suppliers, local communities and society at large."

The term "Quality Management Principle" is understood as follows:

"A comprehensive and fundamental rule or belief, for leading and operating an organisation, aimed at continually improving performance over the long term by focusing on customers while addressing the needs of all stakeholders. [46]"

Table 3.6 Quality Management Principles

Leadership
Involvement of people
Process approach
System approach to management
Continual improvement
Customer-focused organisation
Factual approach to decision-making
Mutually beneficial supplier relationships

4. QUALITY MANAGEMENT SYSTEM IN MARITIME TRAINING AND EDUCATION

4.1. BASIC TERMS OF QUALITY MANAGEMENT IN EDUCATION FIELD

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, especially in the design and manufacture of defence industry based products, automobile industry and consumer products etc. The interest in quality management is now worldwide. In North and South America, England and Europe, Australia and Asia, conferences and seminars on quality management occur, almost daily, with large attendance and testimonials to its success [47].

Although lecturers or educators are among the first to write about new ideas, they are almost always the last to apply them to their own activities or industry. Universities of business are not famous for being well managed. Schools of engineering do not apply engineering methods to their own operations. Thus it has happened that the quality movement has been active in the United States and most European Countries for over a decade, and, yet it has been only in the last year or two that universities making a definite attempt to apply quality management to their own activities [48].

In this section it is discussed how to apply quality management to education, especially higher education, in Maritime Training and Education Field.

4.1.1. WHAT IS THE PRODUCT?

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.

4.1.2. WHO ARE THE CUSTOMERS FOR 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.

The training and education system recognised the existence of a number of supplier, customer relations, as shown in Table 4.1.

4.1.3 WHAT SHOULD SOCIETY EXPECT FROM EDUCATION?

The content can be analysed in four categories:

1. Knowledge, which enables the people to understand what they learn in relation to what they already know [49]. 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.

Table 4.1 Customer - Supplier relations in Education and Training

Customer	Supplier	Services
Students	Teachers	System Management
		Curriculum Design
		Counselling
		Leadership
		Materials and Equipment
	Administrators	System development and analysis
		Materials and equipment
	Faculty Boards	Policy
Teachers	Administrators	Materials and equipment
Parents	Faculty system	Knowledge, wisdom, know-how and character of student
Industry	Faculty system	Knowledge, wisdom, know-how and character of graduates

2. Know-how, which enables people to do. Know-how takes people past merely understanding. Know-how enables people to put knowledge to work [49]. 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.

3. Wisdom is the ability to distinguish what is important from what is not [48,49]. Wisdom enables people to set priorities on how to use resources of time, energy, and emotion.

4. Character, as Stephen Covey has said, is a combination of knowledge, know-how, and wisdom coupled with motivation [49]. 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 educational enterprise to identify what to include in each of these four categories. It appears that in higher education, attention is given only to the first of the four categories, with the last two not even given lip service.

In Higher 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 pay attention to the development of either wisdom or character in accordance with the goals for education in the year 2000.

4.1.4. DEFINING QUALITY IN EDUCATION

Quality in education is what makes learning a pleasure and a joy. Some measures of student performance may be increased by threats, by competitions for grades, or by prizes, but the attachment to learning will be unhealthy. It takes a quality experience to create an independent learner [50].

The lecturer who is providing quality in education when he or she finds the students working diligently with enjoyment in independent study and discussing what they have learned, in an animated way, eager to engage the lecturer in debate or to show the lecturer what they have discovered for themselves.

4.1.5. THE DIFFERENCE BETWEEN FEATURES AND QUALITY

In the application of quality principles, it is important to distinguish between the concepts of features and quality. Features are what the lecturer put into the product to distinguish it from other products and to appeal to the people for whom the product is intended. The kinds of knowledge and know-how that are included in the curriculum represent the features of the educational program. A faculty may boast, for example, the excellent laboratories and workshop facilities for student use or may tout its computer facilities and internship program with industry, these are features.

Quality, on the other hand, has to do with the way the features are delivered. Laboratories may be unkempt, equipment may not always work, the instructions may be poor, the internship in industry may be just an excuse to send the students away for a time and allow them to earn some money while the faculty consults.

4.1.6. THE DIFFERENCE BETWEEN TEACHING AND LEARNING

Teaching occurs when the lecturer show the student how he or she solve a problem. Learning occurs when the student figure out how to solve the problem. Quality management in education should be concerned with the improvement of both processes, teaching and learning.

Learning can never be separated from the motivation to learn. One of the most powerful principles of learning is this. Lecturers therefore should pay great attention to creating a healthy situation in which the students feel a need to know. A common mistake in teaching is to create a need to know through fear, for example announcing an important test to be given in the near future and emphasising that grades will be strongly dependent upon the results. This is the aspect of education that made Einstein says that it was only after his education that he could begin to learn [51]. Edwards Deming is explicit on this point and says that fear is destructive of education. At best it produces conditioned reflexes. At worst, it generates cynicism and disgust with education [51].

4.1.7. THE ROLE OF TESTS AND EXAMINATIONS

Quality leaders in world commerce have eliminated the need for final inspection, so should the aim of academia be to eliminate the need for final examinations in education [52]. Final inspection used to be the method whereby a manufacturer attempted to assure the company and its customers that the product was fit for use. It seemed like a reasonable approach, and, for most educators, the concept of a final examination seems rational. In industry it is found that reliance on final inspection increases cost, produces inferior products, and masks the in efficiencies of the process.

As one who has been an executive and has had to rely on the education of employees to produce better, more competitive products, what every engineering executive will tell that most of the employees do not know how to make use of the materials they studied in school. Most use only a very small fraction of what they have been taught. The efficiency of the teaching and learning process is low education, for most students, is getting past the next examination. For example when the teacher asks, "Are there any questions?" and the first question is always, "Is this material going to be on the test?" Many educators are beginning to understand the following principle with regard to examinations.

The only legitimate purpose of an examination is to enable the lecturer and learner to decide what to do next. What is implied in this principle is that the learning process should be a process of constant improvement in the acquisition of knowledge, know-how, wisdom, and character. The assessments should be designed to provide feedback to both the student and the lecturer as a means to improve the processes of teaching and learning. The student should use the feedback to improve the learning process. The lecturer can use the information to help the student improve the way the student learns. Since each student may have a different style, students should be encouraged to perform tests and to measure the results of different approaches.

The lecturer should use the feedback from all students to assess the effectiveness of the teaching process and to improve it. At the beginning of the semester, the lecturer should discuss with the entire class the list of competencies and the level of mastery

expected for each competency. The students should participate in the discussion of each competency; how they, themselves, will know their level of competency; how they will demonstrate it; how the lecturer will assess it; and what the lecturer will do to help them achieve it.

4.1.8. THE PURPOSES OF MARITIME INSTITUTIONS

Questions of purpose in the professions of maritime institutions are not new. They have been discussed for many years. Statements of purpose of maritime institutions are important. If students, faculty, and administration are to cooperate, they need a common goal. They need to share a common vision of how this goal will be achieved. They need to know how well they are achieving it, and they need to be able to discover, for themselves, what they can do to achieve it better. Setting goals and developing visions begins with a sense of purpose. What should be the purpose of a maritime institution?

When a number of statements of purpose of the different institutions are examined, the dean of a prestigious business school telling the spouses of his students "We teach our students how to get next to the money" Another dean of another prestigious school telling "We prepare the leaders of business." The best definition of a proper goal for a business school came from Tomas Bata who said in 1924 [53]: "The purpose of the business colleges is to teach their students to create values by honest work." Today, this statement would be modified that only by saying. The purpose of a school of business is to teach students how to organise and lead the efforts of others in the improvement of processes that create value for customers by honest work.

This statement can be modified as for the schools of engineering, the purpose of a school of engineering is to teach students how to create value through the design of high quality products and systems of production and services, and to organise and lead people in the continuous improvement of these designs [54]. In this statement of purpose, management is considered a part of engineering.

The statements of purpose of business schools and engineering schools cannot be totally inconsistent with the views of business and other enterprises outside the

school system. If they are to be professional schools, they need to play a role in reshaping these views. The question of the purpose of enterprises is now undergoing a healthy review. A decade ago, if it is asked a top management chosen at random, "What is the purpose of your business?" he or she would probably have immediately answer, "To make a profit!". The managers of successful companies in today's markets know that profit is a result of achieving a purpose that attracts the hearts and minds of customers and employees. Making a profit is essential to survival, but it is not a purpose of successful companies. Breathing is essential to living, but it is not a purpose. Eating is essential to survival, but it is not a purpose. Profit is essential, but it is not a viable purpose.

The purpose of a maritime institution is to teach students how to organise and lead the efforts in the improvement of the technical side of ship management processes that create value for ship managers or the ship operators by honest work.

4.1.9. VISION

The features, that is, the topic included in the education, will differ, but the approaches to quality will be the same. A process of change, with the following steps can be summarised as:

1. The administration and top management of training institution meet and develop a statement of purpose of the faculty. That purpose will make the development of the ability to lead others in the creation of value central to the mission of the faculty.

2. The faculty and administration will develop goals for themselves and their students. These goals will include learning objectives for the administration, faculty and students. The goals will each be stated in such a way that an assessment is possible. The assessment should be planned to be continuous, not periodic, and designed to improve, to improve the potential of students and the faculty.

3. The students, faculty, and administration develop policies with respect to how the education should be presented. These policies describe the responsibilities of all three parties. In many of the transactions of the faculty the different parties are, at one time

or another, customers and suppliers of one another. A lecturer giving an assignment is a supplier for a student. A student turning in a report is a supplier to the teacher. Policy statements should be based on the quality first principle, that is, every supplier should aim to provide customers with the highest possible quality goods and services.

4. Dean should develop a list of competencies as a way of defining the content of the educational offering of the faculty. Each competency should be described by giving both the level of competency and the method of assessment.

5. Dean should develop in consultation with department heads and the lecturers as a means of team work to their own approaches to the development of wisdom and character.

The main tool for teaching wisdom and character is the group project. Experiences with group activities, in which the members of the group are required to exhibit honesty, integrity, perseverance, creativity, and cooperation, provide the basis for critical review by both students and lecturers. Lecturers will need to learn to function more as coaches and resources and less as givers of knowledge.

6. All teaching and learning situations will be under constant review by faculty, students, and administration seeking to find ways to improve their quality.

Faculty board can monitor the effectiveness of the teaching and learning process and the statistical distribution of various measures of effectiveness among the students as a guide to improvement of the teaching process. Faculty can develop measures for and monitor the development of wisdom and character among the students. Since this will often require cross functional cooperation, the faculty should provide leadership in breaking down barriers between departments and among subjects.

4.2. LITERATURE SURVEY

Georgia Institute of Technology's quality journey has been stimulated and influenced by quality leaders in business and industry. Connections were made at the individual level during the 1980s, leading to quality orientation trip in 1991 for top Georgia

Institute of Technology administrators to Milliken Company headquarters in Spartanburg, South Carolina. This trip exposed key institute leadership to the promise and concepts of quality management and initiated the development of quality management process [55].

Firstly Georgia Institute of Technology's objective is to develop a customer driven process for continuous curriculum development. There are several activities that support this objective. Processes that more directly connect curriculum development to customers include [55],

•Twenty academic programs receive input from corporate advisory boards on a regular basis.

•Fifteen of these programs conduct periodic surveys of alumni.

•Focus groups and a quality function deployment process were used to assess industry needs to successfully generate the continuing education curriculum.

Leading the continuous improvement of the overall undergraduate education program at Georgia Tech is the Undergraduate Education Assessment Seminar. Modelled after the Harvard Assessment Seminar, it is undertaking several studies, including student and alumni input, to improve undergraduate instruction and is charged with the continuous improvement of Georgia Tech's general education program following Georgia University System assessment guidelines [55]. Assessment is becoming an increasing part of culture and reality, not only for general education, but also for specific degree programs. Assessment will be conducted for every academic major following the Georgia University System guidelines. Measurable outcomes are defined for every undergraduate major.

They learned how to use benchmarking as an effective improvement tool [56-58]. They have initiated doing informal benchmarking with IBM. At the college of engineering level, the systematic approach began with comparative benchmarking of 10 peer institutions analysing input-output variables. Best-practice process benchmarking visits were planned to four universities: Michigan, Illinois, California-

Berkeley, and Texas [55]. Secondly delivery of course materials at Georgia Tech is in very mixed stages of improvement and is extremely instructor dependent. The concept that has been most widely adopted in the past is based on the principles of fast-feedback systems, where professors obtain frequent feedback from students and report what they have learned back to the students with real-time teaching adjustments. Faculty in engineering have implemented this concept in a number of simple ways, for example, by giving the students red and green slips of paper and asking them to silently hold up the red one when the lecture is going too fast and losing the student or the green one when the lecture is beginning to drag. The instructor can respond immediately by clarifying the topic or moving onto the additional points and passing out index cards at the end of class and asking the student to answer two questions. "What was the main point in today's lecture?" and "What concept needs further explanation at the beginning of next period's class?" The lecturer can analyse the answers to make sure the material is coming across appropriately, and clear up any misunderstandings at the beginning of the next class.

In all parts of CQI, and especially for the academic side, they learned that as they improve, the more they see that needs improvement. Changing culture is not easy; they have a long way to go [59]. The academic environment, with a centuries-old scholastic heritage and a span of many campuses within specific disciplines, has a strong drive to preserve its legacies. There is tremendous resistance to many kinds of change, including the paradigm shifts required for CQI implementation. They are committed to CQI journey for the long term, because they know that there is much to be gained with CQI deployment. CQI implementation is underway at Georgia Tech. They have reported on some of academic side activities that have led to progress to date along with some of the insights they have gained.

•They are still learning how to configure the structures in their systems that will provide the most efficient leadership for journey.

•Curriculum development is becoming more strongly influenced by inputs from industry customers.

•Assessment is becoming part of the way they close the loop in the plan-do-check-act cycle.

•Classroom learning is being improved by fast-feedback methods, although their adoption at this time is still very instructor dependent.

They think that Georgia Tech still has a long way to go on its CQI journey. The same can be said for higher education in general.

The University of Maryland's journey in total quality began in 1990, when the president took an initial interest in the potential application of total quality to the university [60]. From this interest, he has evolved into the role of leader in driving cultural change through the total quality framework in both academic and administrative support functions. The university's pursuit of total quality was driven by necessity as well as by the desire to excel. From the president's perspective, three key factors motivated a serious look at total quality: the uneven quality of services provided by the university, the financial realities besetting the university as a state institution, and the extent to which industry was embracing the total quality framework [60].

The decision that uniquely defines Maryland's experience with total quality is the deliberate strategy to apply change principles to core academic processes such as teaching and academic decision malign. While many implementation questions are common to academic and industry settings, some thorny issues arise in applying total quality to the academic environment, and specifically when classroom learning and teaching processes are targeted.

Much sensitivity and effort is needed to fit the terminology of total quality within the university's traditions and academic discourse. Among faculties in particular, questions raised as soon as the standard terminology of total quality is introduced. Is the notion of customer too passive a label for the student who is partner to the creation of the product (knowledge and personal development) through collaborative learning? Does student involvement in defining academic requirements undermine the role of the teacher? Is the goal of consistency of service quality across the

institution anathema to the academic ideal of creative diversity and intellectual freedom? [61]

An interesting example of the total quality language barrier relates to the notion of the customer. Consider the diversity of customers laying claims to universities' services: students, parents, prospective students and their families, alumni, employers, faculty and staff, researchers at peer institutions, industrial and business partners of the university, accrediting bodies, citizens in surrounding communities, the legislature and tax paying public, community groups, and so forth. Given the rarity of alignment among the manifold interests of these diverse customer groups, the needs of these customers must be balanced against one another. Because of the too many customers syndrome, Maryland group finally converged on the student as the primary recipient (directly or indirectly) of most of the university's core academic and administrative services. Nevertheless, they still find it prudent to use the term student as the designation for primary customer group to avoid the occasionally vitriolic opposition the generic terminology of customers and suppliers may evoke in an educational setting. Similarly, the use of the term continuous improvement, and later CQI, for campus efforts in total quality reflected a compromise in diction over the total quality label. After some thought, they have adopted the following themes as their guiding principles in delivering total quality in the classroom [60].

- Customer-driven orientation
- Feedback-driven design and improvement
- Empowerment of students as co-producers
- Integrative view of problem solving
- Extracting value through teamwork and diversity
- Mutual respect in the classroom

These themes underlie the methods and the practices of the program. They found that, broadly interpreted, these principles can be used as seeds for clusters of activities and decisions, particularly in process oriented features of the program.

1. Customer Driven Orientation: Clearly the student is viewed as the foremost customer, but due attention is also given to the needs of industry as future employers. The Office of Institutional Studies conducted interviews with focus groups of employers in the area to assess the desired profile of their future recruits. As one outcome of this process, they expect to integrate employer needs into the set of metrics that track program success. In keeping with this industry orientation, students are exposed to corporate practices during class time earmarked for speakers from industry, and they also participate in less formal company of the month events, where small groups of students and a faculty member take field trips to examine the quality management practices of companies on site.

An internal customer group for their program is the faculty teaching the core sequence. They obtained frequent feedback from this group using both traditional instruments and detailed one on one and small group discussions. These discussions range from more general topics as evaluation mechanisms and grading, to specific requests for resources and support. Meetings of faculty as a team were crucial in the early design stages of the program, it was important not to make commitments on behalf of the faculty that they later could not live with or deliver. As experience accumulates, the regular team faculty meetings increasingly focus on issues of improvement.

2. Feedback-Driven Design and Improvement: Bateman and Roberts have emphasised the need for frequent and fast feedback as a cornerstone of quality in the classroom [61]. An important use of the electronic classroom is to easily capture and collect this feedback using several tools. For example, a one-minute paper is routinely completed after each class, and group-ware is used during presentations and assessment sessions to solicit and collect group input from both students and faculty teams. As expected, students are quite appreciative when they observe that the feedback is operating two ways. Instructors who go to the trouble of starting a class

with a summary of the feedback from the last class are repeatedly praised in the student evaluations. On the other hand, instructors who systematically ignore students' comments are roundly criticised. The underlying notion of fast feedback pervades routine aspects of the course as well. Driven by the overall orientation of the course, instructors make every effort to return graded examinations and papers as soon as possible, reducing cycle times compared to other courses.

The program as a whole uses multiple channels of feedback. A detailed evaluation is conducted several times a year and recorded longitudinally for an assessment of the program over time. In the case of the few students who withdrew from the program for various reasons, the program director personally conducted detailed exit interviews.

3. Empowerment of Students as Co-producers: Anyone who has gone through the ordeal of a faculty meeting where the notion of "student as customer" is hotly debated, can imagine the resistance elicited by the idea of student empowerment [61]. While the implementation of such empowerment in the academic setting is naturally delicate, it also holds the key to the most far reaching paradigm shift in educational processes. This redefinition of the boundaries of the teacher-learner relationship presents challenges on both sides. The challenge for faculty is to make the difficult transition from sage on the stage to guide on the side, without a feeling of loss or resentment. The challenge for students is to accept certain (possibly evolving) limits to the extent of empowerment. While the student is empowered to participate in designing and changing many features of the ongoing learning experience (for example through fast feedback), the students' initiatives and changes must conform to established ground rules and stop short of setting the academic rules. Moreover, empowerment does not imply an immediate adoption of all suggestions from students. Some may require further discussion in the students' quality team, and some may be tabled because they are in conflict with an instructor's values or teaching style.

As a step in the direction of empowering the students in the IBM-TQ Program, they have tried to encourage a sense of ownership of the program among the students.

Students have formed quality teams, committees and offered various concrete suggestions to enrich the program. They relied on the help and advice of students in marketing the program to prospective students and in screening incoming applications. In a few meetings, commitment to empowerment meant acceding to the students' wishes even when this challenged the initial plan for accomplishing a programmatic element. While each occasion for student participation and leadership may be viewed as small in itself, the cumulative message indicates genuine respect for students and their ability to co-produce the program.

4. Extracting Value Through Teamwork and Diversity: The central importance of teamwork to the IBM-TQ program objectives was realised early on [62]. Not only was facility in teamwork an important consideration in employers' minds, the design of cross functional class assignments necessitated the honing of team skills. Team processes should be facilitated from the start, they required all students to attend an orientation program for team skill development. This intensive three day program goes a long way toward creating team spirit and bonding, and is reinforced immediately thereafter through the assignment of a team project. The composition of each team is deliberately diverse, including both engineering and business students.

5. Integrative View of Problem Solving: Total quality involves an integrated, horizontal view of organisations. To prepare students for a total quality culture in the workplace, the faculty has to address horizontal linkages among disciplines and courses, a project based approach has been implemented in the introductory engineering design course. Engineering students work in teams to design and produce an assigned product. The just in time learning philosophy of this course dispenses with regular class lectures in favour of problem driven acquisition of information on an as needed basis. Naturally, this approach moves the delivery mechanisms of engineering expertise away from preset discipline oriented (vertical) channels [61].

Knowing that the engineering students in the IBM-TQ cohort had already experienced horizontal learning and teamwork in connection with this course. The goal in the first IBM-TQ course was to extend the boundaries of learning to encompass traditional business functions and operations management as well. The

projects assigned in the first and second courses both required integration at this level. In the first course, students must design a new product (such as a hairdryer) and prepare a complete manufacturing and business plan for its deployment. Completed projects are presented to and judged by a cross-functional team of faculty members from different disciplines. Some business students were initially apprehensive about these project requirements since they were not scheduled to take courses in the functional areas (accounting, marketing, operations, and so forth) until their junior year. Students were encouraged to act proactively and to contact faculty to seek the necessary information. In fact, subsequent course evaluations showed that the students associated the greatest amount of learning with the project components of the course, and observed that their effectiveness in teams enabled them to accomplish much more learning than in a regular course.

6. Mutual Respect in Classroom: All of the preceding points require a healthy environment, unadulterated by the trappings of dominance and power play. This applies to faculty respect of students, students' respect of faculty, and students' respect for each other. Significant maturity is expected from the students who, in turn, require caring respect from their instructors and the program administrators.

7. Extending Prototype: In keeping with the role of the IBM-TQ curriculum as a pedagogical prototype, the transfer and porting of ideas and course elements includes a week-long module in total quality, required of all students, that incorporates some of the pedagogical approaches and methods tested in the IBM-TQ Program [62]. Individual courses in the business school have expanded their coverage of total quality as well. Building directly on the working relationships and exposure to the student mix developed in the IBM program, faculty from business and engineering collaborated to incorporate principles of design, operations, quality, and statistical tools for quality management into a new engineering curriculum implemented under a major curriculum transformation grant.

One of the goals in designing the IBM-TQ Program was to marry the concepts of total quality with the improvement opportunities offered through information technologies. The primary arena for this confluence is the IBM-TQ electronic

classroom, although several other CQI projects have been enhanced by information technology as well. The IBM-TQ program includes 20 computers, linked to each other and to the instructor's computers. With each pair of students sharing a computer that recognises the individual students' inputs, the capacity of the classroom is 40 students. The information technology architecture includes multiple software applications including shared graphics, word processing, courseware specific to various classes, group-ware, as well as software developed explicitly to support class note taking and feedback processes. Two large projection screens display the information generated on computers by the students. Alternatively the screens can be used to display instructor designed information or input provided by any one of the students in the class. The program also serves as a true virtual classroom. It is equipped as a teleconferencing facility, enabling the integration of corporate boardrooms or factory back rooms into the learning experience, as long as counterparts have similar teleconferencing capabilities.

There are several pedagogical advantages that are uniquely facilitated by this electronic architecture: (1) It provides equal opportunity for student involvement in ongoing classroom activities, regardless of the student's learning and communication styles; (2) It enables multidirectional communication and feedback processes among students or between professors and students; (3) Cycle time for all processes is dramatically reduced, allowing the use of more frequent and diverse learning and feedback activities in any given class.

Total quality principles guide the pedagogical innovations in the program and the computers are mere enables of these innovations. Some examples of total quality-based learning and teaching processes and tools, facilitated through the electronic classroom environment, include

1. One-minute, anonymous papers at the end of each class, in which students take a few minutes to articulate the key points learned in class and the points that remain muddy. This provides teachers with immediate knowledge of teaching and learning effectiveness, and they respond via electronic or regular mail, or during the next class period, as warranted by the feedback.

2. A student feedback meter that acts as an ongoing pulse taker for teachers. This feedback is also anonymous. Students can hit a key signalling that they got it or didn't get it. The tally is displayed on the instructor's screen as a bar graph in two colors, green for "got it," red otherwise. This meter informs the instructor, in real time, about the pace and success of the teaching and learning, and allows for immediate corrections to be made.

3. Complete group involvement in class design and learning processes via group based interactive software. The tools are very fast and can be used to involve students in establishing class agenda ("Which of the topics for today reflect top learning priorities?"), in uncovering difficulties in understanding the material ("What are the most important questions remaining in mind from the material for today"?), in processing cases ("How would the student solve this problem?"; "what questions would the student ask this client?"), in gauging class opinion around a controversial topic or issue ("Do student agree or disagree with this legislative decision, company policy, suggested design strategy? "), and in designing facets of the course ("Assign suggested weights to the exams and papers for this course"). Every student provides input, and input can be displayed piecemeal (for example, every idea during a brainstorming exercise arrayed on the screens) or in the aggregate (rankings or means displayed).

4. Facilitation of student learning by providing electronic outlines and notes from the instructor, which the students can augment with their own electronic notes. Not only does this facilitate organised learning, it also maintains student attention during the class.

5. Collaborative learning, since students are involved in delivery of the material, and their input is readily shared (via electronic sharing devices) with all other students and with the instructor.

6. Ongoing measurement of learning and teaching processes, facilitated through immediate display of results of the data collection. Results can be discussed as soon as the last person has input his or her ratings.

7. Team teaching to reflect multiple perspective on a given topic, facilitated through electronic communication between the faculty jointly teaching courses.

It is important to emphasise that the IBM-TQ teaching program is not, by itself, the embodiment of total quality in teaching and learning processes. The teaching environment is merely a tool (an efficient and readily available tool) to enable total quality based processes. The faculty must still decide on the nature of the systematic linkages between total quality principles and teaching applications, and exploit the tools of the classroom to this end. Untrained or unwilling faculty thrust into this environment can continue to teach their classes as before, leaving untouched the possibilities inherent in the classroom architecture.



The evaluation of this marriage of total quality principles with the tools of information technology has demonstrated that [61];

- The range of pedagogical approaches used by an instructor can be enlarged through this learning architecture.
- Real time involvement of the entire class greatly adds to the excitement of the learning process.
- Ongoing student feedback enables the teacher(s) to stay in touch with student reactions, and to improve classroom processes immediately
- This is the classroom and the pedagogy of the year 2000. Faculty using these processes are ahead of the curve.

The IBM-TQ teaching program is an example of the enhancement of the CQI process through information technology. There are, however, other illustrations. Technology has enabled on-line student registration and billing using Touch-Tone telephones, thereby providing students with 24-hour access to this instant service from anywhere in the world, cutting down wait times, and freeing personnel to engage in more value-added activities. As another illustration, they are also now in the process of introducing customer feedback surveys via (data linked) telephone system. At the end of a service call after the service provider has signed off, a random sample of

customers will receive an on-line customer service survey, delivered and instantly coded via the voice-based digital telephone system [61].

Maryland, only three years have passed since the beginning of programmatic efforts in total quality. Even by industry standards, this is far from maturity in the process of evolving into a changed culture. In this period they have learned some lessons that provide a firmer foundation for charting the future course.

Students are energised by the sense of ownership and the challenge presented by the program. Students will tolerate a certain level of experimentation and will forgive unintended errors that arise from trying novel processes.

Team teaching is often a first response to the call for integrative course content. As a source of cross pollination and exchange of ideas, this first step has worked well in core program. Students, however, expect the teaching team to add value beyond simple division of labour between the instructors. Team teaching elevates expectations by drawing the student's attention to the interplay of the ideas and perspective of the two instructors. Students appreciate a true dialogue between their teachers.

As a result it can be considered for the above Maryland's QIJ, İ.T.Ü Maritime Faculty has to establish computer based simulation lectures into its Deck and Marine Engineering Department's curriculum. In addition to that teleconferencing and share ware based lectures need to be establish in near future for ensuring competitive implementation in Seafarers Training.

The College of Business at Rochester Institute of Technology (RIT) has been committed to the principles and application of total quality since 1990. Neither the administration nor the faculty accepted this new direction lightly, as it was quickly recognised that such an initiative would challenge the very nature of traditional academic thinking on organisational structure, leadership, faculty responsibilities, and relationships with constituencies [63].

During the 1990-1991 academic year, the faculty and staff were introduced to the tools and techniques of total quality through a series of industry-sponsored

workshops, seminars, and training sessions. They provided a foundation on which to consider application of these principles in an academic environment. A tremendous amount of support was obtained from industry partners such as Xerox Corporation, IBM, Eastman Kodak, and Motorola [63]. These early relationships were invaluable in providing the most current and relevant training available at that time.

In the fall of 1991, the faculty unanimously approved a formal resolution to proceed with the transformation of the college. The college committed itself to the integration of total quality into both the curriculum and operations, resulting in an aggressive transition plan and workload for faculty and staff. With few exceptions, they accepted and met the challenge.

In 1992 the college abandoned the traditional departmental structure found in most colleges, adopting instead a flat organisation with decentralised decision making. Program teams of faculty, staff, and even central support personnel, oversee many of the current initiatives in the college. Several important steps were taken early in the transition period that reinforced and clarified the implications of total quality on the future of the college. First, through the collective efforts of faculty, staff, administrators, and external advisory groups, vision and values statements were crafted that clearly articulate the college's commitment to total quality. Another step taken early in the transition period considered by many to be the most important was a revision of the promotion and tenure norms. The transition to a total quality organisation began with the faculty resolution of 1991; it continues to be dependent on faculty commitment. Current literature on total quality in colleges and universities suggests that few schools have taken this important step in assuring longevity of the movement [64]. The College of Business recognised that it is the faculty, not the administration, who must carry out the changes. Faculty are at the centre of the most important functions of teaching, research, and service.

Most service activities, teaching requires the full participation of the customer. If a student does not study, review, question, and seek help when it is needed, the best efforts of the teacher will fail. Any plan for achieving continuous improvement in teaching must include provision for involving students in the process. Similarly,

more than almost any other service activity, teaching tempts and permits the seller to blame the customer for failure to achieve the objective. Any plan for achieving continuous improvement in teaching must include provision for discovering the causes and defects so they can be eliminated. Teaching can be viewed as the process of instruction and facilitation of learning. Students are excellent judges of the quality of the teaching process since they are the immediate customers of that process. They can provide feedback on the quality of the delivery of instruction and facilitation of learning. Students can tell whether they are learning, whether processes do what they purport to do, and whether faculty is meeting their expectations.

In teaching, it should be seek to meet the expectations of students. The best way to know what they expect is to ask them. Assign students in just one course is not sufficient because they will have different expectations depending on the subject matter. The faculty can get the real expectations to surface by;

Data collection: Questions can be open-ended, such as: What is the most important point of today's lesson? What suggestions do you have to improve the course? What concerns do you have about the course so far? The feedback that lecturer receive will vary.

Analysis of the data: After collecting the data, analyse them to determine which items lecturer will do something about and which items lecturer cannot or will not address.

Feedback to students: At the next class, lecturer can give students some feedback on the data. If they do not believe that lecturer is being responsive to their feedback, they will simply stop giving it.

A common error made by some lecturers who use this feedback mechanism is that they ignore the data and do not make any adjustments in their own behaviour Another error is a failure to inform students how the data were used. College of Business's techniques to improve teaching and interaction with students is demonstrated below [63]:

Course Preparation and Organisation: Think through the course before it begins, prepare a syllabus in accordance with guidelines, be ready for the students who do

not perform as well as best students.

Write learning objectives for each class session. As a result of each session, which objective(s) should the student achieve?

- Recognition or recall. Students should remember or recognise appropriate terminology, facts, ideas, trends, sequences, and principles.
- Comprehension. Students should understand written communications, reports, tables, diagrams, directions, and regulations.
- Application. Students should be able to apply ideas, rules, procedures, formulas, principles, and theories in job-related situations.
- Analysis. Students should be able to break down materials or information into parts, detecting relationships or the parts and how they are organised.
- Synthesis. Students should be able to put together elements and parts to form a whole, combining to form a pattern or structure not previously obvious.
- Evaluation. Students should be able to make a judgment about the value of ideas, works, solutions, methods, or material using prescribed criteria or standards for estimating the extent to which they are accurate, effective, and economical.

First Day of Class : Welcome students, introduce yourself. Have an informal discussion about the course, Ask students to relate experiences within the framework of course topics. Inform them how they will be evaluated, weights for each item, dates for exams, types of exams, and due dates for projects. Institute a system that will enable lecturer to know students by name. Consider the use of a seating chart, name tags or placards, or photographs. Inform students of the days and times that lecturer will be available for office hours.

Demand Their Best : Tell students to work hard. Emphasise the importance of holding high standards for academic and personal achievement. Being customer/student focused does not mean lower standards or expectations.

Outline each session on the white board, a transparency, or in a handout : Summarise main points before class ends. Give a 1-3 minute summary of the last class at the start of each class. Use visuals to supplement lectures and provide copies when possible. Consider whether instructional methods used for day sections are suitable for evening students. Choose strategies to fit the level of students and learning objectives. Have clear and readable handouts.

Use Real World Examples: Encourage students to seek outside materials. Recommend books and articles from the library. Provide applications as often as possible. Give students real life situations to analyse. Let students share and examine learning derived from their cooperative education experiences.

Show Interest and Respect for Students: Respect students as adults. Address students by name and encourage them to do the same with each other. Students may show more interest if lecturer show interest in their learning. Ask questions and encourage class participation. Show the care about them, whether they do right or wrong. Use appropriate humour. Respond respectfully to questions.

Be Flexible : Be fair to students who have missed a class or an assignment for a good reason. If an emergency causes for the absence of lecturer from a class, arrange for an explanatory note to be posted on the classroom.

Show Concern for Their Learning : Speak at a pace that students can take good notes. Listen to their questions and comments. Avoid rushing through material that students do not understand. Ensure understanding, especially students who have a hearing or visual impairment or a learning disability. Avoid excessive discussion of material not related to learning objectives. Encourage students to speak up when they don't understand. Be patient with students who are struggling. Provide extra material for students who lack essential background or knowledge or skills. Avoid giving exams on the last day of class.

Use a Variety of Instructional Methods : Use an appropriate mix of the following methods: case studies, role plays, guest lecturers (industry professional colleague), media such as film strips, demonstrations, class discussion, small group discussion,

exercises, simulations, and video recording. Try a Mix of Learning Projects : Use an appropriate mix of learning projects, such as term papers; case analysis, critical analysis; individual or group presentation research project that requires either a survey or interviews, or other methods; site visits and tours; and problem solving and field activities.

Use Available Equipment : Make use of available instructional equipment, such as the white board, flip charts, overhead projector, slide projector, movie projectors, data show projector, and other equipment.

Advocate Teamwork and Cooperation : On the first day of class, ask students to tell each other about themselves. Encourage students to prepare together for class. Encourage students to do projects together. Ask students to praise the accomplishments of others. Create study groups or project teams. Set aside class time for some work to be done in groups or teams. Encourage students to join at least one campus organisation.

Students Learn Best by Doing : If lecturer tell students something, they may forget it. If lecturer show them something, they may remember it. If you involve them in learning, they may understand it. Ask students to present their work to the class. Give guidance on presentation skills. Ask students to summarise similarities and differences among theorists, formulae, methods, models, research findings, procedures, and processes. Ask student to relate outside events or activities to course topics. Encourage students to respectfully challenge ideas of others. Use simulations, role-plays, or labs. Encourage students to challenge old ways. Get Frequent Feedback from Students. Ask students periodically if they are keeping up with the material. Ask what they learned in class, such as, "What was the most important thing you learned?" and "What didn't you understand?" Respond to feedback in a way that encourages students to freely and frequently give it. Listen intently to student comments and opinions. Add to their ideas. At the end of class, summarise the main points. Announce that everyone who does not understand should see lecturer after class. Ask students to write on a piece of paper any comments about the course and to anonymously submit them. Consider making appropriate adjustments in the

course. Teaching effectiveness is essential to faculty's mission. Teaching effectiveness will be emphasised as faculty continuously improves the products (curriculum, majors, courses) that faculty offers external customers (students and employers) and the process (teaching, advising, administration) by which the products are delivered. Crucial in this endeavour is techniques to improve individual and collective effectiveness as teachers.

Motorola University began in 1981 as the Motorola Training and Education Center. It was created as a result of an analysis of Motorola's training needs and established as a corporate department in the human resources functions. During the 1980s, Motorola University's charter was to help the corporation build a quality culture. To meet this challenge, an internal training design system and implementation process were developed. The 1980s also saw the establishment of corporate wide training plans and training investment policies. By the end of the decade, Motorola University had expanded its operations both in the United States and abroad. The opening of the Galvin Center for Continuing Education in 1986 and the Singapore Training Design Center in 1989 brought new educational opportunities to employees around the world. Since 1990, Motorola University has diversified further, establishing academic partnerships with institutions of higher learning around the world. Motorola University has also implemented cultural design and translation services. This has become especially important as Motorola moves into new and emerging markets in Eastern Europe, South America, and the Asia-Pacific region [65].

The university's instructional design and development efforts are divided into competency centers. The centers include technical experts, researchers, and course developers who produce courses, videos, books, and software. The centers are technology, market development, executive education, product and software engineering, quality, and management education. Other Motorola University services include evaluation, alternative learning, supplier customer training, and the transformation of public education. The university manages numerous training facilities around the world. In general, the facilities include classrooms, break-out rooms, training laboratories, and conference planning and management. During the preparation of 1994 long-range plan in Motorola University, it was considered to

create a new vision of what the future was going to look like. Three pervasive industry issues are cycle-time reduction, global expansion, and optimisation of creativity and innovation. As a part of striving for quality and continuous improvement, Motorola has the following goal for all its processes. Cycle time is the total time for one execution of a process. A number of organisations are introducing an average of a new product or service once a day. Reduction of cycle time of new product or service introduction is critical. Today rapidly increasing rates of change and its imperative of quickly meeting market demands, fast cycle time is critical for global competitiveness.

The query can be raised for the maritime training institutions: Are faculties conveying to students the urgency of speedy new product or process introduction and finding ways to achieve it? In maritime training the new regulations and rules are coming into mandatory implementation rapidly. Is there a methodology in the faculty for the application of new rules and regulations.

A key component of new product or process cycle time is design cycle time in the means of adapting into the existing curriculums. Motorola has benchmarked a number of organisations both in the United States and overseas to find ways of reducing cycle time [65]. It was determined that establishing new programs for the lecturers how to cooperate the new inputs with existing the conditions in training curriculums. In global expansion another query can be raised for the maritime training institution that, are faculties making the students aware of the kinds of global expansion occurring in major companies today? The shift of employee populations from domestic to outside the Turkey? How to maintain company focus and culture in the face of global expansion to achieve the acceptance in different countries? In optimisation of creativity and innovation the query for the each lecture in maritime training institution can be: Are lecturers stressing innovation and creativity in process or are lecturers encouraging only conventional thinking?

To become a lifelong learning institution, and to establish a proper Quality Management Motorola University made five shifts [18].

- From funded operations to a not-for-profit business

- From limited systems to integrated systems
- From a global institution to a transitional institution
- From instructor-based learning to multilearning formats

In accordance with the five shifts the following queries can be obtained:

1-) Do the students have a realistic view of the constraints that exist within corporations, or are they encouraged to believe that corporations have deep pockets and unlimited funds to spend?

2-) Does the faculty have effective and efficient systems that allow to reduce cycle times and that can support the changes that the faculty need to make?

3-) Are faculty board and lecturers in the faculty looking only internally to themselves, or are they looking at what is going on in the outside of campus and bringing in outsiders and trying to learn from them? Does faculty board understand the benefits of bringing together people with different mindset and perceptions in order to get good ideas for improvement and innovation?

4-) Are the students becoming adept at applying what they are learning?

5-) Do the students know how to continue to learn? Do students understand that every experience they have, every interaction they have, offers an opportunity to learn and to apply that learning to their carrier?

Similarly the quality management techniques and ISO 9000 registration process has been initiated by the Arizona State University, University of Tennessee, University of Kansas, Keller Graduate School of Management, Oregon State University, University of Chicago, University of Nevada, Florida State University, Portland State University at the beginning of 1993 [64].

4.3 IMPORTANCE OF QUALITY ACTIVITIES IN EDUCATION

Total quality activities are necessary because their successful implementation will enable faculty to :

- React quickly to customer needs. By determining customer expectations and surveying satisfaction, faculty can become more responsive to the needs of its customers.

- Focus limited resources on activities that truly satisfy customer needs. With data and information regarding customer satisfaction areas faculty can eliminate services that are not key drivers of customer satisfaction.

- Make improvements in a systematic way. Engaging in the problem solving process will enable faculty to analyse facts and base actions on facts and test results, thereby becoming more effective organisation.

- Engage and use the creative abilities of all organisation members. An effective quality implementation strategy in higher education will involve all community members in the continuous improvement and change process.

Focus on improving processes. When results are unacceptable faculty can flowchart, troubleshoot, and modify the processes that deliver those results.

In industry, a focus on the product is perhaps the most straightforward application of total quality because product characteristics are relatively easy to measure, monitor, and improve. Support services are slower to adopt quality management principles. In higher education, it is seen that progression in the opposite direction. The product of education is delivered in the curriculum. Curriculum is the domain of the faculty, who may resist change. Results can be difficult to measure.

As a result the supplier and the customer relationship and the customer expectations need to be investigated in more detailed approach. For this reason it is essential to define the customer of faculty or in the means of higher education.

Society is the ultimate customer of the faculty, Figure 4.1 decipts the customer of heigher education. As Figure 4.2 details, what is required is a twofold quality process, one that addresses not only basic offerings (curricula), but encompasses administrative processes as well. By understanding how faculty can deliver enhanced service (by determining what faculty's customers would like to see in the future). Eventually what was initially an enhanced service will become part of either the basic offering or support service in order to yield higher levels of customer satisfaction. This also will enable the institution to provide products or services that competitor institutions do not currently offer, which yields competitive advantage.

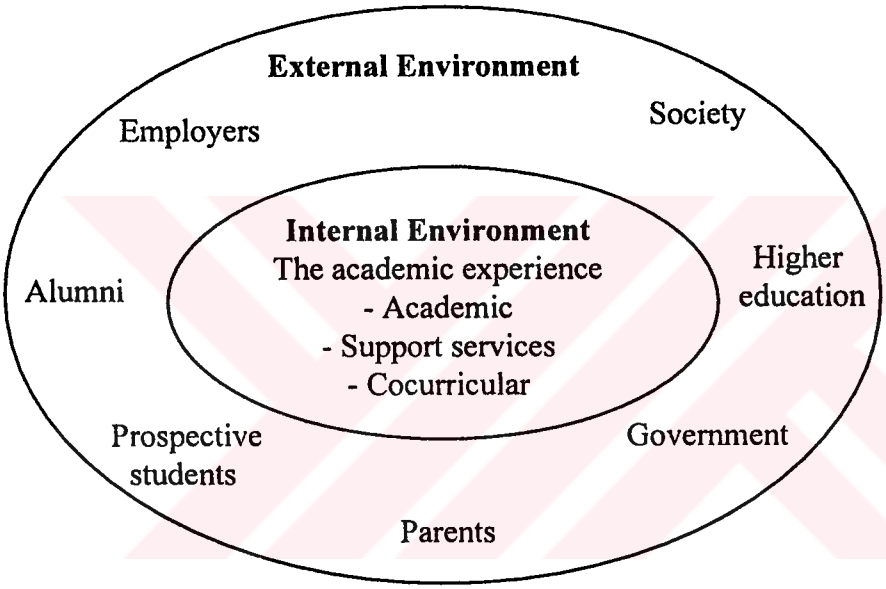


Figure 4.1 Customer of higher education.

Adopting total quality necessitate will give up ownership of the curriculum by the faculty. It will require consideration and accommodation of the needs of multiple customer groups. No longer can faculty simply say the curriculum is the exclusive domain of the faculty. Faculty will need to develop and modify curricula according to input, data, and information from customer segments, including students, employers, and parents. In addition, faculty will need to be cognizant of the connection between the classroom and co-curricular student development opportunities.

Professional service providers (like health care and higher education) must develop more effective strategies to engage the professionals and faculty in the adoption and

implementation of total quality. The classic implementation strategy in industry is a top-down approach. With this strategy there is typically a full-scale, organization wide total quality launch. Training is conducted, teams are launched, and all employees are expected to be involved within a relatively short period of time.

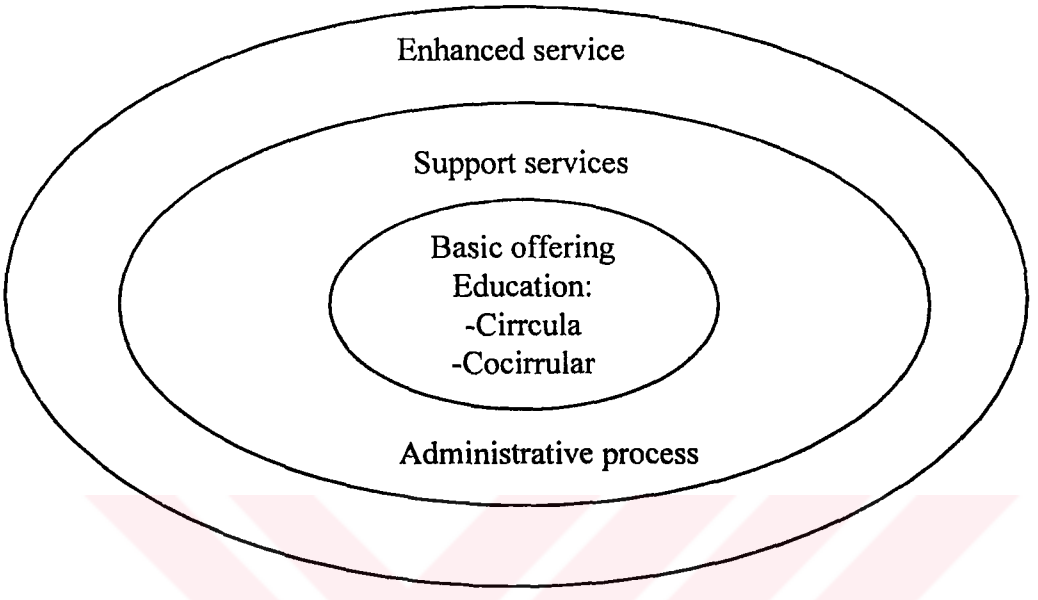


Figure 4.2 A two-fold total quality focus

A main goal of the quality department in the faculty is the development of an organizational infrastructure to facilitate total quality implementation. The model, to be detailed for Maritime Education and Training, using the Shiba's approximation. This model is illustrated in figure 4.3. and figure 4.4 [66]. Specific elements of each of the infrastructure areas are as follows.

1. Goal setting involves articulating what faculty want to achieve with respect to total quality. This includes results as well as process related goals. This can be achieved through the incorporation of quality goals into the current evaluation system and preparation of a strategic plan for quality that includes specific goals for the next specified terms.

2. Organization setting involves deploying the necessary resources for implementation. This could involve setting up a department who reports to the highest level in the organization.

3. Training and education involves enabling people with tools and techniques. Decisions must be made regarding the content and length of training based upon the individual needs of the institution. A significant proporaon of the training is dedicated to effective meeting skills, in order to enable a more disciplined and effective process for meetings.

4. Promotion involves, newsletters, and other written materials as well as visual displays and promotional events to pique interest and enthusiasm. Faculty can also submit information on quality initiative to the student and employee newsletters on a regular basis.

5. Diffusion of success process is a mechanism to learn from others and includes communication of specific means and results, the methodology applied by particular teams, and so forth.

6. Diagnosis and monitoring involves a plan-do-check-act (PDCA) cycle of the overall total quality initiative, which allows modification if necessary. As a result of initial PDCA, faculty can start working more closely with the cabinet on inspecting the process and furthering team motivation. Additional training opportunities in response to employee needs can be developed.

QFD (Quality Function Deployment) is an approach to operationalising the concept of customer focus for an entire product or service line in an organization. The QFD process ensures that customers' needs, expressed in customers' own language, become the basis for definition of a product or service. These needs are translated into operationally defined characteristics, with target values and detailed plans for achieving those values. QFD's purpose is to ensure that quality, as demanded by the customer, is incorporated into each stage from definition to delivery of the product or service [67].

Introduced by Yoji Akao in the late 1960s, QFD was used in Japan in the early 1970s by Mitsubishi and Toyota to improve the quality of their products [68]. Because of its success in Japan, American companies recently have shown a growing interest in QFD.

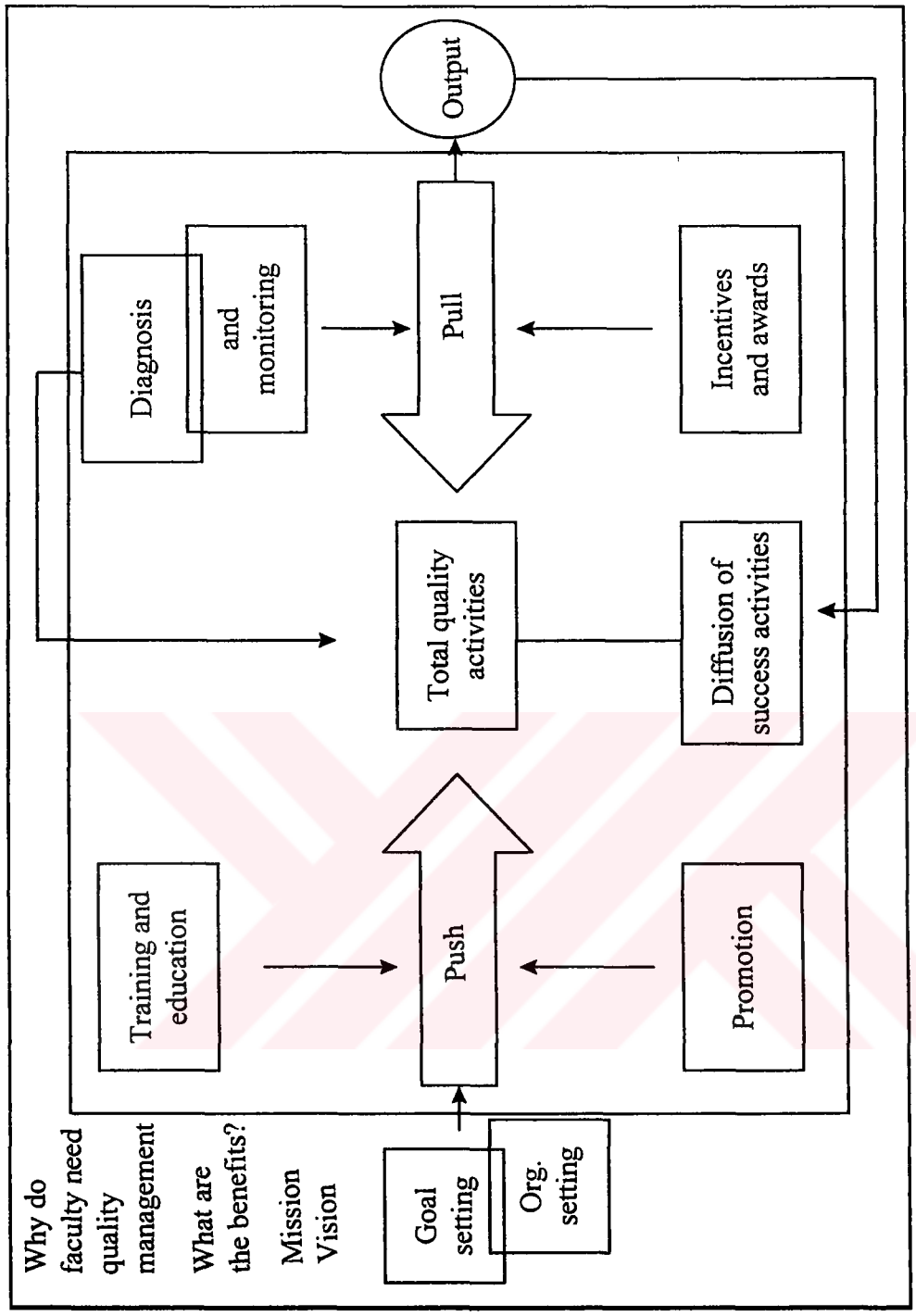


Figure 4.3 Total quality organisational infrastucture

The success of QFD requires that the entire organization understand how the work of every department is linked to meeting customer needs. In a manufacturing organization, for example, marketing, research, design, production, sales, and service people must work as teams to ensure that customer demanded quality is incorporated

systematically through the definition, design, and improvement of a product. Teamwork and a constant focus on customer demands can substantially reduce the time and cost associated with the delivery of a quality product. When more time is spent defining the product, typically less time is required to design the product, and the need to redesign is minimal. The use of QFD shortens the entire process by helping to focus priorities, providing better documentation, and facilitating communication among team members. In this study, it is described an approach to the design and continuous improvement of maritime training service that combines the concepts of QFD that is shown in Figure 4.4.

1. Determine broad customer demands	2. Develop detailed means for achieving broad demands	3. Obtain information about importance of demanded attributes	4. Develop measurable characteristics associated with demanded attributes
1.1 Get input form groups that are knowledgeable about educational requirements	2.1 Define second level detail for broad requirements	3.1 Based on demanded attributes, develop focused areas in which to seek customer input.	4.1 For each detailed demanded attribute, devise related quality characteristics (element that can be measured)
1.2 Organise input into several broad categories of requirements	2.2 Define next level detail as needed	3.2 Obtain customer input about relative importance of demanded attributes	4.2 Combine all derived quality characteristics and organise them into meaningful groups
1.3 Verify accuracy and completeness of results through customer feedback	2.3 Verify accuracy and completeness of results through customer feedback	3.3 Obtain customer input about how well current education meets their requirements	4.3 Review quality characterisitcs for completeness
1.4 If necessary redefine broad demanded quality attributes	2.4 If necessary redefine detailed customer demands		
1.5 Prioritise broad demans			

5. Determine the correlation between measurable characteristics and demanded attributes	6. Determine areas of educational service on which to focus improvement efforts	7. Devise plans to make improvements in chosen areas	8. Monitor results of changes to judge their success
5.1 Establish correlations due to casual relationships	6.1 Select demanded attributes of importance to customers	7.1 Develop theories for improving performance in idenfied areas	8.1 Use quality characteristics to assess impact of experiment
5.2 Establish correlations that result form data analysis	6.2 Use correlated quality characteristics to evaluate current performance	7.2 Use quality characteristics to measure current performance as a baseline	8.2 If change leads to improvement, adopt change
5.3 Establish correlations that are postulated from experience and intuition	6.3 Select areas important to customer where current performance in most deficient	7.3 Devise an experiment to implement the most promising changes	8.3 Evaluate whether performance has improved to a currently acceptable level

Figure 4.4 Top-down flowchart of the QFD process

The top-down flowchart in Figure 4.4 outlines an approach to the use of QFD in the education environment. It begins with the very important, often difficult, step of listening to the customer. This involves asking the question: "Who is the customer, and how should faculty listen?" There may be several groups of customers and many ways to listen, including customer surveys, focus groups, customer interviews, customer complaints, and third-party reports.

Determination of the Broad Customer Demands: Initial action (step 1.1 in Figure 4.4) is to listen to customers by asking what are your needs? Their responses centered on the logistics of obtaining their education and their perceptions of the educational content needed to be a successful person. In order to obtain information about the type of education needed from the perspective of people more familiar with business, a question can be raised that "What general characteristics do students need to have successful business careers?" Finally, information concerning current trends can be

obtained. Specific expressions of need sometimes are reinterpreted by the authors to reflect a more general concept. The question addressed to the students is designed to solicit input regarding their needs while obtaining their education. Their answers may reflect the fact that many students, because of their limited work experience, do not realise the full range of qualities and skills they will need to be successful in the future. The questions addressed to the other groups of customers were designed to gather this information. In analysis faculty can handle the student responses separately from those of all other customers.

Upon completion of this stage of QFD, a large volume of information related to needs could meet. The information consisted of many seemingly unrelated responses and needed to be organized. To accomplish this task (step 1.2 of Figure 4.4), affinity diagrams are constructed from the responses for each of the customer groups [69]. The procedure consisted of transferring the responses to index cards, randomly scattering them on a large table, and regrouping them according to their perceived affinity for one another. For each group an underlying theme can identify and writte on an index card to be placed on the top of that group of cards. Subsequently, the each group was treated as a single card with the response being the underlying theme. The process of grouping responses by their affinity for one another and determining a theme for each group was repeated until all the groups are formed. Construction of an affinity diagram is expected to reveal the broad underlying themes in the original verbal data. For the Maritime Training customer responses to questions is listed in Figure 4.5 and the resulting broad categories of demand are shown in Figures 4.6 and 4.7.

Good knowledge of international competitive forces
Graduates able to mentor, teach, and coach
Graduates exposed to the humanities
Graduates have some idea of how a real company operates
Graduates sensitive to other cultures graduates like the foregin seafarer's value cooperative behavior
Graduates who understand the principles of competing on quality and business speed
Graduates with a high energy level
Graduates with common sense and knowledge of shipping environment and culture
Graduates with good communication skills
Graduates with realistic expectations about their future careers
Graduates with the ability to recognise what is not known

Have the facility to organize and characterize information
Knowledge of the basic subjects from science that are relevant to operational analysis
Knowledge of the relationship between business and society (P&I, H&M, PSC, Class Society etc.)
People who can work across organizational boundaries skills at collecting data, prioritizing, and hypothesizing
Skills at conceptualizing problems that are presented in messy, confusing ways
Skills at hiring, firing, evaluating others, and wording with difficult people
The ability to listen effectively
The ability to observe an activity and to understand why it is being done
The ability to understand how organizations and groups work
The capacity to shift focus from the micro level to the big picture
Willingness of graduates to share power

Figure 4.5 A partial list of customer responses to questions.

As expected, demands differed with perspective. Figure 4.6 makes apparent the curriculum-related concerns of faculty. In contrast, Figure 4.7 reflects students' concerns with administration and delivery of the program as well as curriculum. Clearly, both views would require attention in the subsequent design process.

1. Ability to recognize and solve problems
2. Ability to analyze and synthesize
3. Sound business skills
4. Knowledge of competitive shipping business strategies
5. Understanding of issues facing company people in the real world
6. Ability to enable people
7. Good interpersonal skills
8. Personal attributes
9. Attributes associated with renaissance people

Figure 4.6 Broad demanded characteristics of students as expressed by faculty and publications.

Before proceeding, results were shared with key alumni to verify that all the important dimensions of program had been identified (step 1.3 in Figure 4.4). This group affirmed the broad dimensions in Figure 4.6. In general, it is important to the QFD process that an attempt be made to verify the accuracy of the interpretation of customer expressed needs and to reinterpret if necessary (step 1.4 in Figure 4.4).

1. Better delivery of information about the education
2. Better delivery of the education
3. Fewer hassles in obtaining the education the students need
4. Facilities more conducive to learning
5. An expanded curriculum
6. More exposure to real-world issues
7. More cohesiveness within the faculty community
8. Better services for placement of graduates
9. Better reputation for the faculty

Figure 4.7 Demanded characteristics of maritime training program as expressed by students.

At this point, faculty has to decide to focus attention on one of the broadly defined customer demands, realizing the effort required to address each demand would be significant. Although it is important to eventually attempt to address all customer identified demands, initially one or two priority demands should be targeted for immediate additional analysis (step 1.5 in Figure 4.4). In setting priorities, it must be considered the relative importance of each demand to the customer, the degree to which the organization currently is succeeding in meeting the demands, and the interrelationships among demands. The goal is to focus first on the one or two customer demands that will result in the greatest perceived and actual improvement in service.

To assist in setting priorities, it is useful to consider relationships among the broad groups of demands identified. One way to understand these relationships is to construct an interrelationship digraph. Figure 4.8 displays the interrelationship digraph for broad demanded student characteristics.

Notifying the category "understanding of real-world issues" has four arrows pointing to other categories. This suggests that if changes could be made to improve this category, these changes would affect four other categories: "ability to analyze and synthesize," "ability to recognize and solve problems," "knowledge of competitive strategies," and "renaissance people." Thus, based on its relationships with other customer demands, "understanding of real-world issues" is assigned a high priority. The interrelationship digraph in Figure 4.9 is derived from the student demand categories in Figure 4.7. The two digraphs, considered in light of organizational core

competencies, lead to the final priorities and a selection of the customer demand for understanding of real-world issues for further study. It appeared on both customer demand lists and was prominent in both digraphs.

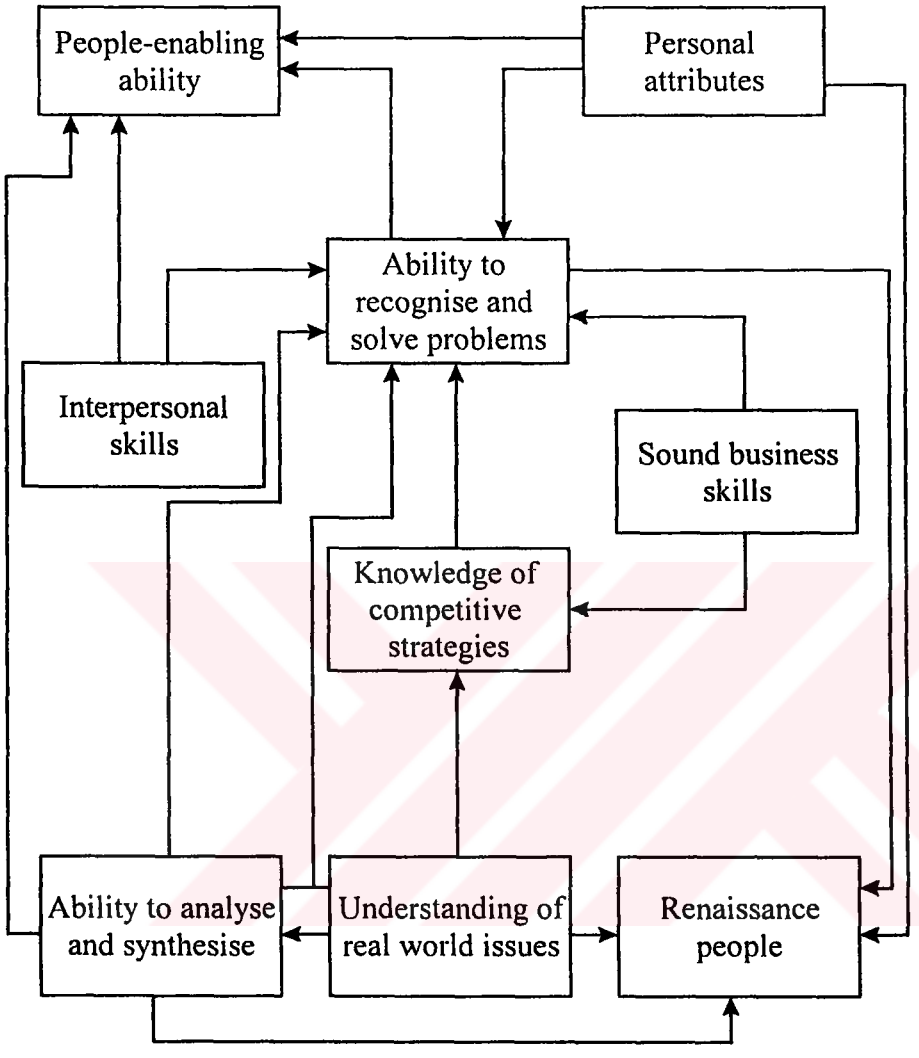


Figure 4.8 Interrelationship digraph for broad demanded student characteristics.

The first series of steps helped clarify the broad categories needing attention and resulted in the selection of one category for further analysis. The next series of steps would yield the details necessary for achieving this broad demand. One tool that is useful in developing the required level of detail is the tree diagram. In this study it is constructed a tree diagram for the characteristic "understanding issues facing business people in the real market."

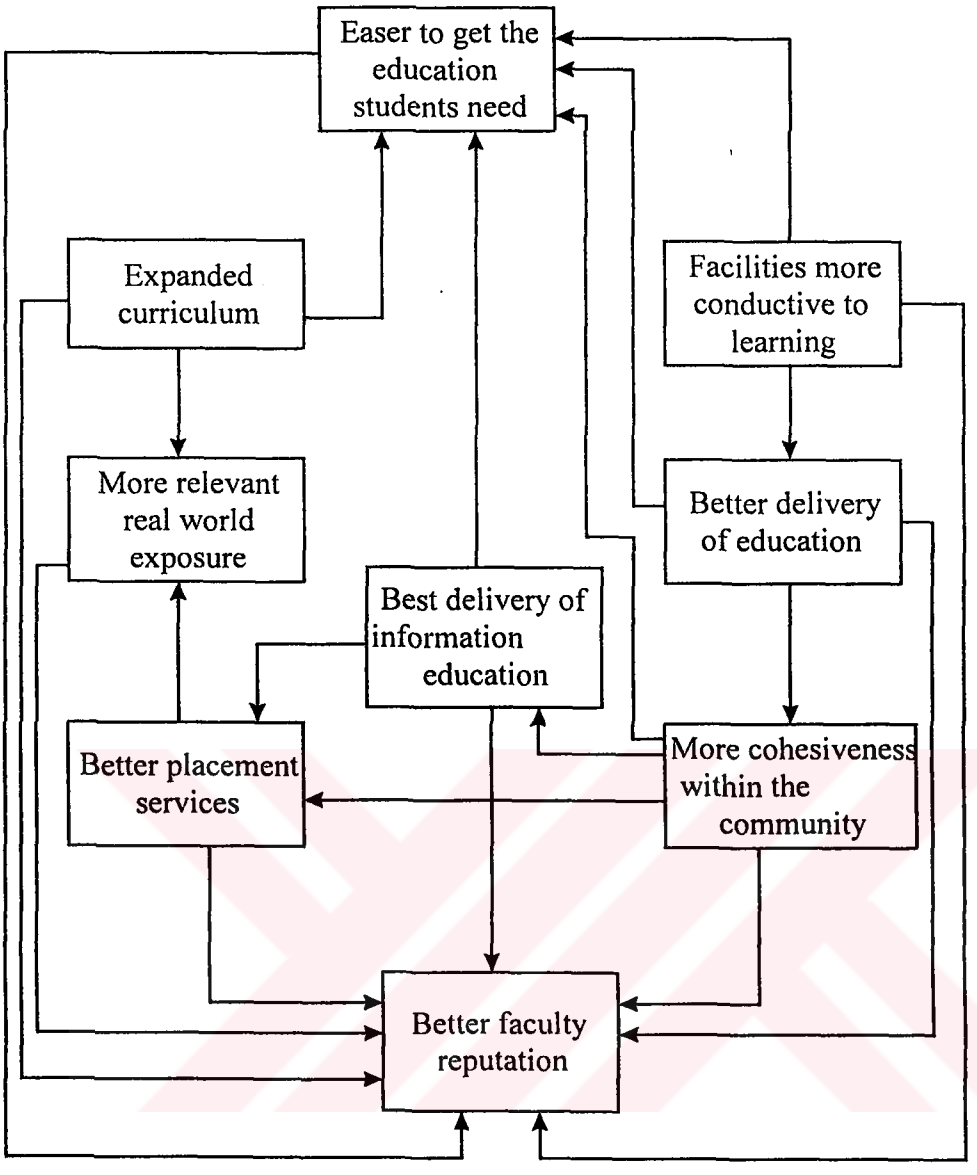


Figure 4.9 Interrelationship digraph of characteristics of education demanded by students.

To begin construction of this tree diagram, a query is raised that "What needs to occur in order for students to have an increased understanding of real-world issues?" Answers, which became branches of the tree, is based on original customer responses coupled with the knowledge and experience of maritime sector. The firstlevel answers to this question are shown in Figure 4.10. (This is an example of the output of step 2.1 in Figure 4.4). While these answers provide detail about the dimensions of understanding the real-world environment, they are still quite broad. To achieve an even greater level of detail, for each branch in Figure 4.10, the question is asked:

"What needs to occur in order for this (answer) to be achieved?" The answers provided in greater detail the means for achieving the original broad customer demands. The process was continued until a sufficient level of detail was achieved to enable a complete listing of demanded attributes. Detailed tree diagrams for the branches "ethical dimensions of business" and "real world work experience" are shown in Figures 4.11 and 4.12. (This illustrates step 2.2 in Figure 4.4).

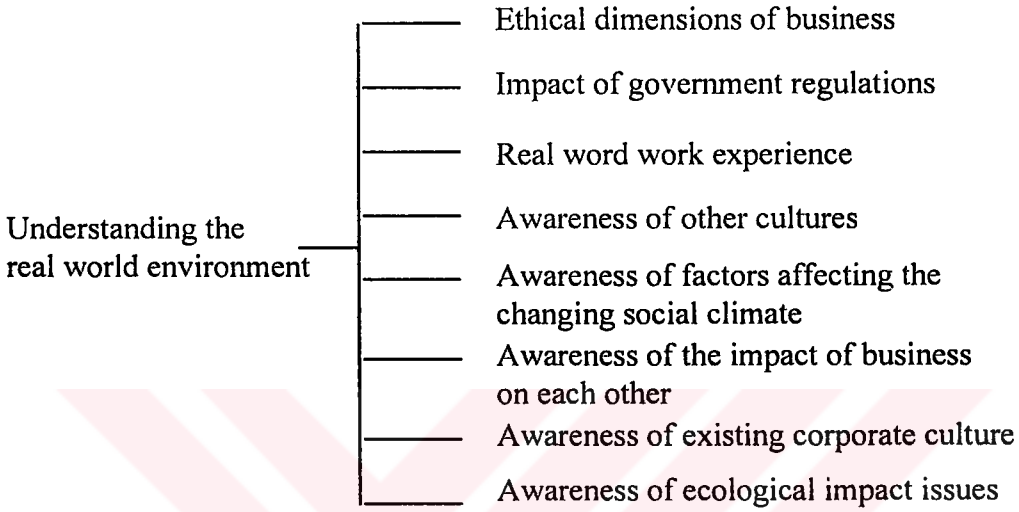


Figure 4.10. First-level means to understanding the real-world environment

Following the drafting of any tree diagram, a backward operation should be carried out from the end branches to ensure that implementation of lower-level details actually will lead to the accomplishment of next-higher-level objectives. In Figure 4.12 the only means for students to obtain "personal work experience" are "worked prior to admission," or "work while in school," or work in "internships." Since these possibilities are all included in the branches, this aspect of the diagram is complete.

Steps 2.3 and 2.4 of Figure 4.4 involve verifying the accuracy and completeness of the demanded attributes by obtaining feedback from customers.

To improve a product or service, it will help to measure the attributes demanded by customers. It is easier to plan for and monitor progress if measurements related to customer demands can be devised. In QFD measurable attributes are called quality characteristics. Quality characteristics help operationalise needed improvements. For example, one demanded attribute of faculty program in Figure 4.11 is "experience in

using ethical reasoning to evaluate decisions." This attribute is not directly measurable, but it is related to the measurable characteristic, the number of times students analyse cases involving ethical decisions. As another example, the Figure 4.11 attribute "exposure to ethical frameworks" is related to the measurable characteristic, class lecture time devoted to the subject ethical frameworks. An increase in this measurable characteristic would indicate improvement in the attribute.

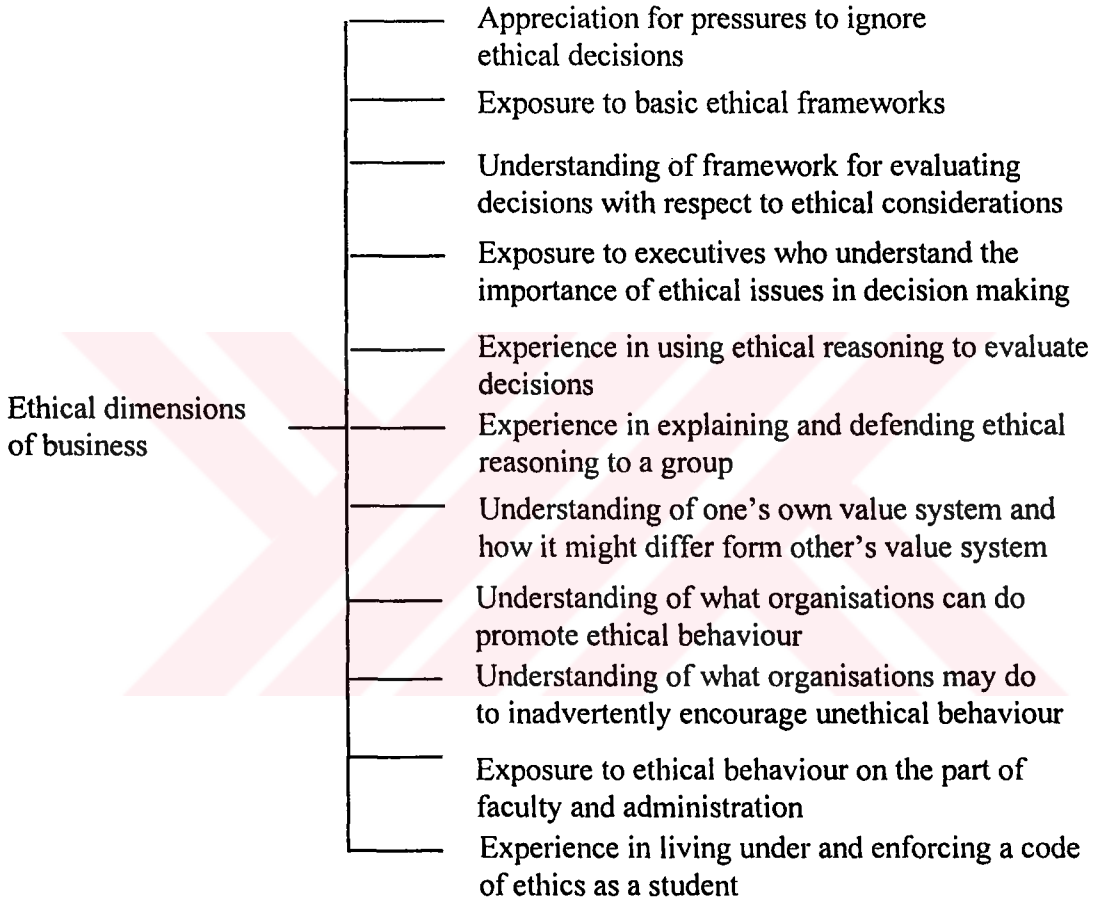


Figure 4.11. Second-level means to understanding ethical dimensions of business

The development of quality characteristics may seem inherently more difficult for service applications than for product applications. Careful attention in the early stages of the QFD process usually results in a sufficient level of detail to mitigate the problem.

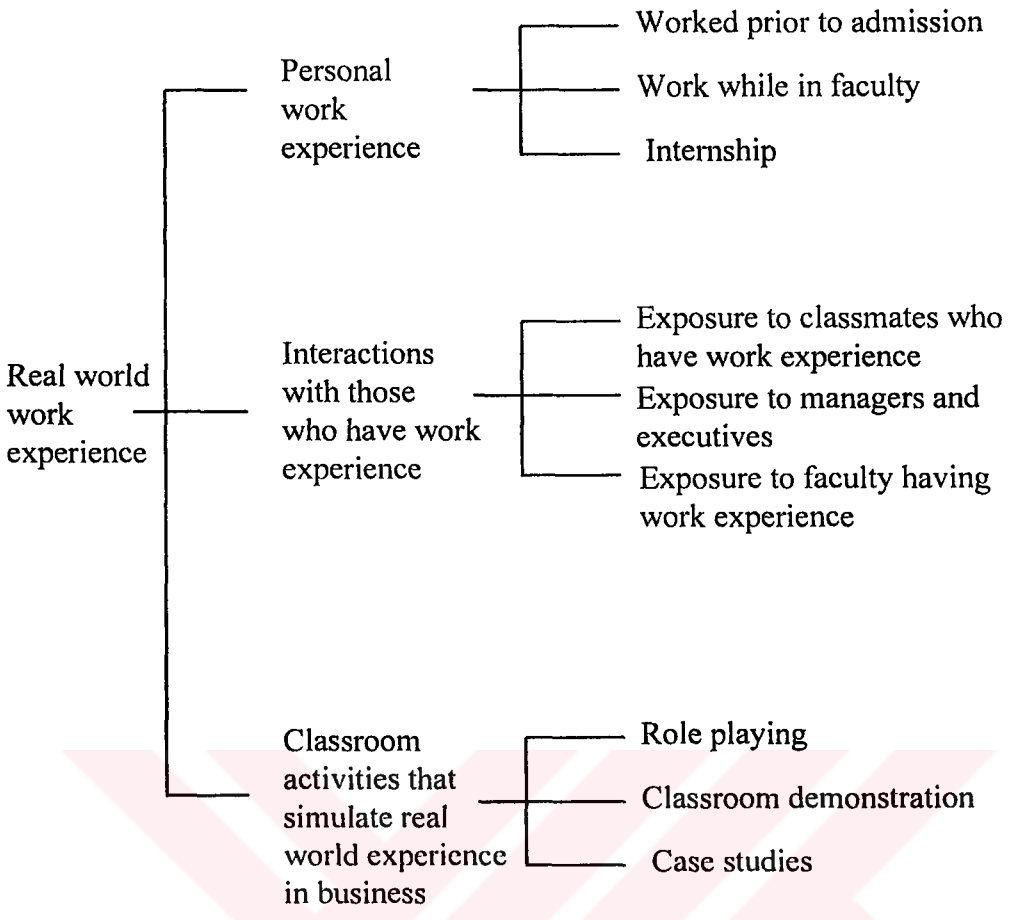


Figure 4.12. Second-level means to real-world environment

For each customer demand, it can be listed variables that were measurable and correlated with the demand (step 4.1 in Figure 4.4). For example the measurable quantities work experience of the student, amount of time students were exposed to real managers discussing ethical decisions, number of cases concerned with ethical pressures, and number of role playing situations dealing with ethical pressures were related to the customer demand, "appreciation for pressures to ignore ethical decisions." The combined lists of measurable quantities consisted of a large number of items. To organize the items and develop general categories of measurable characteristics, An affinity diagram can be constructed. The results are shown in Figure 4.13 (step 4.2 in Figure 4.4). Quality department of faculty can review the list to ensure that obvious measurable quantities had not been omitted (step 4.3 in Figure 4.4).

1. Characteristics of the incoming student body
    1.1 Related work experience
    1.2 Related cultural experience
    1.3 Previous formal educational experience
2. Characteristics of the curriculum taken by all students
    2.1 Faculty lecture delivered
    2.2 External manager lecture delivered
    2.3 Case delivered
    2.4 Delivered by demonstration
    2.5 Delivered through role playing
    2.6 Delivered through structural self assessment
3. Characteristics of faculty
    3.1 Experience in the business world
    3.2 Cultural experiences
4. Characteristics of student
    4.1 Subject matter knowledge upon course completion
    4.2 Subject matter knowledge upon program completion
5. Feedback related to the quality of the program
    5.1 Student feedback related to curriculum delivery
    5.2 External customer feedback related to quality of graduates
5.3 External customer feedback related to curriculum quality

Figure 4.13 Measurable quality characteristics for understanding the real-world environment.

The demanded attributes indicate what is desired, while the quality-characteristics measures provide a means for determining whether what is desired has been accomplished. For planning, it is important to understand the relationships between the demanded attributes and the quality characteristics. In many cases, quality characteristics will be related to more than one attribute. One tool used to represent these relationships is the matrix diagram. With demanded attributes on the vertical axis and quality characteristics on the horizontal axis, the matrix represents, with symbols, the correlatians between attributes and characteristics. Figure 4.14 shows matrix diagram for demanded attributes associated with "ethical dimensions of business." In the diagram, symbols SP, MP, WP, SN, MN, and WN describe relationships as strong, moderate, or weak, and positive or negative. A blank indicates no relationship.

As indicated in steps 5.1, 5.2, and 5.3 in Figure 4.4, assessments of the strength and direction of correlation's were based on the faculty's knowledge of causal

relationships, data that suggested relationships, or simply maritime experience. When the matrix was complete, it needs to check for blank columns and rows. A blank column indicated, for the quality characteristic heading it, a lack of correlation with any demanded attribute. That quality characteristic was dropped. A blank row indicated a lack of quality characteristics for a demanded attribute. Additional effort can be made to discover some way to measure the attribute.

To determine where to focus efforts to improve, the two-by-two matrix described can be augmented with the following information: (1) customer ratings of the relative importance of each demanded attribute; (2) customer ratings of the service to be improved (current service); and (3) customer ratings of competitors' services. This information can be gathered through customer questionnaires. A simplified example of a matrix augmented with this maritime education and training based information is illustrated in Figure 4.15. It is similar to the house of quality, a tool used frequently in QFD applications [68].

A common approach to setting priorities for the quality characteristics involves the use of a simple weighting scheme. In this illustration, Figure 4.15 correlation's are assigned values of 1, 3, or 9 according to whether they are weak, moderate, or strong. The sign of the value is + if the correlation is positive and - if the correlation is negative. Customer ratings are represented on a scale from 1 to 5,1 representing the lowest and 5 the highest rating. In this illustration of how the ratings of customer attributes are translated into ratings for quality characteristics, consider the measurable characteristic "cultural experience" in Figure 4.15. This is moderately positively correlated with both "appreciation for pressures to ignore the ethical component of decisions" and "exposure to basic ethical frameworks." In order to compute an importance rating for "cultural experience," the rating for "appreciation for pressures to ignore the ethical component of decisions" is multiplied by a value +3, the weight associated with a moderately positive correlation (this is denoted by MP in Figure 4.15). Similarly, the rating for "exposure to basic ethical frameworks" is multiplied by +3. These two values are then added to obtain the importance rating of 21 (3 x 4 + 3 x 3) for "cultural experience."

	Characteristics														
	Work Experience	Cultural Experience	Previous Educational Experience	Faculty lecture	External Manager Lecture	Case studies	Demonstrations	Structured Experiences	Structured Self Experiences	Discussions	Retention of knowledge on course completion	Ability to apply knowledge on course completion	Retention of knowledge on program completion	Ability to apply knowledge on program completio
Appreciation for pressures to ignore the ethical component of decisions	MP	MP		MP		SP	MP	SP	MP	SP				
Exposure to basic ethical frameworks		MP		SP		MP		MP			SP		SP	
Undestanding of frameworks for evaluating decisions with respect to ethical considerations				SP		MP				MP	SP		SP	
Exposure to executives who understand the importance of ethical decision making				MN	SP									
Experience in using ethical reasoning to evaluate decisions	MP	MP		MN		SP		SP		MP				
Experience in explaining and defending ethical reasoning to a group		MP	MP	SN		MP		SP		SP		SP		SP
Understanding of one's own value system and how it might differ from others' value system	MP	SP	MP			MP	MP	MP	SP	SP				
Understanding of what organisations can do promote ethical behaviour				MP	SP	MP	MP	SP		MP	SP		SP	
Understanding what organisations may do to inadvertently encourage unethical behaviour	MP			MP	MP	MP	MP	SP		MP	SP		SP	
Exposure to ethical behaviour on the part of faculty and administration			MP	MP										
Experience in living under and enforcing a code of ethics as a student			MP											

Legend: SP = Strongly Positive, MP = Moderately Positive, MN = Moderately Negative

Figure 4.14. Matrix of relationships between demanded attributes and quality

	Quality Characteristics						
	Work Experience	Cultural Experience	Previous Educational Experience	Faculty lecture	Customer rating: importance of attribute to customers (scale 1-5)	Customer rating: faculty's service (scale 1-5)	Customer rating: competitor service (scale 1-5)
Appreciation for pressures to ignore the ethical component of decisions	MP	MP		MP	4	2	2
Exposure to basic ethical frameworks		MP		SP	3	3	4
Undestanding of frameworks for evaluating decisions with respect to ethical considerations				SP	3	2	3
Compositive rating: importance - quality characteristics		21					
Compositive rating: faculty's service		15					
Compositive rating: competitor service		18					

Legend: SP = Strongly Positive, MP = Moderately Positive

Figure 4.15. Simplified house of quality

The correlation-weighted ratings provide information that is useful in choosing characteristics on which to focus improvement efforts. One approach to making a choice would be to focus on those characteristics rated as important by customers that have current service ratings that are below the ratings of competitors' services.

It can be used to select demanded attributes that are important to customers (step 4.1 in Figure 4.4), to evaluate current service with respect to the correlated quality characteristics (step 6.2 in Figure 4.4), and to identify areas where performance is most deficient (step 6.3 in Figure 4.4).

A discussion can be raised for the specific plans that needs changes (step 7 in Figure 4.4). Current levels of performance could serve as baseline quality characteristic measures, providing a basis for systematically and unambiguously evaluating the planned changes. In some cases a trial implementation is advisable, with adoption of the change coming only after evidence of desired improvement is observed. Finally, the attribute related measures should be used to assess the degree to which changes actually have resulted in improvements (step 8 in Figure 4.4). The information that has been gathered and organized is the basis upon which to take action on steps 7 and 8 in Figure 4.4. All of this is part of a continuous cycle of planning, implementing, and monitoring activities.

As a result QFD is a process by which customer requirements are translated into design features, specifications, and operational targets. Customer-perceived value drives the process from beginning to end. In this study it is illustrated how to determine broad customer demands and how to use these broad demands as a basis to derive more detailed requirements. It is shown how to develop measurable characteristics that are correlated with the detailed demands and how to summarize the correlation's between the derived measurable values and the customer demands. Finally, it is indicated how to summarize all this information in a manner that is useful for development of improvement plans. This is only the beginning of a process of continuous improvement. Each subsequent contact with the customer is another opportunity for the supplier to reexamine the product or service in light of customer requirements and to make changes as needed.

The strength of QFD comes from its ability to capture a customer's needs and to make them drivers of all processes, from design to delivery of a product or service. By its nature, QFD involves the entire organization seeking to bring about change, enabling individual members to discover ways to contribute to the improvement of a product or service [69]. Customer needs and perceptions of quality change, requiring the supplier to inquire and listen, examine again and again.

4.4. INTEGRATION OF MANAGEMENT STANDARDS INTO MARITIME TRAINING AND EDUCATION

4.4.1. SYSTEM APPROACH

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 university 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 [70,71]. As an example, Lewis and Smith consider only twelve elements of ISO 9001 to be directly applicable to education [70], while Willborn and Cheng address seventeen [71]. 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 [72,73]. 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 University Production System (UPS) 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 [74]. For example, university's objectives can be to create, preserve and disseminate knowledge. Mainly training institutions 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 are mentioned in section 3. 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 university environment is presented in [74]. 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.

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 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: quality loop and supporting elements 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 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 University Production System, will proceed with the interpretation of all twenty elements and the standard for application in higher education. Table 4.2 illustrates the faculty's Quality Management system for the interpretation of ISO 9001.

Table 4.2 Faculty's Quality Management System for the interpretation of ISO 9001

Term ISO 9001	Student and Knowledge	Programs Courses	Research
Product	Student knowledge, abilities and competencies	Programs and Courses	New knowledge
Customers	Industries, community, alumni, professional organisations	Students, industry, community, professional organisation	Industry, research sponsors other universities, community

Supplier Subcontractor	University/ Faculty/ Department/ High schools, other universities and 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 (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 and maintenance	Value adding to existing knowledge
Manufacturing Process	Learning	Teaching	Researching
Lead Time	Time from enrolment to graduation	Programs: 4 years courses: 1 or 2 terms	Time from contract to delivery
Part	Student knowledge accumulated in a course	Program, course, lectures, labs, tutorials	A phase in a research project
Operation Toll	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 , as formally expressed by the dean (department head)		
Quality Control	The operational techniques and activities used to fulfil the requirements for quality		
Non Conformity	The nonfulfilment of specified requirements		
	Students failure	Course, program failure	Research project failure

4.4.2. 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 university 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 industry and society requirements with respect to undergraduate and graduate programs offered, by means of alumni and employers surveys, questionnaires, interviews, as well as the analysis of available legislation, governmental guidelines and standards.

◊ 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 [75].

◊ 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 government 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. 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.

The following processes should be covered by adequate procedures and records:

◊ purchasing of hardware and software required for the proper delivery of programs, courses and research projects;

◊ subcontracting of resources (facilities management, equipment maintenance, student transport);

◊ appointment of academic and support staff, including professors, teaching and research assistants, administrative and technical staff ;

◊ admission of undergraduate and postgraduate students.

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. An example of such activities may include screening of high school students through visits and so on. In some instances, specific contracts may require the customers to verify purchased products

or services at faculty's premises. This, in general, pertains to research contracts, but may include visits by the representatives of industry and governmental agencies to verify the delivery of programs and research. İ.T.Ü Maritime Faculty's simulator establishment project with JIKA can be given as an example for the above discussion.

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 following processes are included:

◊ design of tests, quizzes, assignments, project requirements, exams;

◊ designing, applying, reviewing, validating, changing and improving the marking and grading schemes;

◊ review of inspection and testing methods for student knowledge, experience and skills;

◊ control, calibration and maintenance of equipment used for inspection, measuring and testing at the course level, such as instant scoring machines, standardized and computerised tests;

◊ control, calibration, maintenance, handling and safeguarding of inspection, measuring and test equipment used in research activities;

◊ control, maintenance and review of methods used for inspection and measurement of the degree to which an undergraduate or a graduate program meets specified requirements.

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.

The faculty and individual department and staff members must identify the training needs of its faculty and staff, and provide for the adequate training. Thus, the following processes should be addressed by appropriate procedures:

◊ development and training of faculty, teaching and research assistants, and support staff;

◊ student curriculum counselling;

◊ faculty members' maintenance of professional competence;

◊ research staff development training, including sabbatical leaves;

◊ faculty promotion and tenure

Appropriate records of training activities must be maintained.

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 a 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.

It is important that the control of the teaming process and its product, namely student knowledge, is also focused by the inspection and testing element of ISO 9001. This element covers the student based control of individual learning, via student presentations, seminars and design projects.

Process control activities may be categorised into four groups:

◊ process control design

◊ control of resources

◊ process control implementation

◊ process control improvement

Table 4.3 illustrates the activities of teaching and research process control, respectively.

Table 4.3 Process control activities

TEACHING PROCESS CONTROL	
GROUP	**ACTIVITY**
Process Control Design	review of course design and quality plans assessing the need and selection for course/program prerequisites identification of critical quality characteristics for the course identification of teaching process parameters to be monitored and

	controlled, planning the methods for monitoring and control of critical quality characteristics and suitable process parameters
Control of Resources	identification of adequate teaching equipment ensuring proper maintenance of teaching equipment identification of proper teaching and learning environment review of equipment, facilities and services admissibility for the course.
Process Control Implementation	incoming inspection of student's prerequisites assessment of student's admissibility to a course assessment of topics and matter taught in course prerequisites course delivery monitoring, measuring and control of critical quality characteristics and teaching process parameters student course evaluation.
Process Control Improvement	planning, implementing and reviewing preventive and corrective actions assessment and review of critical quality characteristics, suitable process parameters, equipment environment, facilities and services.
RESEARCH PROCESS CONTROL	
GROUP	**ACTIVITY**
Process Control Design	identification of critical quality characteristics for a research project identification of research process parameters to be monitored and controlled planning of the methods for monitoring and control of critical quality characteristics and suitable research process parameters
Control of Resources	identification of adequate equipment required for the research project ensuring proper maintenance of research equipment identification of proper research environment review of equipment, facilities and services admissibility for the research project

	research project quality planning
Process Control Implementation	research project delivery monitoring, measuring and control of critical quality characteristics and research process parameters
Process Control Improvement	planning, implementing and reviewing corrective actions assessment and review of critical quality characteristics, suitable process parameters, equipment, environment, facilities and services

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 faculty 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. For example, a class first with grades for specific components of the course indicates a student's inspection and test status in a course. Another example is the student academic status, determined after evaluation by the board of examiners. A student may also be requested to repeat a course, and his status indicated on the transcript. Thus, inspection and test status of undergraduate and graduate students at the course and program levels, as well the status of research projects conducted in the faculty must be identified.

Nonconforming products are students who do not meet course or program requirements, courses or programs that failed to achieve stated objectives, as well as research projects that did not meet specified contract requirements. Research activities have such a nature that sometimes a failure to prove a hypothesis is a valuable research result. The identification, evaluation, documentation and segregation of nonconforming students, courses, programs or research projects are required. In terms of undergraduate students, control of nonconformances related to term work and final exams, as well as control of students under academic suspension is required. Control of graduate students who do not meet course or thesis requirements, as well as nonconforming contracted research must be addressed by appropriate procedures and records, as well.

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 property 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.

The equipment and material include lecture rooms, research laboratories, computer laboratories, overhead projectors, electronic displays, chalk boards, textbooks, software, solution manuals, materials used in tests and experiments, research project

reports, and research papers. Provision of a healthy and safe environment includes proper conduct of faculty, staff and students, personal safety and health, as well as parking regulations, sports services, housing and student life. Adequate procedures and records must be documented and maintained to assure quality.

Servicing of programs, courses and research project follows delivery. Under this requirement, students are provided with information on new developments in the field of expertise. Also included are career counselling, provision of the list of graduates to prospective employers and alumni organisation's services. In terms of research, servicing activities are performed according to specific contracts.

4.4.3. 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. This policy should be drafted and signed by the dean as stated in section 6.1.1.1. A documented and implemented quality assurance system that complies with the ISO 9001 Standard, and will be registered supports this policy. All members of the Faculty understand and follow this policy. The executive management ensures that the quality policy is understood, implemented and maintained. 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 as defined in figure 6.1 and figure 6.2.

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 that the detailed format is given in Appendix C. 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. The Quality Manual describes the quality system and refers to quality system procedures. Depending on the scope of the quality system and the organisational structure of the institution, a Quality Manual can be drafted on a faculty or departmental basis, or it can address specific products, such as programs or research. In terms of procedures, the faculty may decide to prepare one procedure for each requirement of the standard. The procedures explain in detail who does what, when and where. Procedures make reference to instructions that define how an activity or part of a process is performed.

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. Thus, the issuance and approval of quality system documents and data, including the preparation, updating and maintaining the Master List of Quality System Documents, as well as the document and data changes are covered here. The scope of documentation to be controlled includes the Quality Manual, procedures, instructions, records and course and research project plans. The need for and use of each document must be clear and regularly reviewed.

For the purpose of providing evidence that adequate quality assurance activities are being carried out, the faculty must have a procedure in place for the control of all quality records. This requirement of the standard applies to the identification, collection, indexing, access, filing, storage, maintenance and disposition of quality records. To maintain the scope of these records, a master list of all forms considered to be "quality records" should be kept.

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 following processes are addressed by this ISO 9001 element:

◊ issuing and safekeeping of student numbers and identification cards;

◊ issuing and safekeeping of faculty staff identification cards;

◊ handling of department and course numbers;

◊ issuing and distributing registration calendars to students;

◊ assigning numbers and codes to research projects.

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. The principles and the implementation of the audits is given in Appendix B.

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.

The detailed documentation structure for complying the all necessary elements of ISO 9002 is developed and established for İ.T.Ü Maritime Faculty in section 6.

5. MODELLING OF QUALITY MANAGEMENT CYCLE

5.1. PROBLEM SOLVING AND DECISION MAKING

Problem solving can be defined as the process of identifying a difference between some actual and some desired state affairs and then taking action to resolve the difference. Problem solving process involves the following seven steps [76]:

1) Identify and define the nature of problem or the expected conditions.

2) Determine the set of alternative solutions.

3) Determine the criterion or criteria that will be used to evaluate the alternatives.

4) Evaluate the alternatives.

5) Choose an alterative.

6) Implement the selected alternative.

7) Evaluate the results and determine if a satisfactory solution has been obtained.

Decision making is the term generally associated with the first five steps of the problem solving process. The first step of decision making is to identify and define the nature of problem or the expected conditions. Decision making ends with the choosing of an alternative which is the act of making the decision. The relationship between problem solving and decision making is illustrated in figure 5.1.

If the first three steps of the decision making process are combined under the heading of structuring the nature of problem and the latter two steps are combined under the heading of analysing the problem, it provides how to carry out the set of

activities that make up the decission making process. So the alternative classification of the decision making process is illustrated in figure 5.2.

Figure 5.3 shows the analysis phase of the decision making process take on the qualitative and quantitative approach forms. Qualitative analysis is based on primarily director's judgment and experience, it includes the director's intuitive feel for the problem.

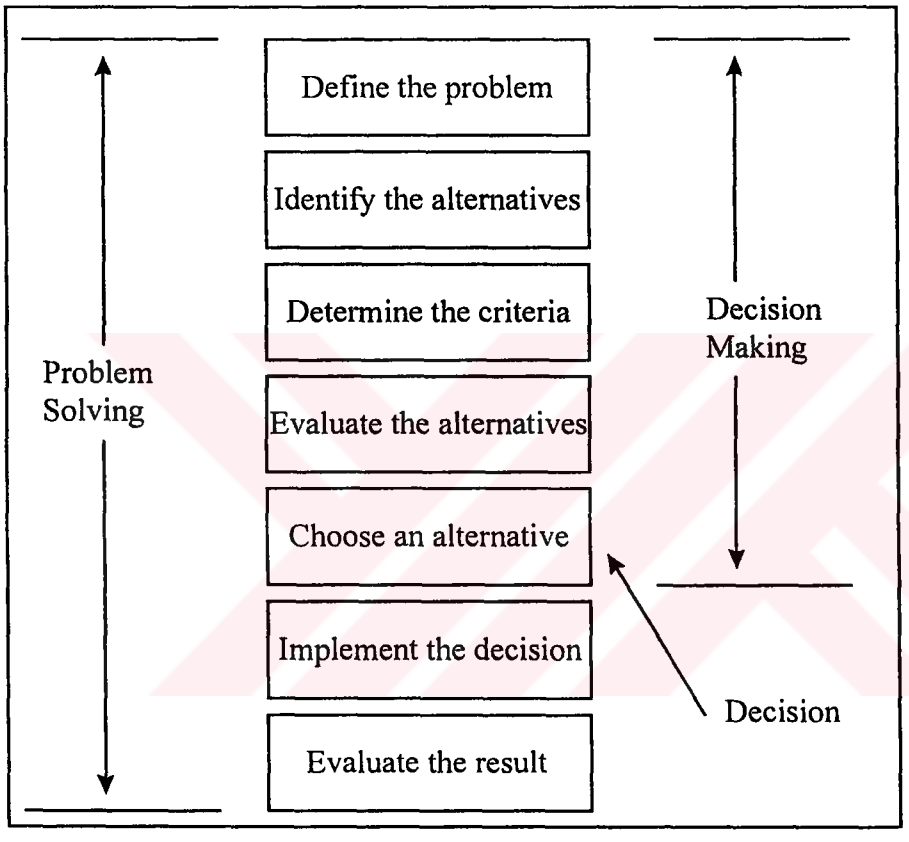


Figure 5.1 Relationship between problem solving and decision making

If the director has had experience with similar problems or if the problem is relatively simple, heavy emphasis may be placed upon a qualitative analysis. However if the director has had little experience with similar problems or if the problem is sufficiently complex, then a quantitative analysis of the problem can be very important consideration in final decision. When using quantitative approach, it will be concentrated on the quantitative facts or data associated with the problem and

develop mathematical expressions that describe the objectives, constraints and other relationship that exist in the problem.

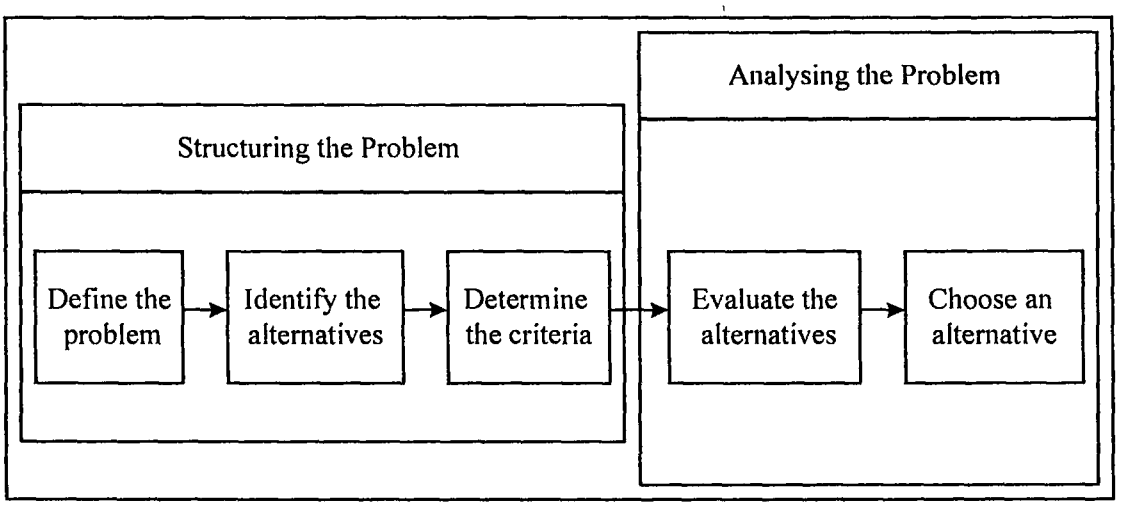


Figure 5.2 Alternative classification of the decision making process

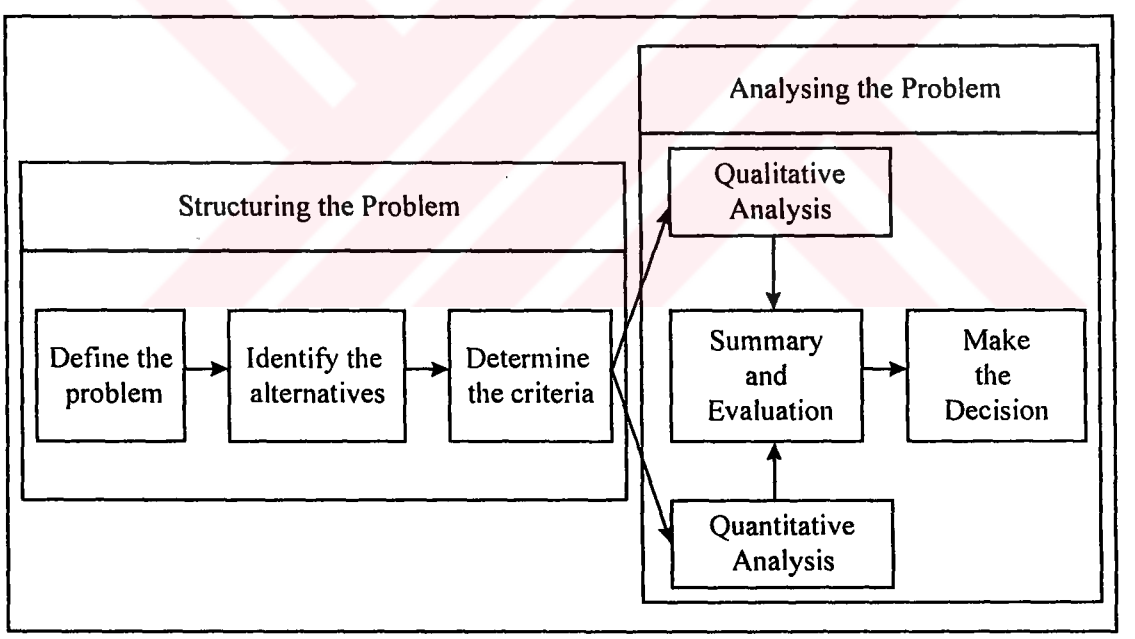


Figure 5.3 The role of quantitative and qualitative analysis

The problem definition step of the decision making process is the most critical component in determining the success or failure of any quantitative approach to decision making. Models are representations of real objects or situations. In modelling terminology, physical replicas are referred to as iconic models [77]. The

models includes those that are physical in form but do not have the same physical appearance as the object being modelled. Such models are referred to as analog models. The models represent a problem by a system of symbols and mathematical relationships or expressions are called as mathematical models and are critical part of any quantitative approach to decision making. The transforming model inputs into output is shown in figure 5.4.

If all uncontrollable inputs to a model are known and can not vary, the model is referred as a deterministic model. If any of the uncontrollable inputs are uncertain and subject to variation, the model is referred as stochastic or probabilistic model. Another step in the quantitative analysis of a problem is the preparation of the data required by the model. Data in this sense refer to the values of the uncontrollable inputs to the model. All uncontrollable inputs or data must be specified before analysing the model and recommend a decision or solution for the problem.

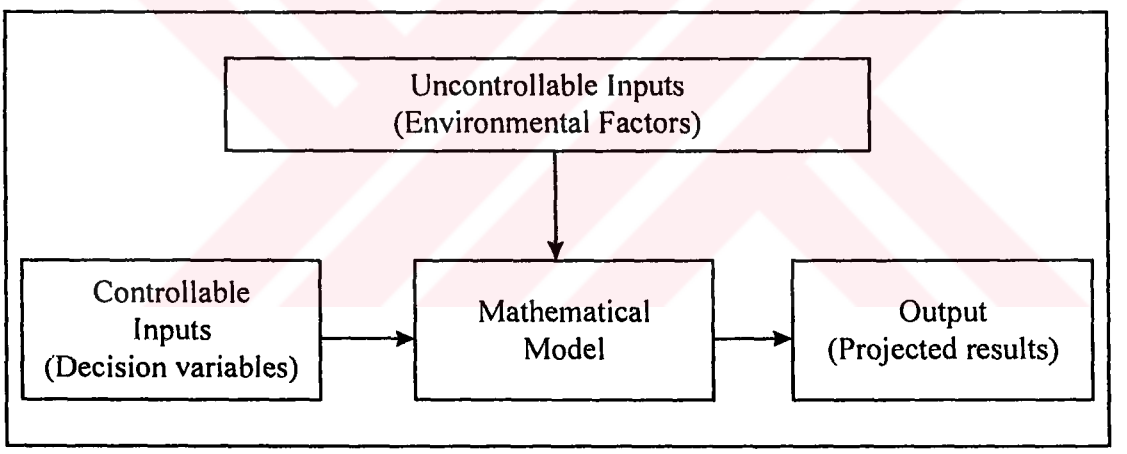


Figure 5.4 Transforming model inputs into output

Model development step and then a separate data preparation step will be performed to obtain the uncontrollable input values required by the model. If this approximation is considered as the establishment of Quality Management Model in Maritime Training Institution, then the following expressions can be obtained for maximising the efficiency of each clause relating with International Management Standard.

c = integration efficiency per each clause

a = integration time per each clause

b = integration capacity per each clause

x = integrated process volume of each clause

s.t.i = subject to integration

$$\underset{s.t.i.}{Max} \quad cx \tag{5.1}$$

$$ax \leq b \tag{5.1a}$$

$$x \geq 0 \tag{5.1b}$$

5.2. MODELS OF COST REVENUE AND PROFIT

The cost of producing a process is a function of the volume process integrated. The produced volume can be considered as process-density in the main terms of service industry. This cost can be usually defined as a sum of fixed cost and variable cost. Fixed cost is the portion of the total cost that does not depend on the process volume. Variable cost is the portion of the total cost that is dependent on and varies with the process volume.

$C(x)$ = Total cost of process

$V(x)$ = Variable cost of process

F = Fixed cost

$$C(x) = V(x) + F \tag{5.2}$$

The relationship between the revenue and process-density is also required while establishing the model with a specified integrated processes. Marginal revenue is defined as the rate of change of total revenue with respect to active gain volume.

$R(x)$ = Total revenue associated with the integration of x process

S = Active gain process volume for each clause

$$R(x) = Sx \tag{5.3}$$

The other important criteria for the managerial decision is making profit. Thus the model of profit $P(x)$ can be derived from the models of the revenue-volume and cost-volume relationship.

$$P(x) = R(x) - C(x) \tag{5.4}$$

The volume that results in total revenue equalling total cost is called break-even point. If the break-even point is known an organisation can quickly infer that a process volume above the break-even point will result in a profit. The break-even point can be found by setting the profit expression equal to zero and solving for the process volume.

$$BEP = P(x) = 0 \tag{5.5}$$

5.3. POTENTIAL EFFORT RELATED COST MODEL

The criteria for deciding the potential know-how or the knowledge of the organisation is sufficient or needs improvement when a project or an improved process demand comes into discuss. In this situation the potential know-how or the knowledge background level for the organisation have a maximum value of Q units effort when it is demanded form the board of organisation or from the customer. Then the organisation will try to satisfy this demand from its potential. The other strategic decision is to use this potential in an efficient and an economical manner for preventing the disturbance of routine jobs or work cycles. Then assuming a constant demand rate of efforts in each period or term as illustrated in figure 5.5. Figure 5.5 indicates that the average potential efforts level for the period is ½ Q. This appears reasonable since the maximum effort level is Q, the minimum effort level is zero and the potential effort level declines at a constant rate over a period.

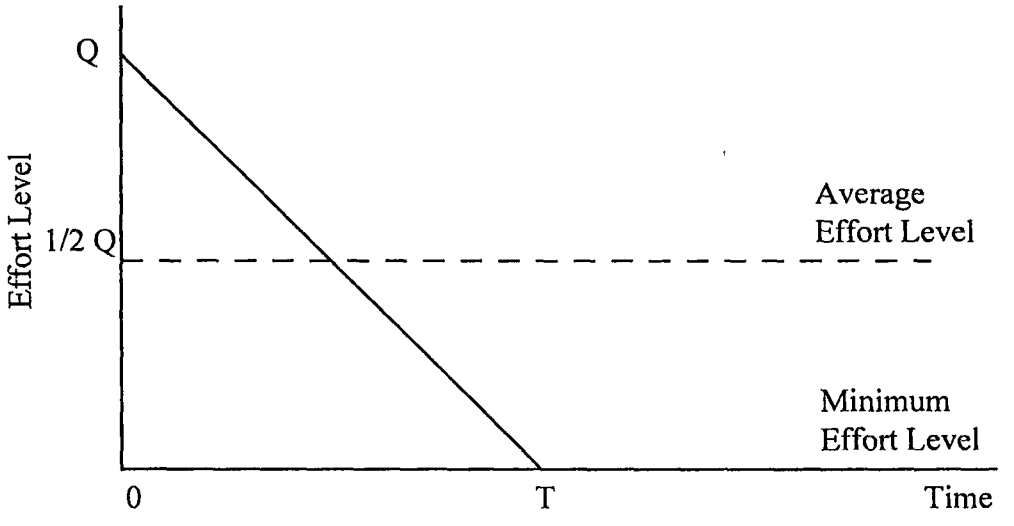


Figure 5.5 Average potential effort level

Figure 5.5 shows the potential effort during each cycle of length T. As the time goes on, this pattern will repeat. The complete potential efforts are shown in figure 5.6. If the average of potential efforts during each cycle is ½ Q, the average of potential efforts over any number of cycles is ½ Q. Then the effort cost can be calculated using the average potential efforts.

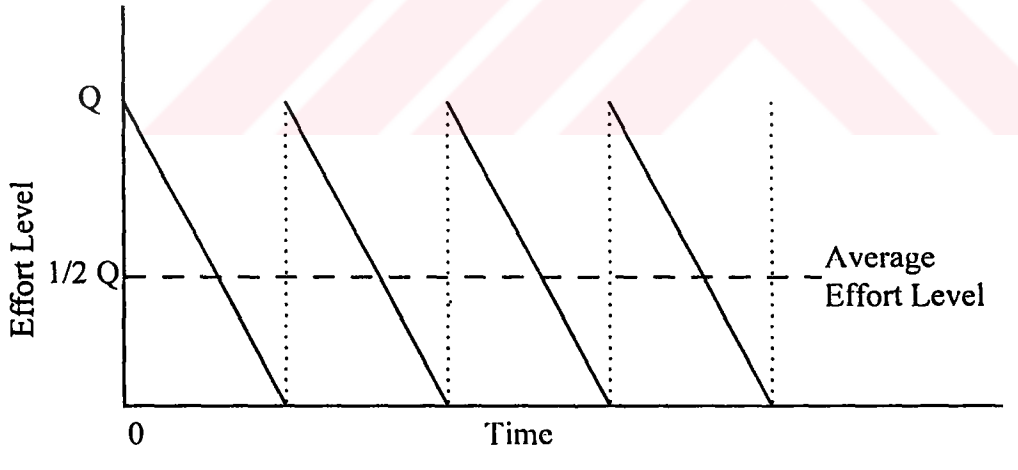


Figure 5.6 Complete potential effort levels

I(i,j) = term based, defined effort rate for effort i and nature of effort j

C(k) = Unit cost of appointed employee

Ch = term based covering cost of each effort

Term based covering cost of each effort is

$$C_h = \sum I(i,j).C(k) \tag{5.6}$$

$$C_h = \sum I(i,j).C(k) = I(1,1)C(1)+I(2,1)C(1)+\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots + I(n,1)C(1)+ I(1,2)C(1)+I(2,2)C(1)+ \ldots\ldots\ldots + I(n,m)C(1)+\ldots\ldots\ldots\ldots I(1,1)C(n)+I(2,1)C(n)+ I(1,2)C(n)+I(2,2)C(n) \tag{5.6a}$$

Then the total cost of average effort is

$$ACE = \frac{1}{2}QC_h \tag{5.7}$$

The other important point is how many process works will be placed in each term. D denote the sum of term based integration demands for the combined or individual processes and by ordering Q units of effort every time, it will be placed D/Q orders per each term. If C_o is the fixed cost plus running cost of each equipment or material that will be used during each process, then total operational cost is,

$$C_d = \sum (D/Q).C_o(j) \tag{5.8}$$

so, the term based demand cost is

$$TDC = \frac{D}{Q}C_o \tag{5.9}$$

so the total cost of project is

Total Cost = Average cost of effort + Term based operational cost

then the economic project development quantity (EPDQ) can be defined in terms of total cost,

$$TC = \frac{1}{2}QC_h + \frac{D}{Q}C_o \tag{5.10}$$

It can be calculated the effort quantity Q that minimise the total cost by setting the derivative dT / dQ, equal to zero and solving for Q^*.

$$\frac{dTC}{dQ} = \frac{1}{2}C_h - \frac{D}{Q^2}C_o = 0 \tag{5.10a}$$

$$\frac{1}{2}C_h = \frac{D}{Q^2}C_o \tag{5.10b}$$

$$C_h Q^2 = 2DC_o \tag{5.10c}$$

$$Q^2 = \frac{2DC_o}{C_h} \tag{5.10d}$$

$$Q^* = \sqrt{\frac{2DC_o}{C_h}} \tag{5.11}$$

The second derivative is

$$\frac{d^2TC}{dQ^2} = \frac{2D}{Q^3}C_o \tag{5.12}$$

Since the value of second derivative is greater than zero for D, C_o and Q greater than zero, Q^* form the equation (5.12) is the minimum cost solution.

In this consideration productivity size model can be expressed as,

d = daily demand rate for productivity

p = daily based actual rate of productivity

t = number of days during productivity cycle

So the productivity build up rate can be expressed as *p-d*, if the productivity process is run *t* days, then the maximum productivity level is *(p-d)t*. The length of the productivity is *t= Q/p* days. Maximum effort level can be expressed as,

$$MEL = (p-d)\ t \tag{5.13}$$

$$MEL = (p-d)\ t = (p-d)\left(\frac{Q}{p}\right) \tag{5.14}$$

$$MEL = \left(1-\frac{d}{p}\right) Q \tag{5.15}$$

in conjunction with equation (5.15) the average effort cost in terms of productivity is

$$ACE = \frac{1}{2}\left(1-\frac{d}{p}\right) Q \tag{5.16}$$

if daily demand and actual rates of productivity *d, p* is written as term bases such as *D, P*, the total cost shall be;

Total Cost	=	Term based average effort cost	+	Term based operational cost

$$TC = \frac{1}{2}\left(1-\frac{d}{p}\right) QC_h + \frac{D}{Q}C_o \tag{5.17}$$

$$TC = \frac{1}{2}\left(1-\frac{D}{P}\right) QC_h + \frac{D}{Q}C_o \tag{5.18}$$

Optimal productivity size can be calculated by the effort quantity Q that minimise the total cost by setting the derivative dT / dQ, equal to zero and solving for Q^*.

$$\frac{dTC}{dQ} = \frac{1}{2}\left(1-\frac{D}{P}\right) C_h - \frac{D}{Q^2}C_o = 0 \tag{5.19a}$$

$$\frac{1}{2}\left(1-\frac{D}{P}\right) C_h = \frac{D}{Q^2} C_o \tag{5.19b}$$

$$\left(1-\frac{D}{P}\right) C_h Q^2 = 2DC_o \tag{5.19c}$$

$$Q^2 = \frac{2DC_o}{(1-D/P)C_h} \tag{5.19d}$$

$$Q^* = \sqrt{\frac{2DC_o}{(1-D/P)C_h}} \tag{5.20}$$

The second derivative is

$$\frac{d^2TC}{dQ^2} = \frac{2DC_o}{Q^3} \tag{5.21}$$

Since the value of second derivative is greater than zero for D, C_o and Q greater than zero, Q^* from the equation (5.20) is the minimum cost solution.

A shortage is a demand that can not be supplied. In many situations, shortages are undesirable and should be avoided if at all possible. However, there are other cases in which it may be desirable from an economic point of view to plan for and allow shortages. In practice, these types of situations are most commonly found where the value per unit of effort is very high and hence the cost is high. In backeffort model when a project or a new process order places, the organisation has to wait to carry out some part of the project that requires outside resources. If S backefforts is not exist when an effort size Q arrives then the remaining Q-S amount of effort are in the organisation to use. Cycle of T days is divided into two distinct phases t_1 days when the effort is on hand and t_2 days when the new effort is placed. With a maximum effort of Q-S amount in t_1 days, the average effort on hand shall be $\frac{1}{2}$ $(Q\text{-}S)$ then the average effort level is,

$$AEL = \frac{1/2\ (Q-S)\ t_1 + 0\ t_2}{t_1 + t_2} = \frac{1/2\ (Q-S)\ t_1}{T} \tag{5.22}$$

since d represent the constant daily demand

$$t_1 = \frac{Q-S}{d}\ days \tag{5.23}$$

$$T = \frac{Q}{d}\ days \tag{5.24}$$

then the average effort level is

$$AEL = \frac{1/2\ (Q-S)\ [(Q-S)/d]}{Q/d} = \frac{(Q-S)^2}{2Q} \tag{5.25}$$

and the term based number of orders is

$$TBNO = \frac{D}{Q} \tag{5.26}$$

the average backeffort level is

$$ABOL = \frac{0\ t_1 + (S/2)\ t_2}{T} = \frac{(S/2)\ t_2}{T} \tag{5.27}$$

then an amount S at a daily rate of d, the length of backeffort is

$$t_2 = \frac{S}{d} \tag{5.28}$$

again the average backeffort level shall be

$$ABOL = \frac{(S/2)(S/d)}{Q/d} = \frac{S^2}{2Q} \tag{5.29}$$

If C_b is the running cost of equipment or material that will be used during the backeffort process, then total cost is

$$TC = \frac{(Q-S)^2}{2Q} C_h + \frac{D}{Q} C_o + \frac{S^2}{2Q} C_b \tag{5.30}$$

$$TC = \frac{(Q^2 - 2QS + S^2)}{2Q} C_h + \frac{D}{Q} C_o + \frac{S^2}{2Q} C_b \tag{5.30a}$$

$$TC = \frac{Q}{2} C_h - SC_h + \frac{C_h}{2Q} S^2 + \frac{DC_o}{Q} + \frac{C_b}{2Q} S^2 \tag{5.30b}$$

$$TC = \left(\frac{C_h + C_b}{2Q} \right) S^2 - SC_h + \frac{QC_h}{2} + \frac{DC_o}{Q} \tag{5.31}$$

Optimal productivity size and optimal backeffort size can be calculated by the effort quantity Q and S that minimise the total cost by setting the derivative $\partial TC / \partial Q$ and $\partial TC / \partial S$, equal to zero and solving for Q^*.

$$\frac{\partial TC}{\partial S} = \left(\frac{C_h + C_b}{Q} \right) S - C_h = 0 \tag{5.32}$$

Solving for S^*,

$$\left(\frac{C_h + C_b}{Q} \right) S = C_h \tag{5.33}$$

Thus

$$S^* = Q \left(\frac{C_h}{C_h + C_b} \right) \tag{5.34}$$

Solving $\partial TC / \partial Q = 0$,

$$\frac{\partial TC}{\partial Q} = \frac{-(C_h + C_b)S^2}{2Q^2} + \frac{C_h}{2} - \frac{DC_o}{Q^2} = 0 \qquad (5.35)$$

Substituting S^* of equation (5.44)

$$\frac{\partial TC}{\partial Q} = \frac{-(C_h + C_b)Q^2(C_h)^2/(C_h + C_b)^2}{2Q^2} + \frac{C_h}{2} - \frac{DC_o}{Q^2} = 0 \qquad (5.35a)$$

Q^* can be solved

$$\frac{-C_h^2}{2(C_h + C_b)} + \frac{C_h}{2} = \frac{DC_o}{Q^2} \qquad (5.36)$$

$$\frac{-C_h^2 + C_h(C_h + C_b)}{2(C_h + C_b)} = \frac{DC_o}{Q^2} \qquad (5.36a)$$

$$Q^2 = \frac{2(C_h + C_b)DC_o}{C_hC_b} \qquad (5.36b)$$

$$Q^2 = \frac{2C_hDC_o}{C_hC_b} + \frac{2C_bDC_o}{C_hC_b} \qquad (5.36c)$$

$$Q^2 = \frac{2DC_o}{C_h} + \left(\frac{C_h}{C_b} + \frac{C_b}{C_b}\right) \qquad (5.36d)$$

$$Q^* = \sqrt{\frac{2DC_o}{C_h}\left(\frac{C_h + C_b}{C_b}\right)} \qquad (5.37)$$

The second order conditions show that equations (5.34) and (5.37) are the minimum cost solutions.

5.4. QMS INTEGRATION SOLUTION TO MARITIME TRAINING INSTITUTE PROVIDED BY EXPERT SYSTEMS

The Quality Management System is established in the provision of ISO 9002 standard, ISO 14001 standard, STCW Convention requirements and Safety Management System requirements for Maritime Training Institution by utilising the CLIPS which is the tool of expert systems.

The expert system is a computer system which emulates the decision making ability of a human expert [78]. Expert systems is a branch of artificial intelligence that makes extensive use of specialised knowledge to solve problems at the level of a human expert or knowledge-based system. Many significant expert systems have been built by expressing the knowledge of experts in rules. In fact some types of expert system tools such as CLIPS allow objects as well as rules [78].

Knowledge can be encapsulated in rules and objects. Rules can pattern match on objects as well as facts. Alternatively, objects can operate independently of the rules. This situation enables to integrate both the clauses of each standard or requirements of IMO Conventions and the effort based cost optimisation during the integration and implementation of quality management cycle in maritime training institution.

The algorithm of integration cycle in the means of flow charts are given in Appendix D. The figure D.1 displays the main menu of the code named subroutine-A and the other subroutines starting with subroutine-B and ends with subroutine-S defines the integration parameters in the means of activity elements of each clause that is defined by quality management standards in maritime training field. For this consideration subroutine-A is mainly functioning as a performance evaluation calculator between each clauses of standards, in accordance with the obtained results starting from subroutine-B to subroutine-S.

In addition to the defined algorithm, the specified non compliance terms are used to describe the optimised effort costs for improving the integration cycle in CLIPS code. The evaluation of non-achieving desired targets are discussed in three categories as

major nonconformity, nonconformity and observation. Three kinds of grouping mechanism directly relates with IMO's established conventions.

As a result the outputs of the code display the performance distribution in each clause of standard depending with integration steps or activity elements, integration costs, rectification weights of each clause related with the occurrence of non compliances and the improvement levels of desired targets.

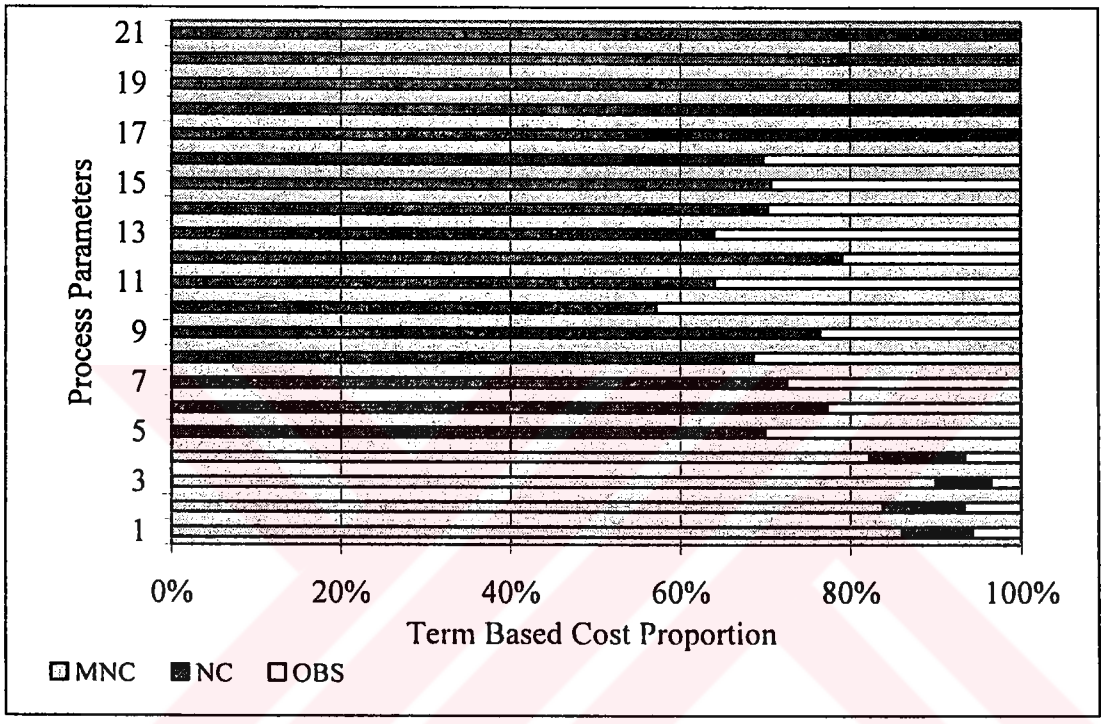


Figure 5.7 Distribution of non compliances in clause 4.1

Figure 5.7 displays the relationship between each action step and the effort distribution rates while the integration of ISO 14001 rules and the specified maritime regulations in clause 4.1. As it is described in Appendix D in subroutine-B1, 4.1.1 directly relates with the establishment of quality policy. If the maritime training institution does not take into account the objectives of the ISM Code then the corrective action cost of this non compliance is 20% of total integration cost of the clause 4.1 that is mentioned in figure 5.7. Similarly if the measurable objectives of ISO 14001 are not defined in policy statement, then it costs again 20% of total integration cost of the clause 4.1. Then the combined weighted non compliance effort will be 40%. Same approximations will be valid for STCW conventional

requirements in policy statement and it costs again 20% of total integration cost of the clause 4.1. In this consideration the combined weighted non compliance effort will be 60%. Although ISO 9002 requirements in policy statement cover the main aspects of ISO 14001, ISM Code and STCW rules, it enforces the maritime training institution to assemble the above regulations with the quality objectives. Its rectification cost then will be 27%. As a result the cost of major non conformity will be 87% of total integration cost of the clause 4.1.

If policy statement is established properly by the maritime training institution, but not implemented by all levels of the organisation, then the total cost of staff's familiarisation will only be the 8% of total integration cost of the clause 4.1. This situation is defined as non conformity in figure 5.7. Finally the revision or amendment requirement cost in policy statement will be 5% of total integration cost of the clause 4.1. The other process parameters like 4.1.2 defining and implementing responsibilities and authority, designation of management representative, clear identification of resources and 4.1.3 management review have the similar probabilities to close out the major non conformities, non conformities and observations in clause 4.1 that is defined in figure 5.7.

The importance of the SOLAS requirements which are directly affecting the training needs of seafarers are examined within the sixth rule of ISM Code. In addition to that MARPOL requirements are examined within the parallel of ISO 14001 and the seventh rule of ISM Code. The coupling actions of STCW Convention and ISM Code are carried out both in 4.8 Identification and Traceability and 4.9 Process Control. The evaluation of implementations are defined in 4.10 Inspection and Testing, 4.12 Inspection and Test Status, 4.17 Internal Audits, 4.1.3 Management Reviews.

Each clause integration cycles and the probability of non compliance occurrences are calculated as similar 4.1. The following results are obtained as indicated, starting from figure 5.8 to 5.16.

Major non conformities that are occurred during the integration process of each combined clause of standards and regulations are discussed in Fig 5.8. The closing out cost of major non conformities in each clause are directly depend upon the nature of requirements which the Maritime Training Institutions should properly establish.

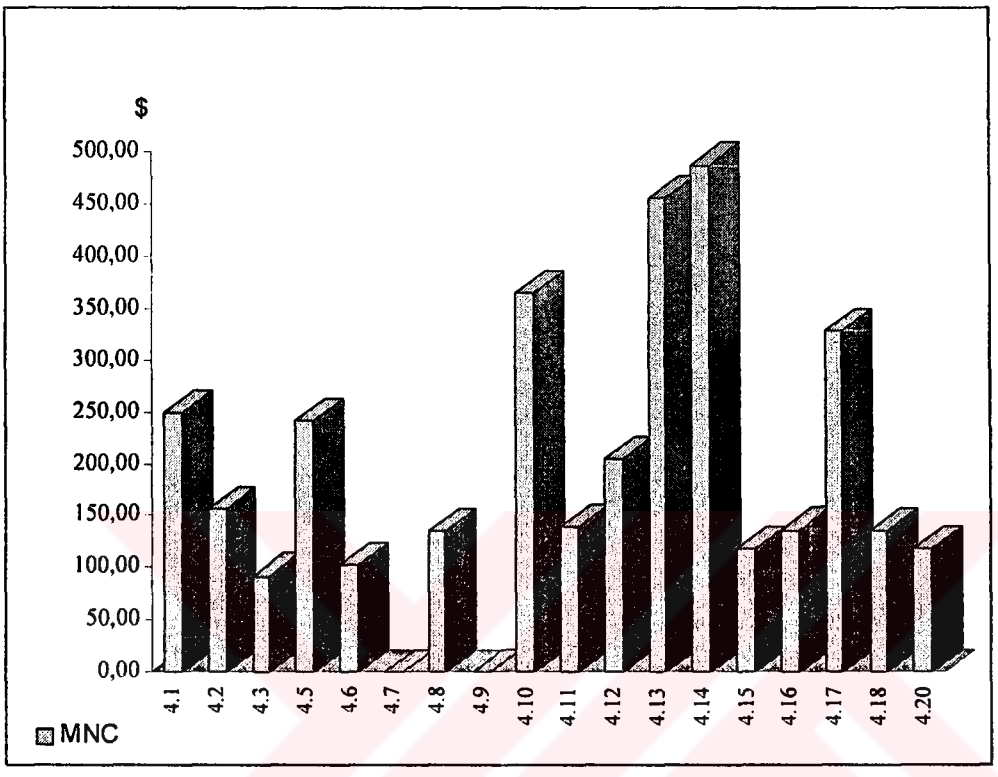


Figure 5.8 Major non conformity - cost distribution during the integration process of quality management system.

In process control clause and customer supplied product or service clause all the requirements are clearly defined and implemented by the IMO's conventions like STCW, SOLAS, MARPOL, COLREG, load line. For this reason, when the 4.7 and 4.9 is taken into account, the occurrence probability of the major non conformities are almost at zero level. Besides in inspection and testing clause that covers the initial inspection, process inspection and final inspection criteria are the generic standards requirements. The combination of inspection and testing statues with management responsibility and authority, effective procedure establishing method, implementing procedural requirements and carrying out audits, result the occurrence of flue areas in management cycle. For this reason to prevent the potential non conformities such as

the lecturers evaluation criteria's which is mentioned in section 4.1.4 are directly affecting the effort rates increase in 4.13 and 4.14. The significant impacts of the 4.1, 4.5, 4.10, 4.12 during the integration process are directly enforcing the implementation of clauses 4.13 and 4.14. The cost of preventing major non conformities then raises to 900-1000$ in maritime training institution.

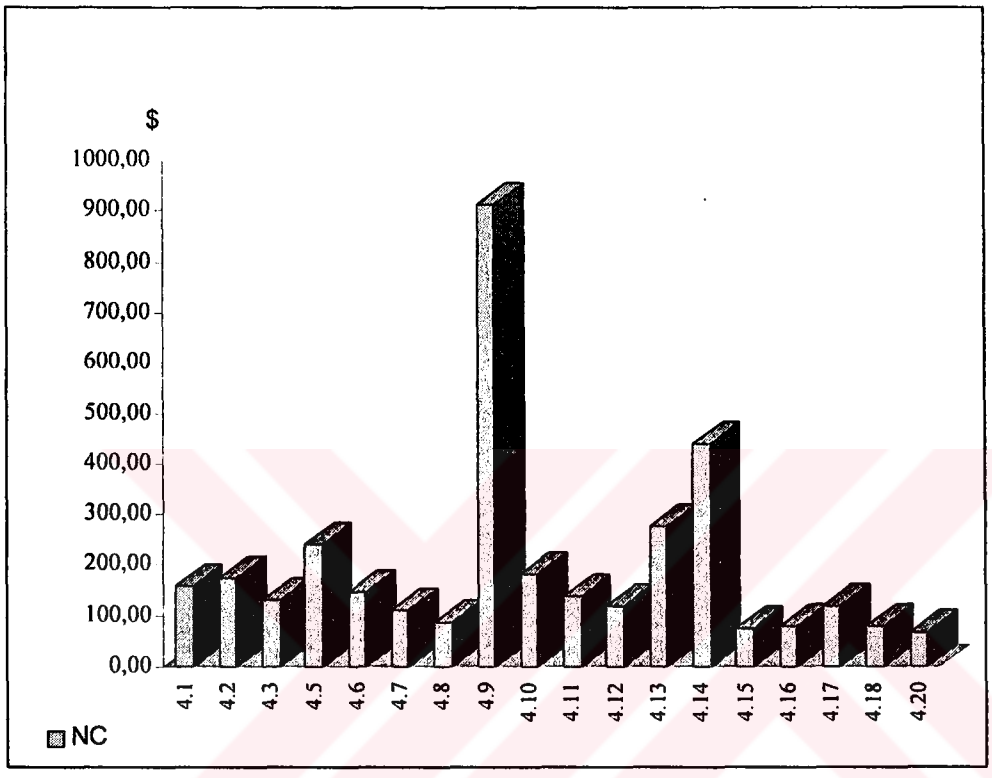


Figure 5.9 Non conformance - cost distribution during the integration process of quality management system.

Non conformances that are occurred during the integration process of each combined clause of standards and regulations are discussed in Fig 5.9. In spite of the major non conformities that are occasinally occured in clauses 4.13, 4.14, 4.10, 4.12, 4.1 and 4.5, the non conformances occurrence probability are mostly seen in 4.9 and 4.14 that is displayed in Fig 5.9. The action steps of each process for integrating the requirements of clauses are clearly defined in subroutine-I and subroutine-N that is mentioned in Appendix D. The reason of cost increase in clause 4.9 directly depends on the updating training curriculums in accordance with the newly established requirements of shipping rules or regulations. For example ballast water management

plan and ballasting-deballasting conditions of ships need to be inserted into the Deck departments training curriculum for ensuring compliance with the resolution A.868(20) in MARPOL Convention. If this situation is missed by the relevant department head, then it will occur a non conformance. In order to carry out necessary corrective actions for closing out this deficiency, the effort rates will contribute to both clauses 4.9 and 4.14. As a result the cost of each corrective and preventive actions shall be 400$ or 450$ in accordance with the subroutine-N in Appendix D.

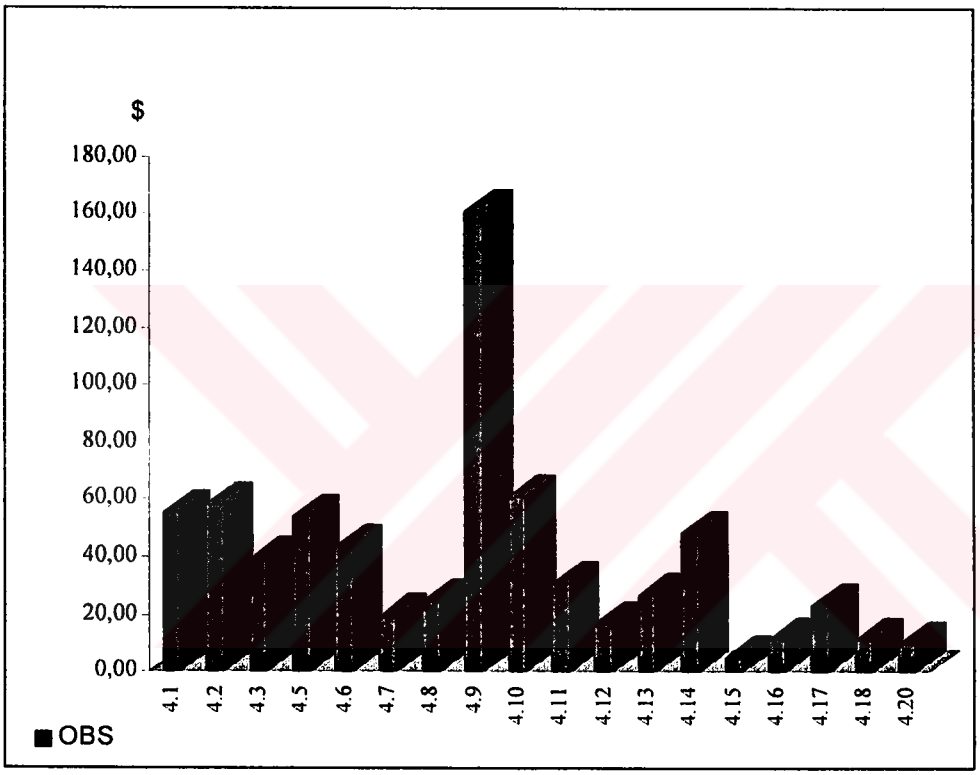


Figure 5.10 Observation - cost distribution during the integration process of quality management system.

Observations that are occurred during the integration process of each combined clause of standards and regulations are discussed in Fig 5.10. The effort rates cause an increase when the minor deficiencies raise in clauses 4.1, 4.2, 4.5, 4.6, 4.10 and 4.14, if it is compared with the Fig 5.9. The main reason of an increase in the amount of observations both in internal audit and external assessment of maritime training institution is caused by the insufficient implementation period of requirements in

generic standards. ISO 14001, garbage management plan in campus can be given as an example for explaning the amount of increase in observations. When the garbages are categorised and the relevant receptacles are defined for the collection of wastes comply the desired targets but recycling of paper or glass based garbages in factories can lead the faculty's budget to improve additional service activities. In this consideration the main aim of each activity can not be restricted to comply only the mandatory requirements. The future improvement levels of each requirements should be defined simultaneously. The results of each observation levels are defined in Appendix D starting from subroutine-B to subroutine-S.

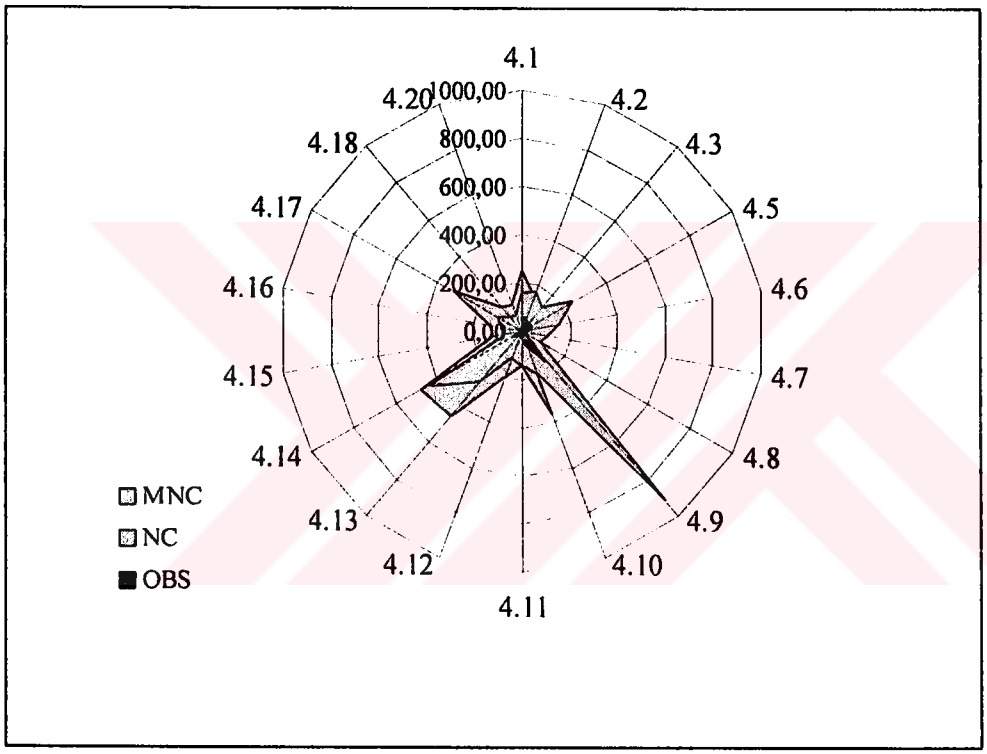


Figure 5.11 Non compliance management cycle during the implementation of quality management system in maritime training institution.

Figure 5.11 indicates the major non conformity, non conformance and observation cost distribution during the integration process of quality management system. After the initial audit and certification process, the training institution does not need to make many revisions or amendments for the supporting elements. If the lecturers responsibilities and duties are defined in 4.1, so there is no need to make highlighted modifications. A few clauses can be inserted into existing statements. In this

consideration faculty will have the deficiencies during the implementation of activity elements. For this reason process control, carrying out inspections, making audits with in the consideration of corrective and preventive actions consist the main activities in the first year's implementation cycle. The cost of each process becomes more important to maintain the necessities of each activity elements. As a result the maintenance cost of activity elements, especially 4.9 can reach to 1000$ in the annual based of faculty's running costs.

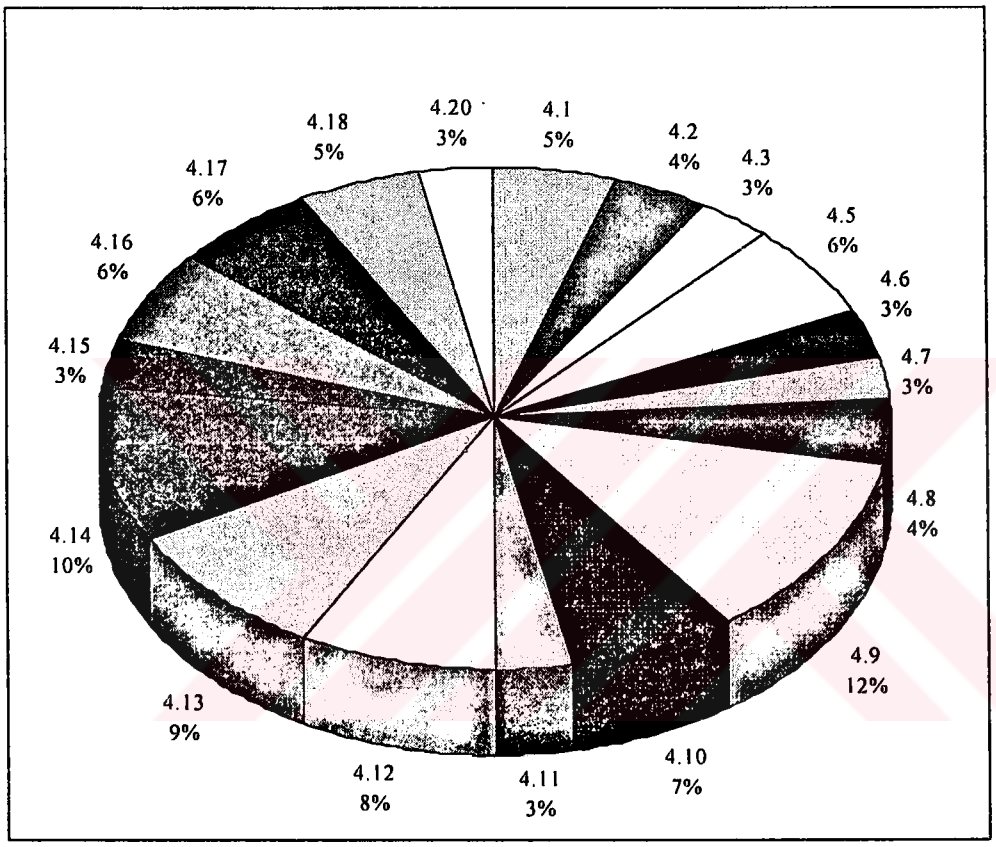


Figure 5.12 Applied effort during project cycle for each clause of standard.

The calculation of effort rates distribution in combined standards are obtained by utilising the data from figures 5.7 to 5.11. As it is indicated in figure 5.12, the activity elements like identification and traceability, process control, control of non conforming product or service, inspection and testing, inspection and test status, corrective and preventive actions, internal audits etc. have 77% affect in whole cycle, when it is compared with the supporting elements as mentioned in section 4.4 of this study. The interpretation of this graph enables the training institution to make

projections while initiating the IMO's conventional requirements into the existing generic clauses mentioned both in ISO 9002 and ISO 14001.

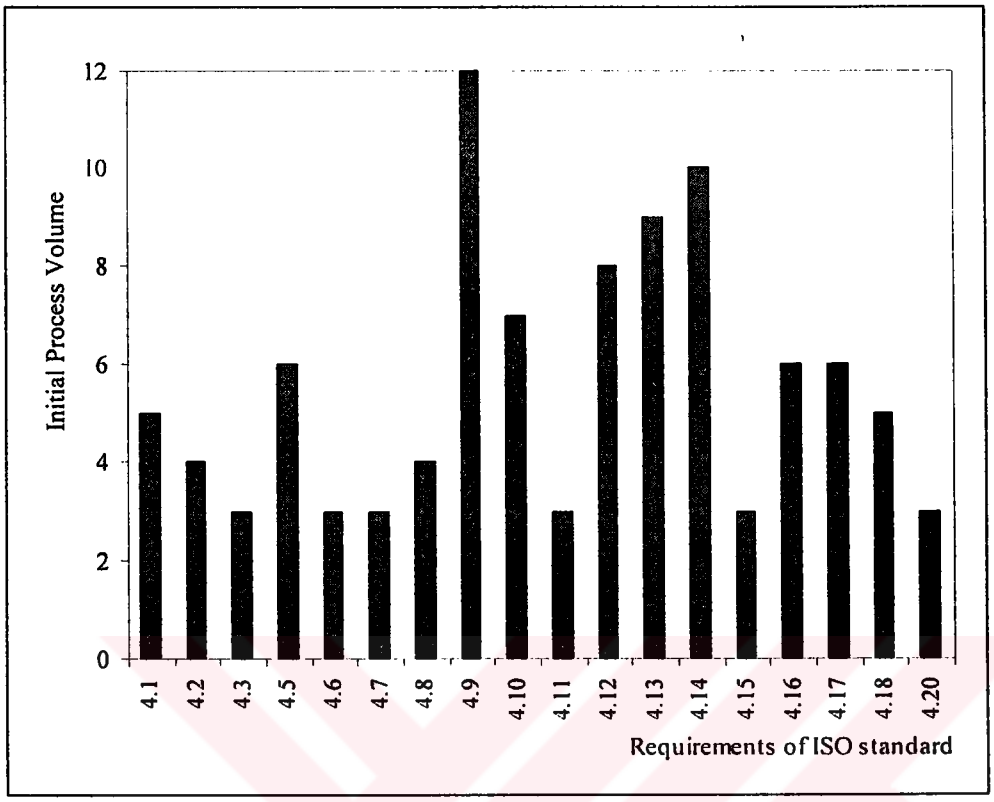


Figure 5.13 Integration volume of each standard clause in maritime training and education.

Figure 5.13 displays the optimum integration periods of each clause which covers the ISO 14001, maritime rules and regulations that are embedded into ISO 9002 clauses. While initiating the integration process to the maritime training institution, the activity elements that their cyclic relationships are closely similar to each other can be taken into account simultaneously with the same or different working groups. This leads the training institution to reduce integration period. As well as that the team members of working groups can find the opportunity to see the clear interrelationship between on going processes. As it is indicated in figure 5.13 while establishing the authorities, responsibilities and duties of faculty members, the relevant clauses such as 4.9, 4.10, 4.12, 4.13, 4.14, 4.16 and 4.17's key drivers has to be appointed. Similarly while establishing the requirements of 4.2 in maritime training institution, 4.5 and 4.16 can be taken into account in the same integration period because

structure of the documentation, establishing the rules of documentation management and control of quality records have similar affects while implementing the STCW Convention and the requirements of the ISM Code in maritime training intitution. Although the clause 4.6 directly relates with the administrative activities of faculty, some of the incoming inspections might be necessary in order to decide supplied goods or materials are functioning at their desired levels. In this consideration, reseach assisstants or some of the lecturers can participate the reporting activities of non conforming products. This results to combine requision and order process specifications to clause 4.1 and 4.10 and 4.13, 4.14. Finally the combination method of each requirements that is mentioned above shall reduce the integration time 40%, between 44 and 48 weeks.

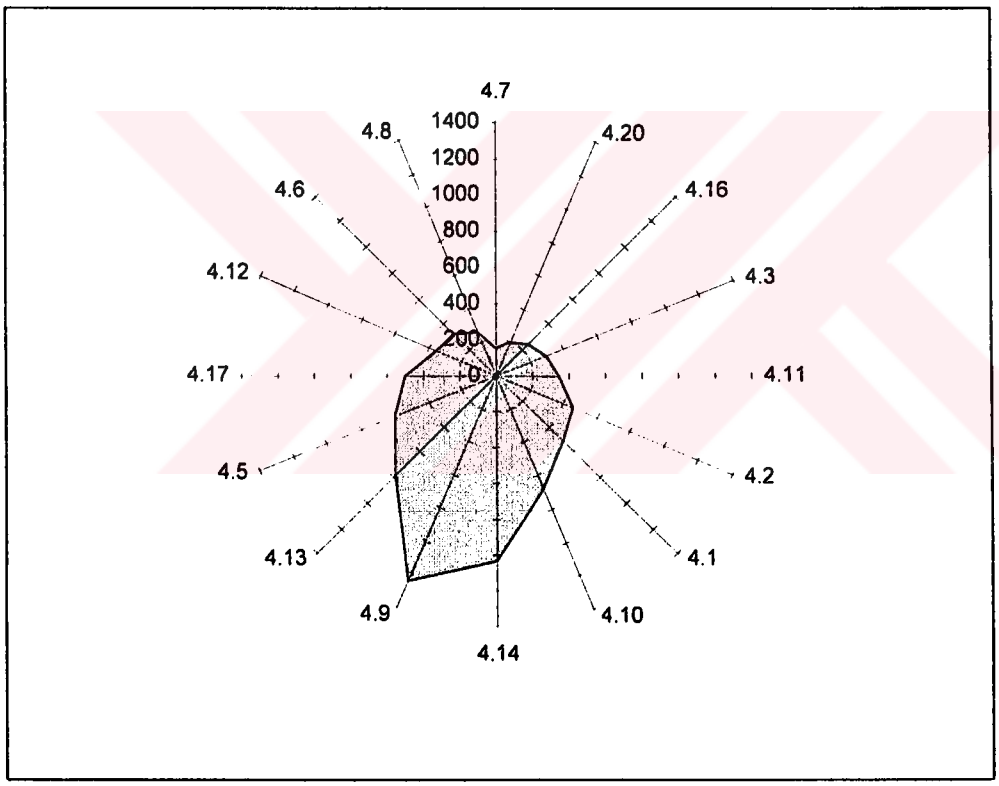


Figure 5.14 Effort cost distribution cycle for implementing ISO standards in maritime education and training.

Figure 5.14 displays the total cost of major non conformity, non conformance and observation efforts that are coupled in each activity cycles as it is defined in Appendix D. This graphical presentation enforces the maritime training institution to

give more importance to reduce the potential deficiencies of clauses 4.17, 4.5, 4.13, 4.9, 4.14, 4.10, 4.1, 4.2 and 4.11 during implementation. This result seems realistic because the motivation of academic staff could easily be lost, when some of the evaluations are assessed like lecturer's performance evaluations, evaluation of realistic project outputs in each term, evaluation of deviations while comparing the industry's expectations etc. This causes many non compliances during implementation and the rectification cost of potential non compliances. Process control can reach up to 1400$/cycle because the establishment level of each requirement needs to be repeated many times until the satisfactory solutions are obtained as indicated in Appendix D.

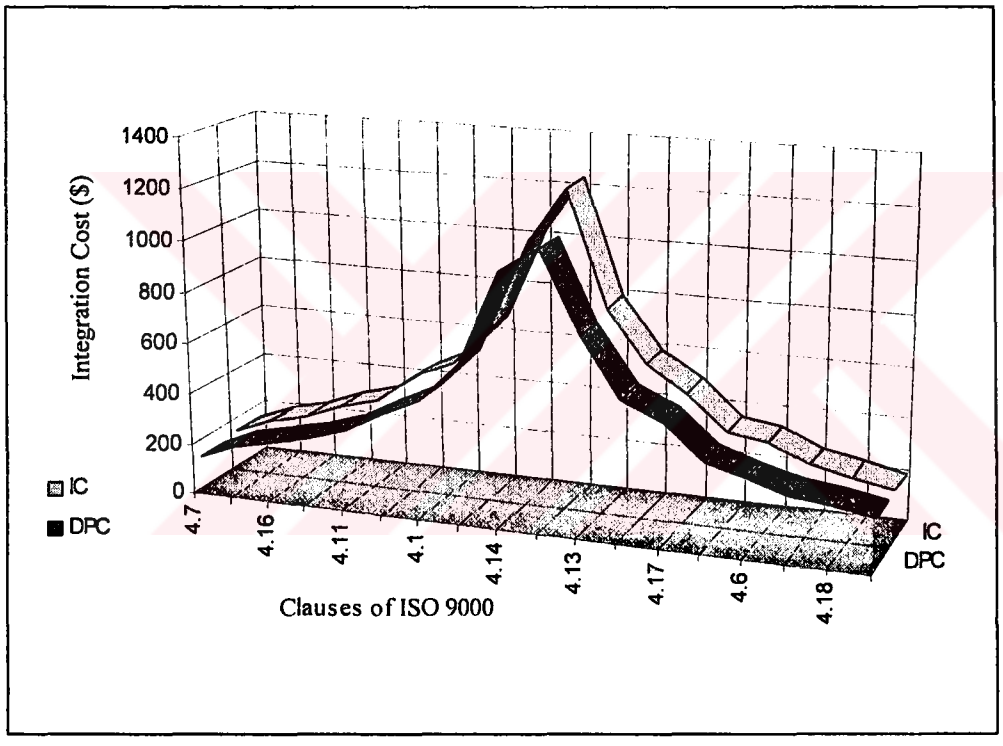


Figure 5.15 Comparison between integration cost and desired productivity based cost in supporting elements of each standard.

After interrelated activity elements of each clause integrated at the same establishment period, then the cost of implementation cycle will result a decrease in supporting elements as it is indicated in Figure 5.15. This graph is only indicating the affects of supporting elements during the integration cycle. For example if the requirements of 4.18 training is taken into account when establishing the clauses like

4.8, 4.9, 4.10, 4.12 etc. then the integration cost reduces 150$/cycle as it is calculated in subroutine-Q in Appendix D. Similar solutions can be achieved for the other clauses like 4.7, 4.16, 4.11, 4.1, 4.14, 4.13, 4.17 and 4.6.

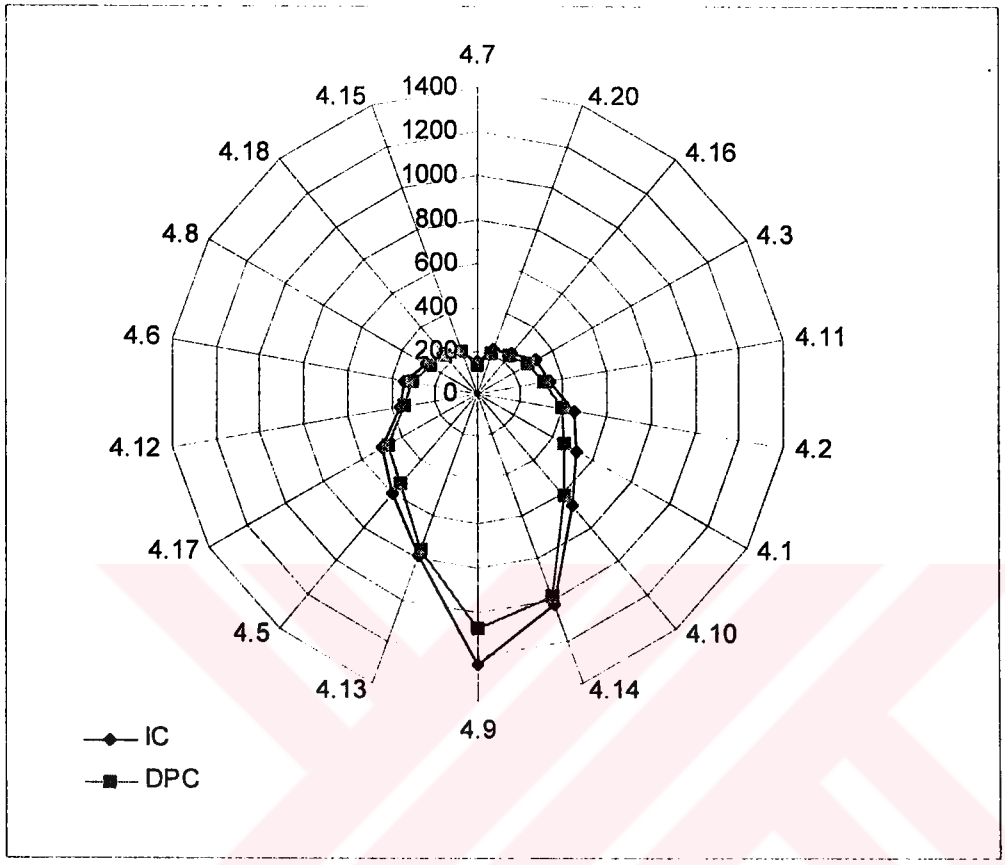


Figure 5.16 Comparison of life cycle cost for implementing generic and specified maritime standards in training institution.

Figure 5.16 displays the difference between the integration cost (IC) and desired productivity cost (DPC) or one year implementation cost after registration process is completed. The main advantage of this system is to increase the productivity for all staff and to reduce unforseen costs. For example the training institution should carry countermeasures on water lines in accordance with ISO 14001. This leads the institution to identify the leakages or unnecessary consumption to take preventive actions. Similar situation can be described by all resources like electricity, fuel consumption or chlorine consumption in swimming pool during the seafarers training etc.

While the cost of each process begins to decrease as indicated in 4.9 then the related costs like 4.10, 4.13 and 4.14 begin to reduce. This cause the overall cost reductions in the other related clauses of standards.

If the mandatory requirements of STCW Convention is established before initiating the generic standards into the maritime training institution then the calculated optimised integration cost is found as 8400$ in 45 weeks period. The amount of integration cost depends only using the internal resources of the faculty consists of ten academic staff with two differentiated working groups who are trained both in generic and specified maritime standards before initiating the integration cycle. The registration and follow-up audit cost depends on the quotations form certification bodies but it changes between the range of 5000$/year to 7000$/year.

Finally the total cost for the first term is between the range of 13400$ to 15400$. After implementing the system one year, the total cost of the IMS reduces to between the range of 9400$ to 12400$. If the IMS is implemented in effective and appropriate manner, it could be interpreted that the implementation costs will have the reducing trends in the foregoing years.

6. DEVELOPED MANAGEMENT MODEL FOR İ.T.Ü MARITIME FACULTY INCLUDING QUALITY, SAFETY AND ENVIRONMENTAL PROTECTION

6.1. INTEGRATED MANAGEMENT SYSTEM MANUAL

6.1.1. MANAGEMENT RESPONSIBILITY

Section 1 of the MSM (Management System Manual) addresses the requirements of clause 4.1 (Management Responsibility) of ISO 9002-1994. In addition, this section addresses the requirements of clauses 4.2 (Environmental Policy), 4.3.3 (Objectives and Targets), 4.3.4 (Environmental Management Program), 4.4.1 (Structure and Responsibility), 4.4.3 (Communication), 4.6 (Management Review), and aspects of clauses 4.4.2 (Training Awareness, and Competence) and 4.5.1 (Monitoring and Measurement) in ISO 14001-1996.

6.1.1.1. QUALITY and ENVIRONMENTAL POLICY

a. The commitment to quality and the environment by İ.T.Ü Maritime Faculty's executive management are reflected in our faculty's mission statement, and in the policies and objectives.

Quality Policy

- At İ.T.Ü Maritime Faculty our policy is to establish and continuously improve a working environment that supports the education, training and associated services to specified and verifiable standards of quality that meet or exceed the defined needs and expectations of our customers - the reason our faculty exists.

Environmental Policy

• At İ.T.Ü Maritime Faculty, we continuously strive to comply with all defined environmental requirements and to improve our service and processes according to our defined environmental objectives and targets in order to prevent pollution and protect our environment. İ.T.Ü Maritime Faculty commits for :

* Ensuring continual improvement

* Communicating the environmental policy to all employees and ensuring availability of the environmental policy to public.

• Comply with the requirements of the relevant environmental legislation, regulations (stated as 2872 Governmental Environment Law), or other requirements that we subscribe to as part of our role in a clean environment.

Quality and Environmental Objectives

◊ Form relationships with both customers and vendors that will improve quality in all aspects of service usage and purchased parts.

◊ Develop and maintain a team approach that emphasises enhancing the competitiveness of the faculty through increased quality and productivity.

◊ Provide an atmosphere that encourages every employee to achieve his or her full potential and pride in workmanship.

◊ Develop a management system based on the ISO 9002 & ISO 14001 Standards to foster continuous process / environmental improvement and problem prevention instead of problem detection.

◊ Define and implement our integrated management system based upon employee involvement and a commitment to excellence.

◊ Give all employees the training and support needed to provide quality services to all customers as well as meeting the environmental objectives.

◊ Communicate our mission and quality and environmental objectives to all employees, and assign individual responsibilities for performance and accountability.

b. İ.T.Ü Maritime Faculty's quality and environmental policy (as embodied in our mission statement and objectives for quality and the environment) is displayed openly as a sign of our pride and commitment, and as a clear reminder of our vision and direction. The policy is also presented to all new employees in our orientation training, and is continuously reinforced by management to ensure understanding and commitment at all levels in the faculty.

c. Our quality and environmental policy is used to maintain İ.T.Ü Maritime Faculty's already considerable reputation for quality and strong commitment to the environment throughout the 1990's and beyond. This policy is available to the public.

6.1.1.2. ORGANIZATION

Responsibility and Authority

a. The organisational structure shown in figure 1.1 illustrates the interrelations and authority of personnel who manage, perform, and verify work affecting the quality of services provided by İ.T.Ü Maritime Faculty. The roles, responsibilities, and authorities of personnel with regard to both quality and environmental issues are defined, documented, and communicated to facilitate the implementation and maintenance of the integrated management system.

b. The Dean is the leader of the quality and environmental efforts within İ.T.Ü Maritime Faculty and is responsible for the delegation of the various responsibilities for quality and environmental issues, assurance that sufficient resources are made available throughout the faculty to support the implementation and control of the integrated management

system as defined in this manual, and for the efficient operation of İ.T.Ü Maritime Faculty. Dean is responsible for preparing Academic and Administrative Annual Performance Report in accordance with 2547 Higher Education Council Law. The authority and the responsibility of Dean is described in 2547 Higher Education Council Law.

The Vice Deans are responsible for the operation of the functions which report to them. These responsibilities include both daily operations and strategic and tactical planning. They must ensure that İ.T.Ü Maritime Faculty's quality and environmental policies are effectively operating in their functions. The authority and the responsibilities of Vice Deans are described mentioned in 2547 Higher Education Council Law.

VICE DEAN (WHO IS RESPONSIBLE FOR FACULTY ADMINISTRATION)

Vice Dean who is responsible for Faculty administration is nominated as Management Representative mentioned in 1.2.3. Decision Criteria for the Appointment of Vice Dean who is responsible for the Faculty Administration as Management Representative which has prepared by Dean is given below.

Purpose of the decision criteria can be defined as to structure and to implement the ISO 9002-1994 and ISO 14001- 1996.

Criteria's:

1-) The Management Representative Ashore must have the enough knowledge and experience to ensure the quality and environmental process in faculty and to provide a link between the executive management of the faculty and the lectures, staff.

2-) The Management Representative shall formulate budgets for management, monitoring, and maintenance of Quality and Environmental Management System.

3-) The Management Representative shall control of Quality and Environmental Management Manual and related procedures and documents.

4-) The Management Representative shall plan and implement the internal audits of Quality and Environmental Management System.

5-) The Management Representative shall nominate and designate of internal audit team members, and responsible for the implementation of audits.

6-) The Management Representative shall report the non-conformities and deficiencies which relates the Quality and Environmental Management System to Dean.

7-) The Management Representative shall establish and control the emergency preparedness and response actions which is mentioned in MSP 09.2

8-) The Management Representative shall verify of corrective action to remedy defects in Quality and Environmental Management System.

9-) The Management Representative must have the proficiency at least at the same level as the PHD proficiency.

10-) The Management Representative shall identify necessary resources and support in order to verify and implement that the services provided by the faculty's objectives and shall report all details to Dean.

11-) The Management Representative must have the ability to maintain the quality aspects of the system, and has the responsibility for:

a-) Matters pertaining to faculty administration and quality training service

b-) Supervision and guidance of all Department Heads

c-) Delegation of responsibilities and authority to all Department Heads

d-) Research in marine technologies

e-) Research in conventions, laws, and regulations

f-) Prevention and handling of casualties

g-) Providing health and safety working conditions.

h-) Prevention of marine and atmospheric pollution

i-) Employment of lecturers and the staff and education and training of all faculty members.

j-) Training faculty staff relating to Quality and Environmental Management System.

k-) Attending the Faculty Administrative Executive Committee Meeting which is established on a weekly basis as described in 2547 Higher Education Council Law.

l-) Attending the Academic Faculty Council which is established on a monthly basis that as described in 2547 Higher Education Council Law.

Management Representative represents the main communication center and link between the between the executive management of the faculty and the lectures, staff.

In the absence of Management Representative, Quality Assurance Coordinator shall be Management Representative and shall act on the responsibilities and duties of Management Representative.

VICE DEAN (WHO IS RESPONSIBLE FOR EDUCATION AND TRAINING)

Vice Dean who is responsible for education and training shall assist the Management Representative. Vice Dean's authority related to Quality and Environmental Management System is described below.

1-) Planning and preparing training needs and training curriculums of students in accordance with the Team Formation Process.

2-) Planning and implementing education and training process and service.

3-) Responsibilities of the Vice Dean related to Quality and Environmental Management System is mentioned below.

a-) Controlling all lessons and their implementation.

b-) Providing of prevention and handling of non conformities regarding with the implementation of training and education process.

c-) Examining the results of exams in order to verify performance analyses .

d-) Maintaining proper conditions, and distributing necessary information to lecturers.

e-) Maintaining necessary instructions for the prevention of non conforming process in lectures.

f-) Providing necessary information to all academical staff about the regulations and rules.

g-) Providing necessary information to all academical staff about technology development.

h-) Attending the Faculty Administrative Executive Committee Meeting which is established on a weekly basis as described in 2547 Higher Education Council Law.

i-) Attending the Academic Faculty Council which is established on a monthly basis that as described in 2547 Higher Education Council Law.

FACULTY SECRETARY

Faculty Secretary is the deputy of Vice Dean who is responsible for the Faculty Administration. Activities of Faculty Secretary related to Quality and Environmental Management System is described below.

1-) Procurement of provision, consumable stores, spares, supplies, and fuel oil.

2-) Coordinating workers for carrying out their daily or weekly jobs.

3-) Checking and supervision of measures for works carried out in faculty.

4-) Analysis of causes of machinery accidents and failures, examination of measures to prevent recurrence, and execution of post-accident/post-failure handling operations

5-) Providing necessary technical information to Management Representative

6-) Planning and execution of maintenance management, and evaluation of maintenance contractors

7-) Planning and implementation of constructual modifications

8-) Collection and study of information on material and equipment for prevention of environmental pollution

9-) Operations related to evaluation, promotion, punishment, and payment of workers.

10-) Operations related to health, safety, and management of medical treatment.

11-) Operations related to employment of crew members, labor management, service, and welfare.

12-) Operations and communication with staff defined in Emergency Preparedness and Response Procedure .

13-) Attending the Faculty Administrative Executive Committee Meeting which is established on a weekly basis as described in 2547 Higher Education Council Law.

The authority and the responsibility of the Faculty Secretary is described in 2547 Higher Education Council Law.

MARITIME SAFETY TRAINING CENTER

In order to carry out the continuing education for all seafarers in Türkiye at International Standards; İTÜ Maritime Faculty executed an International Project funded by UNDP, and implemented in cooperation with IMO at Tuzla Campus named the Marine Safety Training Center of Türkiye. The courses which are carried out in Marine Safety Training Center are Fire Fighting Course, Survival Craft Proficiency Course, First Aid Course etc. Dean is the Head of Marine Safety Training Center. Marine Safety Training Center is administered with in the İ.T.Ü Maritime Faculty which the authorisation granted from the Prime Ministry Undersecretariat of Maritime Affairs which is the Administration in Türkiye. Marine Safety Training Center is managed in accordance with the Governmental Rule.

The **DEPARTMENT HEADS** are responsible for ensuring that İ.T.Ü Maritime Faculty's quality and environmental policies are being carried out on a daily basis. Department Heads are for responsible attending Academic Faculty Council which is established on a monthly basis that as described in 2547 Higher Education Council Law. The Department Heads may delegate the authority for implementation of the quality and environmental functions within their departments, but shall retain the responsibility for each function. It is our policy that such delegation be formally defined and documented.

Both Higher Education Council laws, regulations and İ.T.Ü regulations are applied to all departments and the duties of all departments must confirm to these regulations.

The responsibility chart shown in figure 6.2 summarises the primary and contributing responsibilities of management personnel for the key elements of the integrated management system.

DECK DEPARTMENT

1-) Ensuring an efficient Training & Education process during 4 years (8 semesters) for the students who will be a Deck Officer after graduating from İ.T.Ü Maritime Faculty.

2-) Research in technology, new developments and the methodology including benchmarking with other faculties in the world for establishing quality training service.

3-) Reporting non conformities to Management Representative which is occurred in Deck Department.

4-) Carrying out necessary corrective actions for establishing never ending improvement.

5-) Tracing and implementing the lectures during training process.

MARINE ENGINEERING DEPARTMENT

The responsibilities and the duties of Engine Department is mentioned below :

1-) Ensuring an efficient Training & Education process during 4 years (8 semesters) for the students who will be a Marine Engineer after graduating from İ.T.Ü Maritime Faculty.

2-) Research in technology, new developments and the methodology including benchmarking with other faculties in the world for establishing quality training service.

3-) Reporting non conformities to Management Representative which is occurred in Marine Engineering Department.

4-) Carrying out necessary corrective actions for establishing never ending improvement.

5-) Tracing and implementing the lectures during training process.

MARITIME TRANSPORTATION AND MANAGEMENT ENGINEERING DEPARTMENT

The responsibilities and the duties of Maritime Transportation and Management Engineering Department is mentioned below:

1-) Supporting Deck and Marine Engineering Department relating with the Management and Law based lectures.

2-) Ensuring an efficient Training & Education process during 2 years (4 semesters) for the post graduate students.

3-) Reporting non conformities to Management Representative which is occurred in Maritime Transportation and Management Engineering Department.

4-) Carrying out necessary corrective actions for establishing never ending improvement.

BASIC SCIENCES DEPARTMENT

The responsibilities and the duties of Basic Sciences Department is mentioned below :

1-) Supporting Deck and Marine Engineering Department relating with the Basic Sciences based lectures like Mathematics, Physics, English Proficiency etc.

2-) Reporting non conformities to Management Representative which is occurred in Maritime Transportation and Management Engineering Department.

3-) Carrying out necessary corrective actions for establishing never ending improvement.

Quality and the outside environment are the responsibility of each İ.T.Ü Maritime Faculty employee. Specific responsibilities for activities affecting quality and the environment are specified further and explicitly in İ.T.Ü Maritime Faculty's management system manual, procedures, and work instructions.

FACULTY ADMINISTRATIVE EXECUTIVE COMMITTEE MEETINGS

The purpose of the Faculty Administrative Executive Committee Meeting is to review and discuss the administrative matters/ problems, preventive actions that are occurred during the implementation of process as described in 2547 Higher Education Council Law. Faculty Administrative Executive Committee Meetings are held on a weekly basis. The following shall attend the meeting: Dean, Three Professors, Two Associated Professors, One Assistant Professor, Faculty Secretary, One Research Assistant Representative (if necessary), One Student Representative (if necessary).

ACADEMIC FACULTY COUNCIL

The purpose of the Academic Faculty Council is to review and discuss the education, training matters/ problems, preventive actions, future estimations that are occurred during the implementation of process as described in 2547 Higher Education Council Law. Academic Faculty Council is held on a monthly basis.

The following shall attend the Council :

Dean, Three Professors, Two Associated Professors, One Assistant Professor, Department Heads

QUALITY ASSURANCE COORDINATOR

Quality Assurance Coordinator shall assist the Management Representative and shall be responsible:

1-) Day to day operation of Integrated Management System .

2-) Ensuring all Quality and Environmental requirements are carried out in accordance with the Integrated Management System Procedures, Work Instructions and Records.

3-) Ensuring that the department's staff are suitably trained and experienced depending on the Quality and Environmental Management System Training Curriculum requirements.

4-) The preparation and review of emergency response plans covering emergency situations.

5-) Conducting internal audits of the department as a lead internal auditor.

6-) Participating in Integrated Management System Review Meetings.

7-) Liaising with Management Representative on training requirements.

8-) Dealing with non conformities covering departmental based operations

9-) Investigating potential non conformities regarding with the implementation of Integrated Management System.

c. At İ.T.Ü Maritime Faculty, all persons performing or verifying work affecting quality or impacting the environment have sufficient authority and the organisational freedom to:

- Identify and document quality and environmental problems to initiate corrective actions that prevent the occurrence of non conformities in the service process.
- Recommend, initiate, implement, and verify solutions for continuous quality and process improvement, either directly or through designated channels as defined in the faculty's quality system or environmental management system procedures and/or work instructions.
- Terminate the processing, delivery, and/or use of nonconforming items, until proper rectification of deficient conditions has occurred.
- Respond to accidents and emergency situations as well as reduce the environmental impacts of the above situations.

a. The resource requirements for the management of the quality and environmental system, the performance of work, and in-house verification activities (eg., monitoring of all activities affecting the quality of İ.T.Ü Maritime Faculty's services, as well as impacting the environment) are explicitly defined in the management system procedures, and work instructions.

b. Resource requirements at İ.T.Ü Maritime Faculty include human resources and specialised skills, technology and financial resources.

c. All employees involved in the management, performance, and/or verification of work affecting quality or significantly impacting the environment are qualified on the basis of experience, education, and/or training.

Management Representative

The Vice Dean Prof. Dr. Ahmet BAYÜLKEN has the authority and responsibility for ensuring that the integrated management system is effectively implemented and maintained at İ.T.Ü Maritime Faculty in accordance with the ISO 9002-1994 & ISO 14001-1996 Standards, and for reporting to the faculty's dean on the performance of the management system at the time of the Management Review. This will be used as the basis for improvement of the integrated management system at İ.T.Ü Maritime Faculty.

The Management Representative is responsible for ensuring that environmental objectives and targets are established, documented and maintained at all levels within İ.T.Ü Maritime Faculty. In addition, the Management Representative is responsible for ensuring these objectives and targets are consistent with İ.T.Ü Maritime Faculty's environmental and quality policy, and its commitment to continuously improving and maintaining a clean environment.

Teamwork Approach

As stated in the Objectives for Quality, the "Team Approach" is a key strategy at İ.T.Ü Maritime Faculty to foster continuous quality and environmental improvement through employee involvement. The mechanisms and policies for the teamwork approach are addressed in the Procedure for Team Formation, Operation, and Dispersal MSP 01.1.

Communications

The Internal Communications Procedure MSP 01.2 and External Communications Procedure MSP 01.3 have been established to direct the receipt and documentation of, and response to communications regarding İ.T.Ü Maritime Faculty's environmental aspects (as determined in the Environmental Planning Procedure MSP 02.3) and the quality and environmental management system (as defined in this manual). Such communications may include, but are not limited to:

- Statements regarding İ.T.Ü Maritime Faculty's policy for and commitment to quality and the environment.

- Employee or external party concerns and questions.

- Reports on İ.T.Ü Maritime Faculty's performance with regard to quality and environmental objectives and targets, as determined during audits and management reviews.

Processes for external communication on significant environmental aspects are considered, and related decisions are documented.

6.1.1.3. MANAGEMENT REVIEW

a. The management system at İ.T.Ü Maritime Faculty is reviewed by executive management personnel having direct responsibility for the system at a minimum interval of 12 months according to the Management Review of the Integrated Management System Procedure MSP 01.4.

b. The quality and environmental management system review is coordinated by the Management Representative. The review addresses the following agenda items:

1. Assessment of the effectiveness of the integrated management system in achieving the faculty's quality and environmental policy and objectives, satisfying the requirements of ISO 9002-1994 and ISO 14001-1996, and complying with relevant environmental legislation and regulations.

2. Evaluation of compliance to any legal or other environmental requirements.

3. Assessment of likely future requirements to ensure that the integrated management system will remain suitable and effective.

4. Review of the evidence from internal audits, corrective and preventive actions, customer complaints, reported service defects, environmental assessments, and

concessions granted, in order to determine if changes to İ.T.Ü Maritime Faculty's management system, policy, or objectives are needed.

5. Evaluation of compliance to any legal or other environmental requirements.

6. Assessment of likely future requirements to ensure that the integrated management system will remain suitable and effective.

7. Review of the evidence from internal audits, corrective and preventive actions, customer complaints, reported service defects, environmental assessments, and concessions granted, in order to determine if changes to İ.T.Ü Maritime Faculty's management system, policy, or objectives are needed.

c. Each Head of Department is responsible for conducting a review of the management system in his or her area of responsibility, writing a report addressing the above agenda items and the conclusions reached, and submitting it to the Management Representative. The Management Representative is responsible for reviewing the individual reports, reporting to the Dean on the performance of the quality and environmental management system, and providing information to serve as a basis for continuous improvement. In addition, the Management Representative is responsible for ensuring that the necessary information is gathered to facilitate the management system audit and review.

d. The Vice Dean and Faculty Secretary, in consultation with the Management Representative, initiate corrective actions according to the Corrective Action Procedure MSP 14.1 and preventive actions according to the Preventive Action Procedure MSP 14.2, as appropriate. The results of these actions may include changes to the faculty's policy, objectives, and/or elements of the management system in order to respond to audit findings, changing circumstances, and other opportunities for improvement.

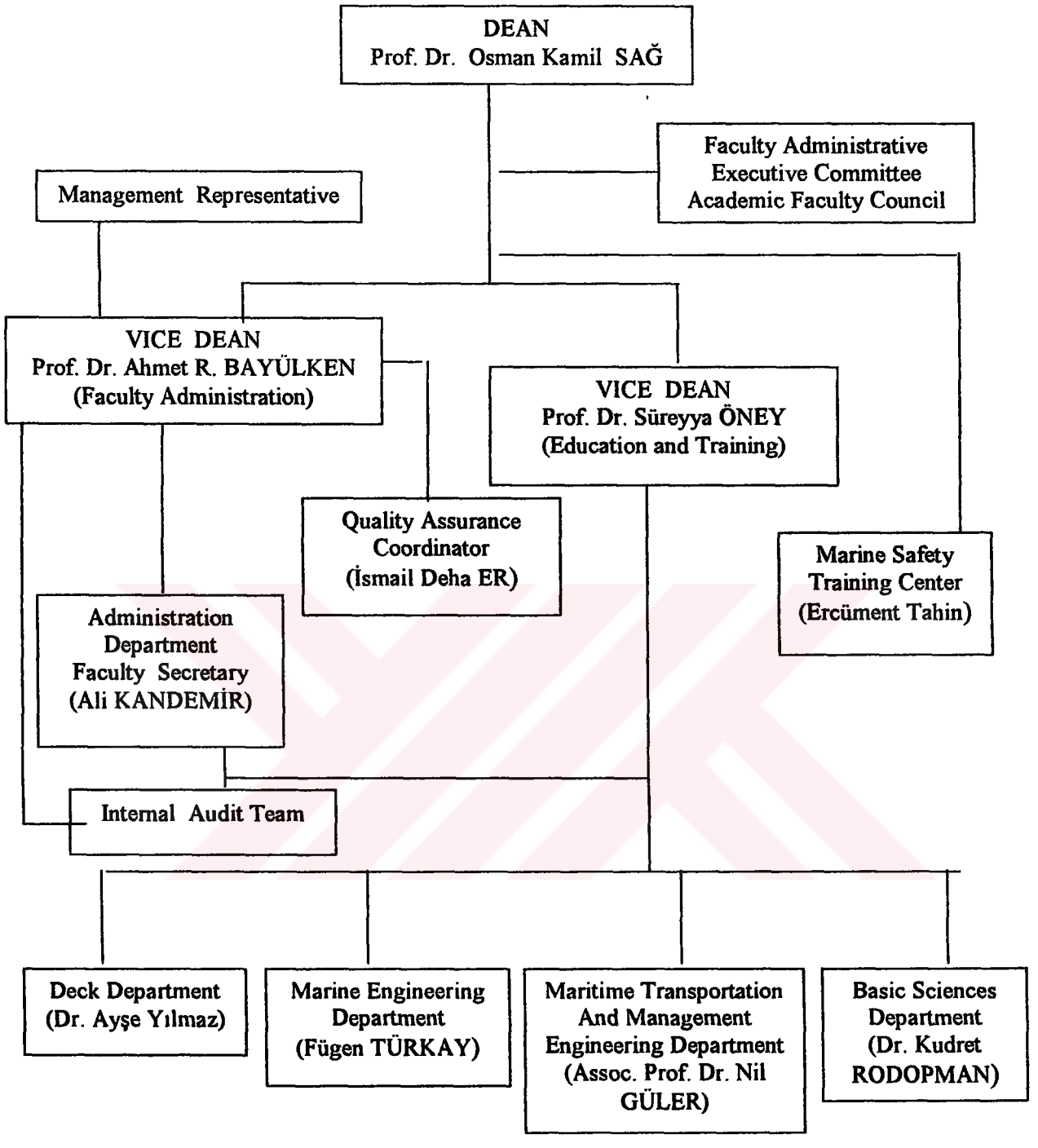


Figure 6.1. Organisational structure at İ.T.Ü Maritime Faculty

** - Primary responsibility
**
Θ - Contributing
Π -Final Approval

	A	B	C	D	E	F	G	H	I
Management Reviews of MS	Θ	****	Θ	Θ	Θ	Θ	Θ	Θ	Θ
Planning/Implementation of MS	Π	****	Θ	Θ	Θ	Θ	Θ	Θ	
Contract Review	Π	****	Θ	Θ					
Document Control		****	Θ	Θ	Θ	Θ	Θ	Θ	Θ
Supplier Selection & Assessment	Π	Θ		****					
Purchase Order Review/Issue		Π		****					
Service Identification/ Traceability	Π	****	Θ	Θ					
Process Control		****	Θ	Θ	Θ	Θ	Θ	Θ	
Preventative Maintenance		****		Θ					
Inspection & Test		Π		****					
Nonconforming Process	Π	****	Θ	Θ	Θ	Θ	Θ	Θ	Θ
Emergency Preparedness and Response		****	Θ	Θ	Θ	Θ	Θ	Θ	
Corrective & Preventive Action	Π	****	Θ	Θ	Θ	Θ	Θ	Θ	Θ
Handling, Storage, Packaging, Preservation, & Delivery		Π		****					
Management System Records	Π	****	Θ	Θ	Θ	Θ	Θ	Θ	
Internal Management System Audits	Π	****		Θ					Θ
Quality, Environmental Awareness & Training		****		Θ					
Support/Customer Service	Π	****	Θ	Θ	Θ	Θ	Θ	Θ	

Figure 6.2 Responsibility chart

Key: A = Dean B = Man. Representative C = Vice Dean (E&T) D= Faculty Secretary
E = Head of Deck Dept. F = Head of Mar. Eng. Dept.
G = Head of Mar. Trans. Dept. H= Head of Bas. Scien. Dept. I = Int. Aud. Team

e. Records of the management reviews are filed and maintained by the Management Representative for a period of five (5) years. The records shall show evidence of how the review was conducted, who was involved, what factors were considered, what conclusions were reached, and what actions were taken.

6.1.1.4. ENVIRONMENTAL OBJECTIVES AND TARGETS

The Management Representative is responsible for ensuring that environmental objectives and targets are established, documented, and maintained at all levels within İ.T.Ü Maritime Faculty. When the objectives and targets are established, consideration is given to the following:

- Relevant legal and other requirements
- Significant environmental aspects of our activities and services

* Garbage Reception Facilities
* Sewage System
* Chimney Emissions
* General cleaning purpose of the environment

- İ.T.Ü Maritime Faculty's technological options
- Financial, operational, and business requirements
- Prevention of pollution and protecting the environment
- Views of interested outside parties

In addition, the Management Representative is responsible for ensuring these objectives and targets are consistent with İ.T.Ü Maritime Faculty's environmental and quality policy, and its commitment to continuously improving and maintaining a clean

environment. Quality objectives are directly interrelates with the Environmental Management System implementations. For this purpose when a quality failure occurs in the management cycle, it is responsibility of Management Representative investigating the situation if it has any affects on the environment or not. The affects of the quality failure may not cause direct non compliances on the environment or vice-versa. In this situation Management Representative shall also investigate the reflections or the probability of occurrence for the potential non conformities on the management system.

6.1.1.5. ENVIRONMENTAL MANAGEMENT PROGRAM

The Management Representative is responsible for ensuring that a program is established and maintained for achieving the environmental objectives and targets. The environmental management program applies to all relevant levels and functions in İ.T.Ü Maritime Faculty and includes the following:

- Designation of responsibilities for achieving the objectives or targets
- Assignment of completion times for the environmental objectives or targets
- Definition of activities and resources

The environmental management program will be amended when necessary to cover projects relating to new developments, and new or modified activities and services.

6.1.2. MANAGEMENT SYSTEM

Section 2 of the Management System Manual addresses the requirements of clause 4.2 (Quality System) in ISO 9002-1994 and clauses 4.3.1 (Environmental Aspects), 4.3.2 (Legal and Other Requirements), and 4.4.4 (Environmental Management System Documentation) of ISO 14001-1996.

6.1.2.1. GENERAL

İ.T.Ü Maritime Faculty maintains a documented management system as a means to ensure that all services conform to specified requirements. This section describes the core elements of the documentation system and their interrelations. The following four levels of documentation are utilised and maintained to meet the requirements of the ISO 9002-1994 and ISO 14001-1996 standards and, where it is necessary, to ensure adequate control.

Level 1: Integrated Management System Manual

The management system manual describes İ.T.Ü Maritime Faculty's quality and environmental policy and the general structure and methods for maintaining the management system. The manual references the related management system procedures followed to meet the specified policies and approaches.

Level 2: Management System Procedures

Documented procedures are used to specify who does what, when it is done, and what documentation is used to verify that the quality or environmental activity was executed as required. Procedures reference related work instructions, records, and forms.

Level 3: Work Instructions

Work instructions are used by İ.T.Ü Maritime Faculty to detail how particular tasks are to be performed where the absence of such instructions would adversely affect quality or impact the environment. In particular, the following two types of work instructions are used:

- System-related instructions. These supplement our procedures by giving detailed instructions on how to carry out a step of a procedure, often related to specified controls, inspections or tests, or how to process service or documents.

• (Regulation/ Contract)-related instructions. These include drawings, material lists, route cards, special inspection, testing, process instructions, etc. which translate the specific requirements of a customer order into working documents.

The steps followed in establishing, implementing, maintaining, and controlling system-related work instructions are defined in the Issue & Control of Process Monitoring & Operating Instructions MSP 09.1.

Level 4: Records and "Forms"

Records are used by İ.T.Ü Maritime Faculty to provide assurance/evidence that the required service quality was achieved, and that the faculty's quality and environmental management system has been implemented correctly.

6.1.2.2. MANAGEMENT SYSTEM PROCEDURES

İ.T.Ü Maritime Faculty maintains documented management system procedures to satisfy the requirements of the ISO 9002 & ISO 14001 Standards and to meet the faculty's need to effectively manage and control the IMS. The steps followed in establishing, implementing, maintaining and controlling documented procedures, as well as system-related work instructions, are defined in the Preparation & Control of Management System Documentation Procedure MSP 02.1. The range and degree of detail of the documentation are dependent upon the complexity of the work, the methods used and corresponding skills required, and the degree of training acquired or experience held by the personnel performing the tasks.

6.1.2.3 QUALITY and ENVIRONMENTAL PLANNING

a. The Management Representative is responsible for performing quality and environmental planning as specified in the Quality Planning Procedure, MSP 02.2 and the Environmental Planning Procedure MSP 02.3. This planning is done to define the specific quality and environmental practices, procedures, and work instructions to be followed in providing the required service to the customer.

b. The Management Representative has the responsibility and authority to define, implement, and maintain the integrated management system at İ.T.Ü Maritime Faculty. These responsibilities and authority include either performing or ensuring that the following activities are carried out by responsible personnel when appropriate:

- the preparation of quality plans

- the identification and acquisition of any controls, processes, equipment (including inspection), fixtures, resources and skills that may be needed to achieve the required quality;

- ensuring the compatibility of the process, servicing and the applicable documentation;

- the identification of any requirement involving capability that exceeds the known state of the art, in sufficient time for the needed capability to be developed;

- the identification of suitable verification at appropriate stages in the realisation of the service

- the clarification of standards of acceptability for all features and requirements, including those which contain a subjective element;

- the identification and preparation of quality records, as defined in Section 16 of this manual.

The identification of the environmental aspects of its activities, and services that İ.T.Ü Maritime Faculty can control and over which it can be expected to have an influence, in order to determine those which have or can have significant impacts on the environment, as required in ISO 14001-1996 and defined in the Environmental Planning Procedure, MSP 02.3. (This information is used as an input to the setting of environmental objectives and targets, and therefore is continuously reviewed and updated.)

The identification and provision of access to legal and other requirements to which the organisation subscribes (and that are) directly applicable to the environmental aspects of its activities, services, as required in ISO 14001-1996 and defined in the Environmental Planning Procedure MSP 02.3.

c. Direct influences between the quality management and the environmental management system can be defined as:

- Establishing periodical short briefings both for staff and the students for aiming pollution prevention.

- Tracing and carrying out in process inspections for garbage reception facilities.

- Carrying out chimney emission control by the Local Government of Tuzla as an annual base.

- Investigating cause and effect analysis of non conformities or potential non conformities relating with the environment.

Indirect influences between the quality management and the environmental management system can be defined as:

- Plantation of different kinds of trees.

- The informative discussions and meetings carried out the sensitise the public information regarding with environment.

- The sanitary work carried out in corporation with Local Government of Tuzla to contribute towards minimising pollution of Tuzla bay. Thus contributing towards increasing of different species of fish in domestic waters.

d. All employees at İ.T.Ü Maritime Faculty have the responsibility to execute and adhere to the requirements of the defined management system.

6.1.3. CONTRACT REVIEW

Section 3 of the MS Manual addresses the requirements of clause 4.3 (Contract Review) in ISO 9002-1994.

6.1.3.1. GENERAL

Contract reviews are conducted, documented, and coordinated with the customer according to the Contract Review Procedure MSP 03.1.

6.1.3.2. REVIEW

a. The Management Representative has the primary responsibility for ensuring that all quotations (tenders) are reviewed prior to submission to ensure that they are adequately defined and documented and that İ.T.Ü Maritime Faculty has the capability to fulfill the tender.

b. The Vice Dean has the primary responsibility for coordinating contract reviews of customer orders for services prior to their acceptance, and assigning responsibilities for their execution. To meet the requirements as stated in clause 4.3 of ISO 9002-1994, each such contract or accepted order is reviewed prior to acceptance to ensure that:

1. All requirements in the contract are adequately defined and documented.

2. Any requirements differing from those in the tender are resolved.

3. İ.T.Ü Maritime Faculty has the capability to meet all contractual requirements.

c. In the case of orders received verbally where there is no written statement of requirement available, İ.T.Ü Maritime Faculty personnel ensure that the order requirements are agreed before their acceptance.

d. İ.T.Ü Maritime Faculty will not accept any order for which it cannot satisfy the above criteria.

6.1.3.3. AMENDMENT TO A CONTRACT

The Management Representative is responsible for coordinating amendments with the customer and notifying all affected departments of relevant changes. Contract amendments are coordinated, reviewed, approved, and communicated according to the Contract Review Procedure MSP 03.1.

6.1.3.4. RECORDS

The results of contract reviews and pertinent related correspondence are documented by İ.T.Ü Maritime Faculty This documentation is maintained in the order file and meets the requirements of Section 16 of this manual.

6.1.4. DESIGN CONTROL

İ.T.Ü Maritime Faculty do not utilise "Design Control" in the provision of their services to clients and therefore this element of the standard is not addressed.

6.1.5. DOCUMENT AND DATA CONTROL

Section 5 of the MS Manual addresses the requirements of clause 4.5 (Document and Data Control) in ISO 9002-1994 and clause 4.4.5 (Document Control) of ISO 14001-1996.

6.1.5.1. GENERAL

İ.T.Ü Maritime Faculty identifies and controls documents and data in all media that relate to the requirements of the Standards. Documents and data supplied by the customer or other external sources and used to provide services which meet defined requirements are controlled according to Control of External Documents and Data Procedure MSP 05.1.

6.1.5.2. DOCUMENT AND DATA APPROVAL AND ISSUE

a. The Management Representative has the primary responsibility for ensuring that all management system documents (manual, procedures, and the system-related work instructions) meet the requirements defined in Preparation & Control of Management System Documentation Procedure MSP 02.1. Specifically, the following controls must be in place:

1. Documents are reviewed periodically, revised as necessary, and approved by the responsible manager or group prior to distribution and use, have provisions for review/approval signatures, and have a means for indicating the document revision level.

2. Documents (and copies) are numbered and assigned to an individual or area of use, and current versions are available at locations where related activities are performed.

3. A register is kept to indicate the document/copy number, the names and locations of all holders of controlled documents, and the current revision status of the document.

4. Document revisions are issued to holders of obsolete documents.

5. Procedures and responsibilities are established and maintained concerning the creation and modification of the various types of documents.

6. Documents are legible, dated (with dates of revision) and readily identifiable and located, maintained in an orderly manner and retained for a specified period.

b. The head of each department issuing Regulation/Contract-Related Work Instructions (engineering drawings; process specifications, plans, and/or programs; special instructions and schedules; and so forth) is responsible for ensuring that:

1. Documents are reviewed and approved by responsible personnel prior to distribution and use.

2. Documents used for planning or similar purposes that have not received final approval are stamped appropriately (Do Not Use For Process, For Planning Only, etc.)

3. Document revisions are issued to holders of obsolete documents.

c. Each head of the department in which quality documents and data are used is responsible for ensuring that the following requirements (as stated in ISO 9002-1994 and ISO 14001-1996) are followed:

1. The pertinent issues of appropriate documents and data are available at all locations where operations essential to the effective functioning of the management system are performed.

2. Invalid and/or obsolete documents are promptly removed from all points of issue or use, or otherwise assured against unintended use.

3. Any obsolete documents retained for legal and/or knowledge-preservation purposes are suitably identified.

6.1.5.3. DOCUMENT AND DATA CHANGES

Document and data changes and modifications are made, reviewed, approved, identified, and communicated at İ.T.Ü Maritime Faculty based on the following criteria:

a. Document and data changes and modifications are reviewed and approved by the same personnel or departments that performed the original review and approval unless specifically designated otherwise. In those situations, all pertinent background information is provided or is available to the qualified designees in order to allow for an accurate and consistent review and approval.

b. Where applicable, the nature of the changes are identified in the document or the appropriate attachments according to the means specified in the related procedures for developing procedures and/or work instructions.

c. İ.T.Ü Maritime Faculty uses registers and other document control mechanisms to indicate the current revision of documents, and thereby prevent the circulation and use of obsolete documents. (See 5.2.a, 3-4,6 and 5.2.b, 3.)

d. Changes to İ.T.Ü Maritime Faculty's management system manual are specifically controlled according to Management System Manual Distribution and Amendment Procedure MSP 05.2.

6.1.6. PURCHASING

Section 6 of the MS Manual addresses the requirements of clauses 4.6.1 (General), 4.6.2 (Evaluation of Subcontractors), 4.6.3 (Purchasing Data), and 4.6.4 (Verification of Purchased Product) in ISO 9002 -1994.

6.1.6.1. GENERAL

The Faculty Secretary is responsible for ensuring that all purchased products and subcontracted services from subcontractors that have a significant impact on the environment or the quality of İ.T.Ü Maritime Faculty's services conform to specified requirements. These control activities are conducted according to documented procedures as described below.

6.1.6.2. EVALUATION OF SUBCONTRACTORS

The Faculty Secretary is responsible for the following activities:

a. Establishing an Approved Subcontractor List (ASL) on the basis of defined criteria related to a subcontractor's ability to meet İ.T.Ü Maritime Faculty's requirements for quality, cost, delivery, and the environment.

b. Maintaining the ASL based upon subcontractor performance and reviews of subcontractor capability versus İ.T.Ü Maritime Faculty's requirements.

c. Defining guidelines to govern the type and extent of control to be exercised over subcontractors in ensuring that the general policy (in Section 6.1) is consistently met. The level of control exerted depends on a variety of factors, including the type of purchased product or service, its impact on the quality of İ.T.Ü Maritime Faculty's

service provided to customers, and the availability of quality and environmental records demonstrating the subcontractor's capability.

d. Conducting subcontractor analyses/evaluations and maintaining records (reference Section 16) of subcontractors' capability and performance as specified in İ.T.Ü Maritime Faculty's Subcontractor Selection and Assessment Procedure MSP 06.1.

6.1.6.3. PURCHASING DATA

a. The Faculty Secretary is responsible for ensuring that purchase orders are reviewed and approved for adequacy of specified requirements prior to release according to Purchase Order Generation and Issue Procedure MSP 06.2.

b. The Faculty Secretary is responsible for ensuring that purchasing documents contain data clearly describing the product ordered, including, where applicable, the following as stated in clause 4.6.3 of ISO 9002-1994:

1. The type, class, style, grade, or other precise identification.

2. The title or other positive identification, and applicable issues of specifications, drawings, process requirements, inspection instructions, and other relevant technical data, including requirements for approval or qualification of product, procedures, process equipment and personnel.

3. The title, number, and issue of the quality system standard to be applied to the product.

6.1.6.4. VERIFICATION OF PURCHASED PRODUCT

The Faculty Secretary is responsible for ensuring that verification arrangements and the methods for product release are clearly defined in the purchasing documents in those situations where personnel from İ.T.Ü Maritime Faculty verify purchased product at the subcontractor's premises.

It is the policy at İ.T.Ü Maritime Faculty to allow the customer to inspect and verify that any subcontracted product conforms to specified requirements provided such verification is specified in the purchasing contract. Verification by the customer does not:

a. Absolve İ.T.Ü Maritime Faculty of our responsibility to provide acceptable product.

b. Preclude the reality of or the customer's right to, rejection of the service at a subsequent time.

c. Serve as evidence of effective quality control by the subcontractor.

6.1.7. CONTROL OF CUSTOMER-SUPPLIED PRODUCT

Section 7 of the MS Manual addresses the requirements of clause 4.7 (Control of Customer-Supplied Product) in ISO 9002-1994.

6.1.7.1. GENERAL

a. İ.T.Ü Maritime Faculty maintains documented procedures for ensuring that all services supplied by our customers are properly controlled.

b. Verification by İ.T.Ü Maritime Faculty of customer-supplied product does not absolve the customer of the responsibility to provide acceptable service.

6.1.7.2. RESPONSIBILITIES

a. The Management Representative has the primary responsibility for ensuring that customer-supplied products are verified against specified requirements, identified, and maintained in adequate storage until required for use or incorporated into our services.

b. The specific assignment of responsibilities for control of customer-supplied product, and guidelines for the reporting and documentation of progress records, are addressed in the Verification and Control of Customer-Supplied Product Procedure MSP 07.1.

6.1.8. PRODUCT IDENTIFICATION AND TRACEABILITY

Section 8 of the MS Manual addresses the requirements of clause 4.8 (Product Identification and Traceability) in ISO 9002-1994.

6.1.8.1. GENERAL

İ.T.Ü Maritime Faculty maintains a documented procedure for identifying records of courses and clients. Courses are identified by a unique course code number. All clients are enrolled and have records kept of their attendance and work undertaken. Course progress is recorded and where specified records of clients assessments are maintained. Product identification is maintained and controlled through İ.T.Ü Maritime Faculty's Product Identification and Traceability Procedure MSP 08.1.

6.1.8.2. IDENTIFICATION OF INCOMING MATERIALS

a. The Faculty Secretary is responsible for ensuring that all incoming materials are clearly identified either individually (where appropriate) or as a lot while they are located at incoming inspection to storage or use in service.

b. The Faculty Secretary maintains records identifying incoming materials by part number, and their corresponding purchasing documentation such as specifications, inspection requirements, acceptance criteria, and other pertinent data.

c. İ.T.Ü Maritime Faculty record the receipt of materials, maintain accurate and timely records on inventory location and age, and update inventory status on a real time basis.

6.1.8.3. IDENTIFICATION OF IN-PROCESS SERVICES

The Head of each department in consultation with the Vice Dean is responsible for ensuring that in-process services are clearly identified.

a. Course programs and lay outs show its routing, and denotes its current state of processing.

b. Necessary equipment or product to carry out an efficient course

c. Course assessment and reporting process

6.1.8.4. IDENTIFICATION OF FINISHED SERVICES

The Vice Dean is responsible for ensuring that finished services relating with courses at İ.T.Ü Maritime Faculty are identified by means of a recording relevant data reference as required by the contract.

6.1.8.5. TRACEABILITY

İ.T.Ü Maritime Faculty maintains records for each service which include the applicable specification sheets and contract specifications used for customers. Records on traceability are maintained for a period of one year and meet the requirements described in Section 16. Service traceability is controlled through İ.T.Ü Maritime Faculty's Product Identification and Traceability Procedure MSP 08.1, and provides for unique identification of individual courses as applicable.

6.1.9. PROCESS CONTROL

Section 9 of the MS Manual addresses the requirements of clause 4.9 (Process Control) in ISO 9002-1994, as well as clauses 4.4.6 (Operational Control) and 4.4.7 (Emergency Preparedness and Response), and aspects of clause 4.5.1 (Monitoring and Measurement) of ISO 14001-1996.

6.1.9.1. GENERAL

Head of departments involved in functions, activities, and processes which directly affect quality of intermediate and end services, and/or are associated with the environmental aspects identified according to the Environmental Planning Procedure MSP 02.3, are responsible for ensuring that these processes are identified, planned, executed, and maintained under controlled conditions.

Controlled conditions are defined to include the following requirements:

a. Documented procedures and/or work instructions for servicing, where their absence would adversely affect quality or could lead to deviations from the environmental policy, objectives, and targets. (See İ.T.Ü Maritime Faculty's Issue and Control of Process Monitoring & Operating Instructions Procedure MSP 09.1.)

b. Suitable servicing equipment and working environment.

c. Compliance with reference standards, codes, and quality and environmental plans and, or documented procedures.

d. Monitoring and control of suitable process and service characteristics during courses.

e. Approval of processes and equipment, as appropriate.

f. Criteria for workmanship which are either written or expressed by means of representative samples.

g. Equipment maintenance practices to ensure suitable and continuing process capability.

h. Operating criteria which are defined in documented procedures.

i. Documented procedures and/or work instructions for measuring, monitoring, and documenting performance on key characteristics of processes that may have significant environmental impacts (as identified during Environmental Planning Procedure MSP 02.3). The recorded information shall also be used to track progress toward İ.T.Ü Maritime Faculty's environmental objectives and targets.

6.1.9.2. SPECIAL PROCESS CONTROL

Special processes are defined in ISO 9002 as processes, the results of which cannot be fully verified by subsequent inspection and assessment of the service, and where, for example, process deficiencies may become apparent only after the service is in use.

Special processes at İ.T.Ü Maritime Faculty are subject to the following rules and safeguards for ensuring that the special requirements are satisfied:

a. Special processes are performed and monitored by qualified personnel using written work instructions or documented guidelines where applicable (see Section 9.1a).

b. Special processes are pre-qualified in terms of their capability and comply with the requirements listed under Section 9.1.

c. The requirements and compliance of qualified processes, equipment, and personnel are maintained and documented (reference Section 16) in a manner to ensure service quality, safety, and a minimised impact on the environment.

At İ.T.Ü Maritime Faculty, the following processes are considered to be special processes and are subject to the requirements of this clause:

Fire Fighting Course, Proficiency Training for Survival Craft, Survival at Sea Course etc.

6.1.9.3. EMERGENCY PREPAREDNESS AND RESPONSE

The Management Representative is responsible for ensuring that procedures and practices are established for preventing and responding to accidents and emergency situations where there may be a significant impact on the environment. The procedures address the following:

a. Identification of potential accidents and emergency situations.

b. Proper response to emergencies and prevention or mitigation of serious environmental impacts.

c. Provisions for periodic reviews and revisions of the procedures. Such reviews will always be initiated after the occurrence of such events.

d. Periodic drills to test the effectiveness of the Emergency Preparedness and Response Procedure MSP 09.2.

6.1.10. INSPECTION AND TESTING

Section 10 of the MS Manual addresses the requirements of clause 4.10.1 (General), clauses 4.10.2 through 4.10.4 (Inspection and Testing at Receiving, In-process, and Final Operations respectively), and 4.10.5 (Inspection and Test Records) in ISO 9002-1994.

6.1.10.1. GENERAL

İ.T.Ü Maritime Faculty establishes and maintains documented procedures and/or work instructions or quality plans which define the required inspection and testing activities and related records used to verify that all requirements are met prior to process distribution, processing, or use.

6.1.10.2. RECEIVING INSPECTION AND TESTING

a. The Faculty Secretary has the responsibility for ensuring that incoming material and equipment is not used or processed until it has been verified as conforming to specified requirements. When material and equipment is needed in an urgent supply situation, the requirements stated in Section 10.2.c apply.

b. Verification through inspection and testing is done in accordance with İ.T.Ü Maritime Faculty's Receiving Inspection and Testing Procedure MSP 10.1 which addresses such issues as:

1. Specification of proper work instructions and/or inspection plans for receiving inspection and testing, based in part upon the level of quality control that the subcontractor has demonstrated.

2. Reference to the Nonconforming Product Review and Disposition Procedure MSP 13.1 for isolation, identification, and control of nonconforming materials.

3. Methods for the identification and distribution of acceptable materials.

4. Documentation, use, and storage of inspection records.

c. Where incoming material or equipment is needed and released for an urgent supply situation, it is identified in a manner to allow its recall and replacement in the event the process is determined not to be in compliance with specified requirements. This requirement and the related responsibilities, methods, and records generated (reference Section 16) are also addressed by İ.T.Ü Maritime Faculty 's Receiving Inspection and Testing Procedure MSP 10.1.

6.1.10.3. IN-PROCESS INSPECTION AND TESTING

a. The Faculty Secretary is responsible for ensuring that in-process assessment is held and not used or processed further until it has been evaluated, tested, or otherwise verified as conforming to specified requirements, except when course is released under positive recall. Release under positive recall means attendance course certificate does not eliminate the need for course to be confirmed as conforming, as required in the quality plan and/or inspection and test procedures.

b. Inspection and testing of in-process evaluation is done in accordance with İ.T.Ü Maritime Faculty's In-process Inspection and Testing Procedure MSP 10.2 which addresses such issues as:

1. Specification of proper work instructions, work standards, and/or inspection plans for evaluation and testing.

2. Reference to the Nonconforming Process Review and Disposition Procedure MSP 13.1 for control of nonconforming process.

3. Documentation, use, and storage of records.

6.1.10.4. FINAL INSPECTION AND TESTING

a. As acting Seafarer Examination Centre on behalf of Government, it is the course organisers responsibility to ensure that the customers and the clients are given the opportunity to express their satisfaction or dissatisfaction with the course and that the resulting information is incorporated in the course review and evaluation procedure. Where appropriate, clients on specified courses undergo final assessments and/ or examinations which lead to award of a qualification

b. The Faculty Secretary is responsible for ensuring that no progress is dispatched until:

1. All final inspection and testing are complete according to the appropriate documented procedure and/or work instruction or quality plan to show evidence of material / equipment conformance to specified requirements.

2. All data and documentation covering all inspections and tests (incoming, in-process, and final) specified in the management system procedures and control plans are available and authorised to show compliance and that the results meet specified requirements.

c. The requirements of clause 4.10.4 (ISO 9002-1994) are addressed in detail in İ.T.Ü Maritime Faculty's Final Inspection and Testing Procedure MSP 10.3 which addresses such issues as:

1. Specification of proper work instructions, work standards, and/or inspection plans for final inspection and testing.

2. Reference to the Nonconforming Process Review and Disposition Procedure MSP 13.1 for control of nonconforming materials.

3. Documentation, use, and maintenance of records.

6.1.10.5. INSPECTION AND TEST RECORDS

a. Inspection and test records are established and maintained at İ.T.Ü Maritime Faculty to identify the persons performing inspection and test activities, the authorised personnel responsible for verification activities. The responsibility for generating, filing, and maintaining inspection and test records is defined in the three management system procedures referenced above; namely, MSP 10.1, MSP 10.2, and MSP 10.3. Inspection and test records meet the requirements given in Section 16.

b. When process does not meet inspection evaluation and test requirements, the Nonconforming Process Review and Disposition Procedure MSP 13.1 is initiated.

6.1.11. CONTROL OF INSPECTION, MEASURING, AND TEST EQUIPMENT

İ.T.Ü Maritime Faculty do not utilise "Control of Inspection, Measuring, and Test Equipment" in the provision of their services to clients and therefore this element of the standard is not addressed. If there should be a requirement in the future, a procedure will be established and implemented to cover this aspect of this standard.

6.1.12. INSPECTION AND TEST STATUS

Section 12 of the MS Manual addresses the requirements of clause 4.12 (Inspection and Test Status) in ISO 9002-1994.

6.1.12.1. GENERAL

In accordance with the requirements as stated in ISO 9002-1994 İ.T.Ü Maritime Faculty identifies the inspection and test status of all process by using markings or other suitable means, which indicate the conformance or nonconformance of the evaluation with regard to the inspections or tests performed. The identification of inspection and test status is maintained, as defined in the Inspection Procedures MSP 10.1, MSP 10.2, and MSP 10.3, throughout servicing of the process for ensuring quality aims.

6.1.12.2. RESPONSIBILITIES

a. The responsibility to identify the inspection and test status of service (as defined in Section 12.1) lies with the head of each department responsible for performing the inspection and/or test. These responsibilities are formally stated in the applicable inspection and testing procedures and/or work instructions.

b. Faculty personnel responsible for ensuring the conforming service (based upon inspection and test activities) are responsible for "signing off" on the appropriate inspection and/or test "reports" which serve as records.

c. Faculty personnel who detect nonconforming service are responsible for following the policies and procedures addressed in Section 13 of this manual.

6.1.13. CONTROL OF NONCONFORMING PRODUCT

Section 13 of the MS Manual addresses the requirements of clause 4.13 (Control of Nonconforming Product) in ISO 9002-1994 and aspects of clause 4.5.2 (Non-conformance and Corrective and Preventive Action) in ISO 14001-1996.

6.1.13.1. GENERAL

The Management Representative is responsible for maintaining documented procedures for ensuring that:

a. service not conforming to specified requirements is clearly identified and segregated to prevent recurrence until the process is reviewed and disposition is determined,

b. records of activities relating to nonconforming process (reference Section 16) are maintained, and

c. all relevant functions receive notification of nonconforming service.

This is done in accordance with the Nonconforming Process Review and Disposition Procedure MSP 13.1. The Management Representative is also responsible for

maintaining and analysing data from the Non-Conformity Reports (NCMRs) as defined in İ.T.Ü Maritime Faculty's Failure Code Reporting and Feedback Procedure MSP 13.2.

6.1.13.2. NONCONFORMING PROCESS REVIEW AND DISPOSITION

The Nonconforming Process Review and Disposition Procedure MSP 13.1 is followed by all personnel who detect nonconforming service. This procedure considers the following factors:

a. All service found to be nonconforming is immediately marked. The service is physically segregated (whenever possible), or is prevented from further processing or use by other means.

b. Head of Departments are identified and consulted for service review and determination of nonconforming process disposition. The procedure addresses the following options for service review and disposition:

1. Rework service to meet the specified requirement.

2. Accept service with or without modification (as-is) by concession.

3. Regrade process for alternative applications where service meets required specifications.

4. Reject the service.

c. The occurrence of a nonconforming service condition is documented by use of the Non-Conformity Report (NCMR). This report describes the nonconformity, addresses the disposition, and for possible corrective action (see Section 14) and/or process improvement activities to prevent recurrence.

d. Materials or equipment that are reworked or repaired are reinspected according to İ.T.Ü Maritime Faculty's appropriate inspection and test procedures.

e. Disposition decisions to "use as-is" or "repair through concession" in cases where the

nonconformance may affect service performance require technical justification, customer approval, analysis and mitigation of possible environmental impacts, and documentation of the actual condition.

f. Notification of affected personnel is done in cases where the nonconforming process situation would lead to failure in meeting specified service needs.

6.1.14. CORRECTIVE AND PREVENTIVE ACTION

Section 14 of the MS Manual addresses the requirements of clause 4.14 (Corrective and Preventive Action) in ISO 9002-1994 and clause 4.5.2 (Nonconformance and Corrective and Preventive Action) in ISO 14001-1996.

6.1.14.1. GENERAL

a. İ.T.Ü Maritime Faculty establishes and maintains documented procedures and related documentation for implementing both corrective and preventive action, as described below. These procedures describe the processes, responsibilities, and authorities for managing and investigating cases of nonconformance, taking action to mitigate any environmental impacts caused, and eliminating the cause of actual or potential management system problems (quality and environmental) and related nonconformities to a degree commensurate with the magnitude of the problem, its potential outcome, and the level of risk involved.

b. The Management Representative for the IMS and this Standard is responsible for ensuring that all faculty personnel involved with the Corrective and Preventive Action Programs understand their importance in achieving İ.T.Ü Maritime Faculty's mission and quality and environmental policy, and for providing the personal commitment and resources necessary to execute these actions in an efficient and timely manner.

c. Corrective and preventive actions are important inputs to the Management Review Process specified in Section 1.3 of this manual.

d. The Management Representative is responsible for ensuring that changes to documented procedures resulting from corrective and preventive actions are implemented and recorded according to Section 5 of this manual.

6.1.14.2. CORRECTIVE ACTION

a. Corrective action at İ.T.Ü Maritime Faculty is directed at revising the faculty's management system, policies, procedures, and work instructions in order to eliminate the root cause(s) of quality and/or environmental problems. İ.T.Ü Maritime Faculty's Corrective Action Procedure MSP 14.1 is utilised in the following situations:

1. To resolve quality and environmental management system problems related to nonconformities found during internal, external (customer), or third party audits.

2. To revise the quality and environmental management system policies, procedures, work processes, and/or work instructions to eliminate the cause of a poor quality service, customer complaint, internal quality failure, or environmental problem.

3. To resolve management system problems found during the "Management Review" process.

b. The responsibility for undertaking the corrective action lies with the manager who is responsible for the related quality and environmental management system element and, or procedure.

c. The Management Representative is responsible for ensuring that the Corrective Action Program is managed effectively. This involves, but is not limited to, the following activities:

1. Ensuring that the Corrective Program is managed effectively according to the Corrective Action Procedure MSP 14.1.

2. Maintaining a system of records for managing the corrective action documents, monitoring the status of corrective action activities, and storing closed out Corrective Action Requests (CARs) for a period of (5) years.

3. For ensuring that CAs are studied at the time of the Management Review

6.1.14.3. PREVENTIVE ACTION

a. In addition to preventing problems through corrective action (by eliminating root causes of management system failures), preventive action at İ.T.Ü Maritime Faculty is directed at revising the faculty's quality and environmental management system policies, procedures, and work instructions in order to eliminate the root cause(s) of potential problems. İ.T.Ü Maritime Faculty's Preventive Action Procedure MSP 14.2 is utilised in the following situations:

1. To resolve weaknesses found and capitalise on "opportunities for improvement" identified during internal audits.

2. To use information such as quality and environmental records, concessions, service reports, customer feedback, regulatory feedback, process capability studies, and management review reports to identify, analyse, and eliminate causes of potential nonconformities.

b. The responsibility for undertaking the preventive action lies with the head of department who is responsible for the related quality and environmental management system element and/or procedure.

c. The Management Representative is responsible for ensuring that the Preventive Action Program is managed effectively. This involves, but is not limited to, the following activities:

1. Ensuring that the Preventive Action Program is managed effectively according to the Preventive Action Procedure MSP 14.2.

2. Maintaining a system of records for managing the preventive action documents, monitoring the status of preventive action activities, and storing closed out Preventive Action Requests (PARs) for a period of (5) years.

3. For ensuring that PAs are studied at the time of the Management Review.

6.1.15. HANDLING, STORAGE, PACKAGING, PRESERVATION, AND DELIVERY

Section 15 of the MS Manual addresses the requirements of clauses 4.15.1 (General), 4.15.2 (Handling), 4.15.3 (Storage), 4.15.4 (Packaging), 4.15.5 (Preservation), and 4.15.6 (Delivery) in ISO 9002-1994.

6.1.15.1. GENERAL

a. Faculty Secretary is responsible for handling, storage, packaging, and delivery of materials and equipment and also responsible for establishing, documenting, and maintaining methods appropriate to satisfy the requirements in service and those specified by contract.

b. Methods pertinent to the requirements of clause 4.15 are documented in the Handling, Storage, Packaging, Preservation, and Delivery Procedure MSP 15.1.

6.1.15.2. HANDLING

İ.T.Ü Maritime Faculty policy is to use methods and means appropriate for handling and transporting equipment or materials in the campus in a manner that prevents loss of material value and ensures employee safety.

6.1.15.3. STORAGE

a. İ.T.Ü Maritime Faculty maintains facilities, equipment, and designated areas to store material in a manner that prevents loss of value.

b. Methods and means appropriate for ensuring proper receipt of material, and proper dispatch to and from all pertinent areas are required and used.

c. Faculty Secretary having jurisdiction over departments where material is stored is responsible for assessing and recording the condition of those materials at intervals sufficient to guarantee the prevention of their damage or deterioration.

6.1.15.4. PACKAGING

All materials are appropriately packed and identified on the packaging in a manner which allows for ready identification through all stages of processing and prevents the loss of value.

6.1.15.5. PRESERVATION

All products are segregated and preserved as necessary to maintain material quality and value when the material is under the faculty's control.

6.1.16. CONTROL OF MANAGEMENT SYSTEM RECORDS

Section 16 of the MS Manual addresses the requirements of clause 4.16 (Quality Records) in ISO 9002-1994, as well as clause 4.5.3 (Records) in ISO 14001-1996.

6.1.16.1. GENERAL

İ.T.Ü Maritime Faculty's management system is documented through the use of quality and environmental records. Records are valuable to the faculty in the following ways:

1. They provide assurance that the quality and environmental requirements for the service were satisfied, and demonstrate conformance of the management system to the ISO 9002-1994 and ISO 14001-1996 Standards.

2. They show the degree of implementation and success of our quality and environmental management system.

3. They provide a basis for measurement and feedback essential for continual improvement.

Pertinent quality records from subcontractors are also a part of this system. Records at İ.T.Ü Maritime Faculty are controlled according to the Management System Record Maintenance Procedure MSP 16.1.

6.1.16.2. RESPONSIBILITY

Responsibilities for establishing, collecting, filing, indexing, storing, maintaining, and disposing of records are defined in İ.T.Ü Maritime Faculty's Management System Documentation Traceability and Responsibility Record.

6.1.16.3. POLICY

İ.T.Ü Maritime Faculty has the following policy regarding management system records:

a. Records shall be legible and clearly identified and traceable to service involved, or to the management system activity they document.

b. Records shall be filed, indexed, and maintained in a manner that provides for ready access or retrievability, and prevents loss, damage, or deterioration.

c. Retention times shall be defined for all quality and environmental records in the appropriate procedures.

d. Records shall be an accurate and truthful representation of actual events, documented in a timely manner.

e. Records shall be dated and initialled or signed by personnel responsible for the documented outcome or activity.

f. Personnel involved in collecting data for records will be provided instructions and training to the degree necessary to ensure that the records are generated correctly.

6.1.17. INTERNAL MANAGEMENT SYSTEM AUDITS

Section 17 of the MS Manual addresses the requirements of clause 4.17 (Internal Quality Audits) in ISO 9002-1994 as well as clause 4.5.4 (Environmental Management System Audit) in ISO 14001-1996.

6.1.17.1. GENERAL

a. İ.T.Ü Maritime Faculty plans and conducts internal management system audits according to the Internal Management System Audits Procedure MSP 17.1 for the following purposes:

1. To verify whether quality and environmental activities and related results comply with planned arrangements, including the requirements of the ISO 9002-1994 and ISO 14001-1996 Standards, and relevant environmental legislation and regulations.

2. To ensure that the management system has been properly implemented and maintained.

3. To determine the overall effectiveness of the management system.

4. To provide information on the results of the audit to management for review.

b. The documented audit program and schedule ensures that a minimum of one internal audit is conducted per year, and every element of the management system is audited based upon the importance (with respect to both quality and the environment) and status of the element as determined from previous audits.

c. An audit team consists of one or more qualified auditors (trained in ISO requirements and auditing) and the Management Representative. A research assistant of the faculty and a selected employee of the faculty also participate periodically to foster management and employee involvement and awareness. The manager of the department being audited acts as an observer to answer questions. One or more teams are used depending on the status and progress of the management system elements.

d. Audits are carried out by personnel independent of those having direct responsibility for the activity being audited.

e. The Internal Management System Audit Procedure MSP 17.1 addresses the audit scope, establishment of the audit program and schedule, and responsibilities and methods for planning, conducting, reporting and following up on audits.

6.1.17.2. RESPONSIBILITIES

a. The Management Representative is responsible for organising and coordinating the internal audit to ensure that the requirements of the Internal Management System Audits Procedure MSP 17.1 are followed.

6.1.17.3. AUDIT RESULTS

a. The results in the audit report are reviewed and approved by the Management Representative. The audit results are then distributed to Dean and to the heads of the audited departments.

b. In the case of noncompliances or weaknesses (in either the management system and procedures, or the performance and adherence to those systems and procedures), timely action is taken by the relevant department head according to the Corrective Action Procedure MSP 14.1 and/or Preventive Action Procedure MSP 14.2, and the implementation and effectiveness of the corrective and preventive actions are verified and recorded (see Sections 14 and 16).

c. The results of the internal audit are used as key input information for conducting the management reviews.

d. Records documenting the audit process and results are kept for a period of five (5) years by the Management Representative.

6.1.18. TRAINING

Section 18 of the MS Manual addresses the requirements of clause 4.18 (Training) in ISO 9002-1994 as well as clause 4.4.2 (Training, Awareness and Competence) in ISO 14001-1996.

6.1.18.1. GENERAL

a. At İ.T.Ü Maritime Faculty, people are the faculty's most valuable asset. Investing in people through effective training is thus a key corporate strategy for achieving the faculty's mission and quality and environmental policy.

b. It is our policy at İ.T.Ü Maritime Faculty to identify the training needs and provide for the training of all personnel performing activities affecting quality or impacting the environment. Specifically, the Training Assessment and Delivery Procedure MSP 18.1 addresses the following issues:

1. Identification and assessment of education and training needs.

2. The qualification of people to perform tasks affecting quality or impacting the environment.

3. Mechanisms for delivery of training.

4. Assessment of training effectiveness.

5. Maintenance of appropriate training records (reference Section 16).

c. Because every employee at İ.T.Ü Maritime Faculty must play a role in maintaining and improving the environment, the purpose of the Training Assessment and Delivery Procedure MSP 18.1 is also to ensure that all employees are aware of:

1. The importance of, and their individual roles and responsibilities for, conformance to the environmental policy and relevant requirements of the management system, including emergency preparedness and response.

2. The actual and potential effects on the environment of their activities and of departure from specified operating procedures, and the potential environmental benefits of improved individual performance.

6.1.18.2. RESPONSIBILITIES

a. The Management Representative is responsible for the following activities:

1. Ensuring that all new personnel receive quality and environmental awareness training.

- Quality awareness and environmental training covers the following topics to provide knowledge of İ.T.Ü Maritime Faculty's quality and environmental philosophy and system:

◊ İ.T.Ü Maritime Faculty's strategy and marketplace

◊ Mission statement and objectives for quality and the environment

◊ Key concepts and documentation structure of ISO 9002 and ISO 14001

◊ Management system organisation: responsibility, authority, and structure

◊ The employee's role and responsibility for quality and conforming to the environmental policy, procedures, and other requirements of the management system at İ.T.Ü Maritime Faculty including emergency preparedness and response procedures

2. Ensuring that training is given to prevent the recurrence of nonconformities.

3. Using appropriate methods to identify the key knowledge and skills needed by employees in specific job tasks, and qualifying personnel on the basis of appropriate education, training, and/or experience.

4. Measuring and assessing the effectiveness of training given to ensure that the objectives and needs of the training were met in a cost-effective and efficient manner.

5. Maintaining appropriate training records to show the amount, type, and effectiveness of (quality and environmental) training given to employees.

b. All heads of departments have a contributing responsibility in assessing training needs, providing on-the-job reinforcement of skills, and evaluating the effectiveness of training given for the employees they directly manage.

c. It is İ.T.Ü Maritime Faculty's policy that any employee may request training at any time if the employee feels that training is essential for providing knowledge and skills required to maintain the requirement of the Standards.

6.1.19. SERVICING

İ.T.Ü Maritime Faculty do not utilise "Servicing" in the provision of their services to clients and therefore this element of the standard is not addressed. If there should be a requirement in the future, a procedure will be established and implemented to cover this aspect of this standard.

6.1.20. STATISTICAL TECHNIQUES

İ.T.Ü Maritime Faculty do not utilise "Statistical Techniques" in the provision of their services to Clients and therefore this element of the standard is not addressed. If there should be a requirement in the future, a procedure will be established and implemented to cover this aspect of this standard.

The relevant integrated management system procedures and work instructions are demonstrated in Appendix E.

7. CONCLUSION AND DISCUSSIONS

Customers of the maritime training institution are organisations the graduated students work for. The customers specify quality characteristics, such as employability, ability of students to solve problems in ship management cycle and ability to upgrade their knowledge.

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 that 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.

Although the ISO 9000 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 training institution management system 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. Mainly training institutions create three main products:

- student knowledge, abilities and competencies
- courses and programs
- research

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. 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 9000 standard, approved in 1994, consists of twenty requirements, each representing one element of the quality system.

The establishment of an ISO 9002 quality management system, ISO 14001 environmental management system and the conventional requirements in maritime training institution certainly requires a considerable amount of human, financial and information resources. If the advantages of quality management system for each individual member of an academic community are set up front and the executive management is committed to achieving this goal, the ground for a successful implementation of the system will be set.

The establishment of quality management system and complying the minimum requirements of the standards are only the first few stages in quality improvement journey. In order to establish a never ending continuos improvement philosophy in a maritime training institution, the following constraints need to be considered.

In shipping business the management can be considered as the technical and the commercial management of ships. 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 departments curriculums in an efficient manner in the technical side of ship management. As well as the Port State Control (PSC) parameters and the effects of these parameters in shipping environment cause rapidly positive change improvements of ship management. As a result lectures academic research has to point out port state control inspection results and the classification society's survey requirements that complies the statuary certification of vessels. 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. Curriculum development process has to include the Hull and Machinery (H&M) Insurance and the P&I Club requirements as well.

This study covers the integration and the implementation of ISO 9000 standard, ISO 14000 standard, ISM Code and the requirements of STCW Convention in Maritime Education. Quality management system documentation is established for the Maritime Faculty of İstanbul Technical University in accordance with the above considerations. In addition to that the quality management system integration process is embedded into a computer program (CLIPS) which defines the optimum integration steps and effort levels. In each step of the computer code, the realised percentages in the local process and the global process are calculated. The realised cost of each clause and the optimum remaining costs are also calculated for the each routine by utilising the integration efficiency of each process required by the international standards.

In this consideration knowledge can be encapsulated in rules and objects. Rules can pattern match on objects as well as facts. Alternatively, objects can operate independently of the rules. This situation enables to integrate both the clauses of each standard or requirements of IMO Conventions and the effort based cost optimisation during the integration and implementation of quality management cycle in maritime training institution.

The importance of the SOLAS requirements which are directly affecting the training needs of seafarers are examined within the sixth rule of ISM Code. In addition to that MARPOL requirements are examined within the parallel of ISO 14001 and the seventh rule of ISM Code. The coupling actions of STCW Convention and ISM Code are carried out both in 4.8 Identification and Traceability and 4.9 Process Control. The evaluation of implementations are defined in 4.10 Inspection and Testing, 4.12 Inspection and Test Status, 4.17 Internal Audits, 4.1.3 Management Reviews.

If the mandatory requirements of STCW Convention is established before initiating the generic standards into the maritime training institution then the calculated optimised integration cost is found as 8400$ in 45 weeks period. The amount of

integration cost depends only using the internal resources of the faculty consists of ten academic staff with two differentiated working groups who are trained both in generic and specified maritime standards before initiating the integration cycle. The registration and follow-up audit cost depends on the quotations form certification bodies but it changes between the range of 5000$/year to 7000$/year. As a result the total cost for the first term calculated between the range of 13400$ to 15400$. After implementing the system one year, the total cost of the Integrated Management System reduces to between the range of 9400$ to 12400$.

While initiating the integration process to the maritime training institution, the activity elements that their cyclic relationships are closely similar to each other can be taken into account simultaneously with the same or different working groups. This leads the training institution to reduce integration period. As well as that the team members of working groups can find the opportunity to see the clear interrelationship between on going processes. While establishing the authorities, responsibilities and duties of faculty staff, the relevant clauses such as 4.9, 4.10, 4.12, 4.13, 4.14, 4.16 and 4.17's key drivers has to be appointed. Similarly while establishing the requirements of 4.2 in maritime training institution, 4.5 and 4.16 can be taken into account in the same integration period because structure of the documentation, establishing the rules of documentation management and control of quality records have similar affects while implementing the STCW Convention and the requirements of the ISM Code in maritime training intitution. Although the clause 4.6 directly relates with the administrative activities of faculty, some of the incoming inspections might be necessary in order to decide supplied goods or materials are functioning at their desired levels. In this consideration, reseach assisstants or some of the lecturers can participate the reporting activities of non conforming products. This results to combine requision and order process specifications to clause 4.1 and 4.10 and 4.13, 4.14. Finally the combination method of each requirements that is mentioned above shall reduce the integration time 40%, between 44 and 48 weeks.

If the Integrated Management System is implemented in effective and appropriate manner, it could be interpreted that the implementation costs will have the reducing trends in foregoing years.

As a result the implementation of developed management model in this thesis has been carried out as a pilot study in İ.T.Ü Maritime Faculty, then the faculty has been certified by the Accreditation bodies who are RINA (Registrano Italyano Navale), IQNET (International Quality Network), Class NK (Nippon Kaiji Koyokai), JAB (Japanese Accreditation Body), RVA (Holland Accreditation Body).

Pointing out the future considerations of maritime training field, İ.T.Ü Maritime Faculty has to establish computer based simulation lectures into its Deck and Marine Engineering Department's curriculum. In addition to that teleconferencing and share ware based lectures need to be established in near future for ensuring competitive implementation in seafarers training.

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APPENDIXES

APPENDIX A. ISO 9000 AND ISO 14000 FAMILY

Table A.1 ISO 9000 family

STANDARDS and GUIDELINES	PURPOSE
ISO 8402, Quality management and quality assurance – Vocabulary	Defines the fundamental terms used in the ISO 9000 family, which user need to know, to be sure of avoiding misunderstandings both internally and externally.
ISO 9000-1, Quality management and quality assurance standards – Part 1: Guidelines for selection and use	Establishes a starting point for understanding and selecting the standards appropriate for the user needs.
ISO 9000-2, Quality management and quality assurance standards – Part 2: Generic guidelines for the application of ISO 9001, ISO 9002 and ISO 9003	Assists the user in interpreting and applying ISO 9001, ISO 9002 and ISO 9003.
ISO 9000-3, Quality management and quality assurance standards – Part 3: Guidelines for the application of ISO 9001:1994 to the development, supply, installation and maintenance of computer software	Provides the user with specific interpretation of the requirements of ISO 9001 for computer software development applications.
ISO 9000-4, Quality management and quality assurance standards – Part 4: Guide to dependability programme management	Gives the user guidance on how to plan, organise and control resources to produce reliable and maintainable products.
ISO 9001, Quality systems – Model for quality assurance in design, development, production, installation and servicing	This is the requirement standard user use when user wish to demonstrate capability for design/development of product or service, as well as for production, installation and servicing.

STANDARDS and GUIDELINES	PURPOSE
ISO 9002, Quality systems – Model for quality assurance in production, installation and servicing	This is the requirement standard user use when user are not responsible for the design/development of product or service, but wish to demonstrate capability for production, installation and servicing (identical to ISO 9001 except for design control requirement).
ISO 9003, Quality systems – Model for quality assurance in final inspection and test	This is the requirement standard user use when user only need to demonstrate capability to control product or service by final inspection and test.
ISO 9004-1, Quality management and quality system elements – Part 1: Guidelines	This is not a requirement standard, but provides user with guidelines to implement a quality system to satisfy customers' and own organisation's needs.
ISO 9004-2, Quality management and quality system elements – Part 2: Guidelines for services	This standard is made up in a similar way as ISO 9004-1, but the guidelines are designed with special regard to the conditions pertinent to the service sector.
ISO 9004-3, Quality management and quality system elements – Part 3: Guidelines for processed materials	This standard provides user with quality management guidelines applicable if user is a producer of processed materials, which are typically provided in bulk.
ISO 9004-4, Quality management and quality system elements – Part 4: Guidelines for quality improvement	Provides user with guidelines for implementing continuous quality improvement within the organisation using tools and techniques based on data collection and analysis.
ISO 10005, Quality management – Guidelines for quality plans	This standard gives user guidance on how to prepare quality plans for the control of specific products, projects or contracts.
ISO 10006, Guidelines to quality in project management	Guidelines to help user ensure the quality of both the project processes and the project product.

STANDARDS and GUIDELINES	PURPOSE
ISO 10007, Quality management – Guidelines for configuration management	Gives user guidelines to ensure that a complex product continues to function when components are changed individually.
ISO 10011-1, Guidelines for auditing quality systems – Part 1: Auditing	Provides user with guidelines for auditing a quality system, and for verifying the system's ability to achieve defined quality objectives. User can use this standard internally or for auditing suppliers.
ISO 10011-2, Guidelines for auditing quality systems – Part 2: Qualification criteria for quality systems auditors	Provides guidance on the education, training, experience, personal attributes and management capabilities needed to carry out an audit
ISO 10011-3, Guidelines for auditing quality systems – Part 3: Management of audit programmes	Provides basic guidelines for managing quality system audit programmes.
ISO 10012-1, Quality assurance requirements for measuring equipment – Part 1: Metrological confirmation system for measuring equipment	Gives user guidelines on the main features of a calibration system to ensure that measurements are made with the intended accuracy.
ISO 10012-2, Quality assurance for measuring equipment – Part 2: Guidelines for control of measurement processes	Provides supplementary guidance on the application of statistical process control when this is appropriate for achieving the objectives of Part 1.
ISO 10013, Guidelines for developing quality manuals	Provides guidelines for the development, preparation and control of quality manuals tailored to user's specific needs.

Table A.2 ISO 14000 family

STANDARDS	PURPOSE
ISO 14001 : 1996	Environmental management systems – Specification with guidance for use
ISO 14004 : 1996	Environmental management systems – General guidelines on principles, systems and supporting techniques

STANDARDS	PURPOSE
ISO 14010 : 1996	Guidelines for environmental auditing – General principles
ISO 14011:1996	Guidelines for environmental auditing – Audit procedures – Auditing of environmental management systems
ISO 14012 : 1996	Guidelines for environmental auditing – Qualification criteria for environmental auditors
ISO 14020 : 1998	Environmental labels and declarations – General principles
ISO/DIS 14021: 1999	Environmental labels and declarations – Self-declared environmental claims
ISO/FDIS 14024 : 1998	Environmental labels and declarations – Type I environmental labelling – Principles and procedures
ISO/DIS 14031 : 1999	Environmental management – Environmental performance evaluation – Guidelines
ISO/TR 14032 : 1999	Environmental management – Environmental performance evaluation – Case studies illustrating the use of ISO 14031
ISO 14040 : 1997	Environmental management – Life cycle assessment – Principles and Framework
ISO 14041 : 1998	Environmental management – Life cycle assessment – Goal and scope definition and inventory analysis
ISO/CD 14042 : 1999	Environmental management – Life cycle assessment – Life cycle impact assessment
ISO/DIS 14043 : 1999	Environmental management – Life cycle assessment – Life cycle interpretation
ISO/TR 14048 : 1999	Environmental management – Life cycle assessment –Life cycle assessment data documentation format

STANDARDS	PURPOSE
ISO/TR 14049 : 1999	Environmental management – Life cycle assessment –Examples for the application of ISO 14041
ISO 14050 : 1998	Environmental management – Vocabulary
ISO/TR 14061 : 1998	Information to assist forestry organisations in the use of the Environmental Management System standards ISO 14001 and ISO 14004
ISO Guide 64 : 1997	Guide for the inclusion of environmental aspects in product standards

CD = Committee Draft;

DIS = Draft International Standard;

FDIS = Final Draft International Standard;

TR = Technical Report. ISO 14000 – Meet the whole family

APPENDIX B. PRINCIPLES AND IMPLEMENTATION OF AUDIT

The audit is a management tool used to evaluate, confirm, or verify activities related to quality or environment. Audit is a systematic and independent examination to determine whether activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve objectives [79] . Audit is not an alternative to an inspection operation. An inspection or test program is a decision-making process involving either an accept or reject decision, eg., the product, service, or process does or does not conform to certain predefined criteria.

The auditor may use inspection techniques as an evaluation tool. For example, in determining the effectiveness of an inspection procedure, the auditor may require measurements to validate accept and reject decisions. The review of the facts may result in an accept or reject decision. However, this decision will be with respect to the documentation and implementation of the quality system. It will not based solely on the inspection results.

The system of any organisation is an integrated program of activities introduced by management, either of its own volition or as the result of a customer-imposed procurement quality standard. In either case, management must have some means of determining the effectiveness of the existing system and identifying areas requiring correction or improvement. The quality system may be that of management's own organisation, a potential supplier, an active supplier, or an independent organisation. The results of the audit provide an assessment of the adequacy of the existing program. They also provide a bench mark against which system improvements can be developed and evaluated [15]. Audits provide objective evidence to the management of the organisation being audited and of the organisation requesting the audit about conformity to requirements and effectiveness of the various elements of the system.

Quality audits can be subdivided into four categories or classifications based on:

- The purpose of the audit - "Why?"
- The object of the audit - "What?"
- The nature of, the audit - "Who?"
- The method of the audit - "How?"

Each of these classifications subdivides into subsidiary categories. The purpose of the audit is to determine either or both of the following:

1. Suitability of the quality program (documentation) with respect to a predetermined reference standard.

2. Conformity of the operations within the quality system to the documented quality program.

Thus the suitability quality audit validates the documentation, eg. the planning aspects, of the quality system against the predetermined reference standard, while the conformity quality audit validates the activities of the quality system, eg. the implementation, measurement, corrective action, and subsequent follow-up, against the documentation forming the quality program. As a result the suitability quality audit is an audit or in-depth evaluation and comparison of the quality program (documentation) for the organisation, specific elements of that organisation, product, process, service against the reference standard, predetermined by the client. Conformity quality audit is an audit or in-depth evaluation and comparison of the activities within the quality system against the predefined quality program, eg. against quality policies and procedures.

The object of the audit is first quality program audit includes the policies, procedures, operating instructions necessary to define the various responsibilities, accountabilities, and actions necessary to achieve the desired quality level. This level may be based on:

1. The desires of management

2. The needs of the intended marketplace

3. National or international standards for quality assurance

4. Procurement quality standards from major customers or potential customers

5. Good manufacturing practices as laid down by certain regulatory agencies

6. Specific requirements in the applicable product, service, or process specification or standard

The client selects the reference standard based on the purpose of the quality system. The reference standard may be any of the above mentioned documents or one suggested by an outside consultant as applicable to the important facets of a particular quality program. The quality program, in its various forms, provides the policies, guidelines, and instructions for the various activities in the quality system and the reference standard for comparing and evaluating these activities. The formal documentation of the quality system, required by many international and national quality system program standards, ensures that all concerned are working according to a common set of ground rules, whether those tasks involve carrying out a particular operation or activity, verifying the output of operations, or auditing the system's activities.

The quality program audit is carried out to determine the suitability of the documents comprising the program. Therefore, it consists of a comparison between these documents with the requirements of the reference standard. Each requirement clause must be addressed by the documentation and must be reviewed by the auditor. Quality program audit is a suitability audit or in-depth comparison and evaluation of the documentation comprising the quality program, for the organisation or elements thereof, product, process, service against the agreed on predetermined reference standard.

The object of the audit is secondly quality system audit comprises the quality program plus all the activities and operations required to implement it effectively. It

covers the planning, implementation, measurement, and correction phases of the traditional management cycle. This management cycle applies whether one is considering the overall organisation or a particular element, product, process, or service within that organisation. As applied to fluidity systems, this cycle is actually a repetitive function operating as a converging spiral as new or more innovative techniques are developed for improving the system and the results of that system [80]. The constant improvement philosophy applies as much to the quality system as to the output of the organisation.

The initial cycle as shown in Figure B.1 represents the functions necessary to introduce the initial elements of the quality system. Each correction phase results in a complete management cycle, eg. the corrective action must be planned and implemented, its effectively measured, and then it, must be followed by further corrective action to further improve the operations. As each correction cycle is repeated, the corrections required should be smaller and smaller and fewer and fewer until the desired quality level is achieved.

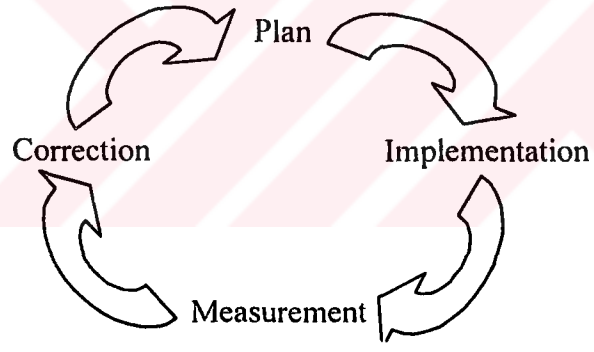


Figure B.1 Initial elements of the quality system

Quality system audits can cover one or all of the following typical categories:

1. Performing a suitability quality audit on the quality program with respect to some predetermined quality system requirement; then, if the documentation is satisfactory, performing a conformity quality audit to determine the effectiveness of the resulting activities.

2. Performing a suitability audit on the changes made to an approved quality program to confirm that it is still acceptable; if it is still suitable, performing a conformity quality audit to evaluate the changes and determine continuing compliance with the approved quality program.

3. Performing repetitive or periodic conformity quality audits on the implementation of an approved quality program to determine continuing compliance and effectiveness

The choice of scenario will depend on the relationships between client, auditor, and auditee. The object of the audit is thirdly management quality audit reviews and evaluates the responsibilities, accountabilities, actions, interactions of the management team with respect to all the activities contributing to the output quality of the organisation. This type of audit applies equally to product- and service oriented organisations. The actions and interactions of the various functions within the organisation will depend on the complexity of the quality system. In turn, the complexity of the system will depend on a number of factors, including:

1- The complexity of the applicable procurement quality standard

2- The criticality of the application of the item concerned in terms of operation, safety, etc.

3- The requirements of the intended marketplace

4- The maturity of the product, service, or process

5- The requirements of the particular product, process, or service standard or specification

As defined in ANSI/ASQC Z1.15, this activity implies the performance of quality system conformity audits and reporting the results to management [81]. Management is, of course, the normal destination of internal quality audit reports.

Management review activity appears in several quality system standards under various titles, including quality system review, quality control system review, and

review and evaluation. By their descriptions, all of these require an internal quality system audit to determine conformity and effectiveness. In most cases, the requirements imply that the audit should be carried out by management personnel. Only the Australian Standard AS 2000 actually recognises the practical approach to meeting, these requirements, eg. that the audit be conducted by qualified, independent personnel who report their findings to management. These qualified, independent personnel would normally be quality auditors [82].

Normally, surveillance implies the observation of particular activities being performed as part of a production or verification process, in order to validate the action being taken, the results noted, and the decision being made. However, the review of quality system standards undertaken by the author revealed several instances where surveillance activities have been given much broader responsibilities. In these cases the responsibility for examining and evaluating the effectiveness of the applicable quality system elements has also been included. Thus, quality audit functions have been added to the traditional surveillance activities. Where this situation arises, care must be taken to ensure that duplication of effort does not occur.

The product quality audit is an audit or in depth examination and evaluation of the quality system as it applies to a particular product. As such, it examines all elements of the product and their related quality system elements to evaluate the system against the referenced standards or specifications for that product. Such an audit normally includes evaluating the ability to make valid quality decisions by those having this responsibility. This evaluation usually includes an analysis of both accept and reject decisions. A product quality audit may include inspection or test activities as part of its data gathering methods. However, the audit should not be responsible for carrying out any periodic tests or inspections involved with product acceptance or rejection.

The process quality audit is an audit or in depth examination and evaluation of the quality system as it applies to a particular process. As such, it examines all elements of the process and their related quality system elements to evaluate the system against

the referenced standards or specifications for that process. This normally includes evaluating the ability to make valid quality decisions by those having this responsibility. These decisions may be made by persons carrying out particular operations or those verifying these operations. The audit evaluation normally includes an analysis of accept and reject decisions based on regular production inspection and test routines as well as those based on specialised periodic tests or inspections required to obtain and maintain process approval.

The service quality audit is an audit or in depth examination and evaluation of the quality system as it applies to a particular service. As such, it examines all elements of the service and their related quality system elements to evaluate the system against the referenced standards or specifications for that service. Normally, this will include evaluating the ability to take actions that reflect the quality objectives of the organisation and to make valid quality decisions by those having these responsibilities. In the service industry field, more of these decisions and actions will tend to be made by the people actually providing the service than by those undertaking any verification function.

Decision sampling is a particular audit technique used to evaluate the ability of decision-making personnel to make valid quality decisions. The nature of the audit is the relationship between the auditor and audit, results in the following two categories of quality audits:

1. Internal quality audits: These audits are conducted by auditors who are members of the audit's organisation. The position of the auditor in the organisational hierarchy does not modify this simple relationship.

2. External quality audits: These audits are conducted by auditors who are not members of the audit's organisation. In those cases where the auditee is also the client, the auditors are specialists from outside the organisation hired to conduct an independent audit.

Managing the quality audit subdivides into the following functions and their evaluation :

1- Initiation of the quality audit

2- Planning the quality audit

3- Implementation of the quality audit

4- Interpretation or analysis of the quality audit

5- Reporting the quality audit results

6- Corrective action requests and follow-up with the auditee

7- Measuring the effectiveness of the quality audit

8 - Corrective action and follow-up with the auditors

Internal quality audits are those conducted by auditors employed by the organisation being audited. The audit may be conducted by an individual or a team selected from audit specialists, managers, executives, etc. As these individuals are involved with the quality system of the organisation being audited, to varying degrees they are not normally in a sufficiently independent situation to fully assess the suitability of the quality program against some external standard. Executives, of course, would be in a position to assess such suitability relative to the organisation's quality policy. Normally, internal quality audits are involved with evaluating the conformance of the various activities to the quality program and the effectiveness of the quality system.

The internal quality system audit is primarily carried out to determine the degree of conformity of an organisation's activities with its predefined quality program and the effectiveness of that program. This in turn determines whether the agreed upon policies and procedures are actually being applied effectively throughout the organisation. The audit may be initiated as the result of:

1. A management desire to maintain or improve the efficiency of the organisation's operations and the organisation's image in the marketplace

2. A management desire to determine how disciplined and effective the organisation's operations are

3. A potential contractual or certification requirement

The reference standard for this type of quality audit is the predefined, and mutually agreed upon, quality program of the organisation, which defines its policies, lines of responsibility and accountability, procedures, work instructions. Conformity to the documentation indicates a controlled and disciplined operation. However, the documented program may be rendered less effective through changes in requirements, techniques, technical developments, operator skills which have not been reflected in updated procedures. Nonconformity indicates a lack of discipline and response within the system. Internal audit criteria both for the ISO 9002 and ISO 14001 that is developed for the maritime education and training is demonstrated in Table B.1 and Table B.2.

Table B.1 ISO 9002 internal audit questionnaire

	4.1 Management Responsibility
1	Has executive management defined and documented its commitment to quality? (Clause 4.1.1) Provide evidence that confirms executive management's commitment or lack of commitment to quality.
2	Has a quality policy been defined that coincides with the faculty's organisational goals? (Clause 4.1.1) Record the specific aspects that are common to both the organisational goals and the faculty's quality policy.
3	Has a quality policy been defined that considers the needs and expectations of its customers? (Clause 4.1.1) Explain specifically how the faculty's quality policy is relevant to the needs and expectations of its customers

	4.1 Management Responsibility (continuing)
4	Have the quality policy and quality objectives been communicated and maintained at all levels of the organisation? (Clause 4.1.1) Interview faculty personnel and verify that the faculty's quality policy and objectives are both understood and followed.
5	Do the quality policy and quality objectives influence staff's attitudes toward quality and the manner in which they perform their duties? (Measure of Effectiveness for Clause 4.1.1) Provide examples and verify that every staff feels responsible for quality
6	Is there evidence confirming the use of employee/staff -based work teams as a key strategy at faculty to foster continuous quality improvement? (Not Specifically Required)
7	Are the responsibility, authority, and the interrelation of all personnel who manage, perform, and verify work affecting quality explicitly defined and in the faculty's Quality Manual, procedures, and/or work instructions? (Clause 4.1.2.1) State the evidence and check to ensure that a brief "responsibility and authority" statement is also given in the manual for the upper tier of Department Heads.
8	In cases where managers have delegated the authority for implementation of the quality functions within their departments, has such delegation been formally defined and documented? (Measure of Effectiveness for Clause 4.1.2.1) Review the quality procedures and interview personnel to verify awareness of these issues.
9	Do the personnel having responsibility for verification activities understand their authority and organisational freedom to control quality? (Clause 4.1.2.1) Interview a sample of verification personnel addressing the five items (a-e) stated under 4.1.2.1 of the ISO 9002-1994 Standard.
10	Have the resource requirements been defined and provided for the management, performance of work, and verification activities including internal quality audits?(Clause 4.1.2.2) Interview faculty personnel and state the results.

4.1 Management Responsibility (continuing)	
11	Are verification personnel qualified through education, training, or experience? (Clause 4.1.2.2) Interview faculty staff and check the training records.
12	Does the appointed management representative have sufficient authority and responsibility for ensuring that the requirements of the Standard are implemented and properly maintained?(Clause 4.1.2.3) Verify that the Management Representative has executive level responsibilities (check organisation chart) and state examples as evidence.
13	Does the Management Representative provide quality system performance reports to executive management for review, and are they used for improving the quality system? (Clause 4.1.2.3) Verify that such reports exist, and interview the Management Representative to discuss their use and the benefits obtained. Provide examples.
14	Has all management personnel with executive responsibility for the quality management system been directly and actively involved in the management review process? (Clause 4.1.3) Review the records and state the evidence.
15	Do all management personnel understand the purpose and value of the management review as defined in the Management Review Procedure? (Measure of Effectiveness for Clause 4.1.3) Interview personnel.
16	Do all managers involved in the management review have sufficient quality records and data to conduct the review effectively? (Measure of Effectiveness for Clause 4.1.3) Interview personnel.
17	Do the records exist for the management reviews clearly stating how the review was conducted, who was involved, what factors were considered, what conclusions were reached, and what actions were taken? (Clause 4.1.3) Review the records for the latest management review.
18	Are the management reviews conducted at defined intervals sufficient to ensure the continuing suitability and effectiveness of the quality system in satisfying the requirements of the ISO 9002 Standard and the faculty's defined quality policy and objectives? (Clause 4.1.3)

	Review the planned or actual intervals and discuss these issues with the Management Representative
	4.2 Quality System
1	Has a documented quality system been established and deployed at all levels to ensure that the faculty's services conform to specified customer / internal requirements?(Clause 4.2.1) Check for policy, procedures, instructions, and forms.
2	Has a Quality Manual been developed that contains or references the faculty's quality system procedures? (Clause 4.2.1) Verify and review the quality manual, and state the results
3	Does the Quality Manual outline the documentation structure of the faculty's quality system and also cover the requirements specified in the ISO 9002-1994 Standard? (Clause 4.2.1) Verify and review the quality manual, and state the results.
4	Is the Quality Manual properly distributed to and understood by those having direct responsibility for the quality system? (Measure of Effectiveness for clause 4.2.1) Interview managers and others to verify their understanding.
5	Are the quality system work instructions referenced in the quality system procedures and are the quality system forms referenced by the quality system procedures or work instructions when appropriate? (Measure of Effectiveness for clause 4.2.1) Sample various documents and look for an effective numbering system for relating and cross-referencing the quality manual, quality system procedures, work instructions, quality system forms, and other quality documentation.
6	Has the faculty prepared documented quality system procedures consistent with the requirements of the ISO 9002-1994 Standard the faculty's own quality policy? (Clause 4.2.2) Check the document register list for completeness and sample some procedures for consistency.
7	Are the quality system and the related procedures effectively implemented in order to assure service quality? (Clause 4.2.2) Provide specific examples and evidence of effectiveness.

4.2 Quality System (continuing)	
8	Are the faculty's quality system procedures excessive in covering commonly performed operations that don't directly affect quality? (Measure of Effectiveness) List any possible occurrences of over-documentation.
9	Are the quality system procedures clearly written in a manner that is consistent with the skills, methods, and training level of the personnel using them? (Clause 4.2.2) State the evidence based on a review of several procedures.
10	Does the quality planning system define and document how the requirements for quality will be met? (Clause 4.2.3) Review the system and the quality planning records, and then state the evidence.
11	Are the faculty's quality planning activities consistent with all the requirements of its defined Quality System? (Clause 4.2.3) Review the quality planning activities and note any that are not consistent.
12	Are the quality planning activities documented in a manner that suits the faculty's personnel and methods of operation? (Clause 4.2.3) Examine the quality planning documentation and note any deficiencies.
13	Are there documented policies, procedures, and/or work instructions for the preparation of quality plans? (Measure of Effectiveness for clause 4.2.3a) Verify their existence and determine the conformance.
14	Does the faculty identify the proper human and capital resources and methods needed to achieve the required levels of quality? (Clause 4.2.3b) Verify the execution of these activities and the level of their effectiveness.
15	Are the process, servicing, inspection, and test methods and the faculty's quality system procedures, work instructions, and other documentation compatible with one another? (Clause 4.2.3 c) Check for similar formats, levels of detail, & consistency of content.
16	Are the quality control, inspection, and testing techniques and related instrumentation updated as appropriate to ensure quality in verification? (Clause 4.2.3 d) Interview several personnel that perform these updates.

4.2 Quality System (continuing)	
17	Are measurement capability requirements identified in sufficient time to develop these capabilities in cases where they exceed the known state of the art? (Clause 4.2.3 e) Interview several people.
18	In the process of new service development, are suitable verification activities identified for various stages of service? (Clause 4.2.3 f) Sample some drawings or other contract related work instructions and check for critical characteristics.
19	Are standards of acceptability defined for all service features and requirements, and other visual verifications that require a subjective evaluation? (Clause 4.2.3 g) Check various work instructions and areas of the faculty.
20	Does the faculty's quality system documentation clearly define the requirements for and the nature of quality records? (Clause 4.2.3 h) Sample the documentation and state the findings.
4.3 Contract Review	
1	Does the faculty have a documented Contract Review Procedure for conducting reviews for both simple and complex contracts and quotations? (Clause 4.3.1) Check the procedure register and interview the Operation personnel.
2	Are personnel involved in contract reviews aware of the threefold purpose of performing a contract review? Namely, to ensure that: The requirements are adequately defined and documented. Any requirements differing from those in the tender are resolved. The faculty has the capability to meet contractual requirements. (Clause 4.3.2) Interview the Operation personnel who perform such reviews, listing the names and results.

4.3 Contract Review (continuing)	
3	Does the Contract Review Procedure ensure that the customer's requirements are adequately defined and documented prior to acceptance of an order or contract? (Clause 4.3.2) Review past contracts and note any discrepancies.
4	Does the Contract Review Procedure: 1. Adequately provide for coordination of contract review activities by all affected and responsible personnel? 2.Assign responsibilities of all personnel for coordinating and carrying out contract reviews? (Clause 4.3.2) Review the procedure and interview the Operation personnel who perform such reviews.
5	Does the Contract Review Procedure sufficiently address how to resolve situations where the customer's requirements are not adequately defined? (Clause 4.3.2) Review the procedure and interview the Operation personnel who perform such reviews.
6	If contracts are accepted without a written statement, what means exist to ensure that the contract or order requirements are agreed to prior to acceptance? (Clause 4.3.2) Review the procedure and interview the Operation personnel who perform such reviews.
7	Are final contracts reviewed to resolve any differences between customer requirements and those in the initial bid/quotation? (Clause 4.3.2) Review the procedure and recent records to confirm or dispute.
8	In the case where contract projects go through a bidding or tender stage, is a "contract review" initiated prior to submission of a tender? (Clause 4.3.2) Review the procedure and interview the Operation personnel who perform such reviews.
9	Does the Contract Review Procedure address how to incorporate special customer requirements into the service development system? (Clause 4.3.2) Review procedure and interview the personnel who perform such reviews.

4.3 Contract Review (continuing)	
10	Is the Contract Review Procedure followed correctly? (Clause 4.3.2) Sample records of recent contract reviews and evaluate their adequacy.
11	Does the Contract Review Procedure address how to ensure that the faculty has the capability to meet the contract requirements prior to acceptance of the order or contract? (Clause 4.3.2) Review the procedure and interview the Operation personnel.
12	Does the Contract Review Procedure address the resolution of differences between the customer's stated requirements and the faculty's capability to meet the requirements? (Clause 4.3.2) Review the procedure and interview the Operation personnel.
13	Does the Contract Review Procedure address how to resolve conflicts involving an accepted contract or order? (Clause 4.3.2) Review the procedure and interview the Operation personnel.
14	Does the faculty have an effective way to incorporate contract revisions into the work order system after the project has been initiated? (Clause 4.3.3) Review the procedure and interview the Operation personnel.
15	Are complete and accurate records of "Contract Reviews" maintained in a manner appropriate to the type of contract? (Clause 4.3.4) Review the procedure and files.
16	Is the retention period for contract review records defined and followed? (Clause 4.3.4) Review the procedure and the files in the Operation personnel.
4.5 Document and Data Control	
1	Has the faculty established documented procedures to control all documents and data that relate to the requirements of ISO 9002?(Clause 4.5.1) Check the procedure register and look for documented procedures governing the review, approval, revision, and distribution control of the following documents: Quality System Policy Manual, Quality System Procedures, Quality System Instructions

4.5 Document and Data Control (continuing)	
2	Does the faculty have a procedure to control external quality-related documents such as data, drawings, or standards that originated outside of the faculty, and quality information not recorded on paper? (Clause 4.5.1) Check the procedure register.
3	Do all quality system documents have a signature and date indicating proper review and approval by authorised personnel prior to issue, and a provision for indicating the revision status of the document? (Clause 4.5.2) Review the Quality Manual and sample several QSP's, QSWI's, & QSF's to verify.
4	Does a master list (or other equivalent means) exist to identify the current revision of all controlled quality system documents? (Clause 4.5.2) Verify that the system is used easily accessible and effective to preclude the use of invalid or obsolete documents.
5	Does a well-defined system exist to indicate the names of all holders of controlled documents (including external standards)? (Clause 4.5.2) Verify that the a system is up-to-date and effectively used.
6	Does the faculty have pertinent quality documents (procedures, work instructions, reference data, forms) available to personnel at the locations where operations essential to the effective functioning of the quality system activities are performed? (Clause 4.5.2 a) Audit various locations and verify.
7	Is the approach used to identify the current revision of documents effective to preclude the use of non-applicable documents in all cases? (Clause 4.5.2 b) Verify that all documents are current & show the revision status.
8	Does the faculty ensure that obsolete or invalid quality documentation is promptly removed when new documents are issued? (Clause 4.5.2 b) Review the appropriate procedures and verify that all documents are current.
9	Are safeguards used to ensure that documents that are in use but are not complete, or documents that are used for planning or similar purposes, are clearly marked to prevent their use in service? (Measure of Effectiveness: 4.5.2) Check to make sure that such documents are stamped "Do not use for service," "For planning purposes only," "Preliminary," etc.

4.5 Document and Data Control (continuing)	
10	If obsolete or invalid quality system documents are retained for knowledge preservation or other purposes, are they properly marked to prevent their use for normal quality activities? (Clause 4.5.2 c) Ask department managers to show such documents and verify.
11	Does the Quality Manual state that documentation generated prior to the ISO 9002 starting date may not conform to requirements? (Measure of Effectiveness: 4.5.2) Check the Quality Manual.
12	Does the faculty ensure that changes to quality system documents and other forms of data are reviewed and approved by the same functions or organisations that performed the original review and approval? (Clause 4.5.3) Review the appropriate QSP's to ensure they adequately cover the activities that must occur for document and data changes, and verify that all documents and data changes are made appropriately.
13	Is there any evidence that quality documents have written changes or revisions are dated? (Measure of Effectiveness: 4.5.3) Verify some QSP's, QSWI's, or PRWI's (part drawings).
14	Is there an effective approach for controlling an activity that is in service when document or data changes are issued? (Measure of Effectiveness: 4.5.3) Interview the managers and state the findings.
15	Does the faculty ensure that the function or group performing document or data changes has access to associated background information upon which to base their review and approval? (Clause 4.5.3) Review the document change files.
16	Is the manner in which changes to documentation or data are identified clear and appropriate to all affected personnel? (Clause 4.5.3) Review several documents and base the response on sampled evidence and ask personnel to explain what is revised.
17	Do faculty personnel at all levels understand their roles in document control and revisions? (Measure of Effectiveness: 4.5) Interview personnel and state the findings.

4.6 Purchasing	
1	Has the faculty established and maintained documented procedures to ensure that all purchased products and services conform to specified requirements? (Clause 4.6.1) Check the procedure register and interview the relevant personnel
2	Is the faculty's Subcontractor Selection and Assessment Procedure understood and followed by all personnel involved? (Clause 4.6.1) Interview the personnel in Purchasing who use it.
3	Have documented criteria (based on quality system, quality assurance, and other requirements related to meet quality, delivery, and cost) been defined to use as a basis for evaluating and selecting subcontractors? (Clause 4.6.2 a) Verify that such criteria exist, and that they are effective and consistently followed.
4	Is an Approved Subcontractor List (ASL) established and maintained based upon suppliers' performance and reviews of suppliers' capability versus the faculty's requirements? (Measure of Effectiveness: 4.6.2a) Verify the ASL (or equivalent) and assess the level of control used.
5	Does the faculty define the type and extent of control exercised over the subcontractors? (Clause 4.6.2 b) Check for different levels of receiving inspection, vendor or subcontractor performance evaluations, etc., and discuss this issue with the Purchasing personnel
6	Does the faculty purchase any products that directly affect quality from subcontractors not on the ASL? (Measure of Compliance & Effectiveness: 4.6.2) Sample some purchase orders and check the ASL for the corresponding subcontractors.
7	Does the ASL also include subcontractors that deal with temporary employment services, and other non-material-related suppliers? (Measure of Compliance & Effectiveness: 4.6.2) Check the ASL and sample some purchase orders for the corresponding subcontractors.

4.6 Purchasing (continuing)	
8	Are the criteria and process established to not only add but also remove suppliers from the ASL appropriate and effectively used? (Measure of Compliance & Effectiveness: 4.6.2) Review process, state findings.
9	Are the records showing when and why subcontractors were placed on the ASL accurate and complete? (Clause 4.6.2 c) Sample the records and state the results.
10	Do the purchasing documents (such as contracts and purchase orders) clearly identify the product and/or service ordered in terms of type, model, part number, or other sufficient precise identification? (Clause 4.6.3 a) Review a sample of purchasing documents and check for complete descriptions of materials by units of measure, grade, type, etc.
11	When drawings, catalogues, specifications, reference standards, safety and environmental factors, inspection or testing instructions, and so forth are essential for the control of purchased products, are such reference documents clearly identified on the P.O.'s? (Clause 4.6.3 b) State the evidence based on a sample of purchasing documents.
12	Is a quality system standard (ISO 9002, MIL STD., etc.) stated on the P.O. when needed? (Clause 4.6.3 c) Review PO's, state the evidence.
13	Are requirements concerning the approval or qualification of subcontractor supplied material, process equipment, personnel, and/or procedures clearly stated on the applicable purchasing documents? (Clause 4.6.3 b) Review P.O.'s, state the evidence.
14	Is Receiving Inspection Notified of changes (such as change of a supplier, change of specifications, change of incoming inspection requirements, or others)? (Measure of Compliance & Effectiveness: 4.6.2 & 4.6.3) Interview personnel at Receiving.
15	Is the Purchase Order Generation and Issue Procedure understood and consistently followed? (Measure of Compliance & Effectiveness:4.6.3) State the evidence based on a sample of appropriate personnel and purchasing documentation.

4.6 Purchasing (continuing)	
16	Is there any evidence to show that purchasing documents are released prior to proper review and approval for adequacy of specified requirements? (Clause 4.6.3) Sample purchasing documents and state the results.
17	Do purchasing documents specify arrangements for product verification at the subcontractor's premises and method of product release when applicable? (Clause 4.6.4.1) Examine purchase contracts that require subcontractor site product verification to verify that the requirements are clearly stated.
18	Does the faculty ensure that when specified in the contract, the customer or its representative has the right to verify purchased products at the premises of the subcontractor or upon receipt at the faculty? (Clause 4.6.4.2) Interview Purchasing personnel and check its applicability.
19	Do all verification and other key personnel at the faculty understand that verification by the customer at the subcontractor's premises does not serve as evidence of effective control of quality by the subcontractor (if this situation should occur)? (Clause 4.6.4.2) Interview verification and Purchasing personnel, and also check that this policy is clearly stated in the quality manual.
20	Is the duty personnel of Purchasing knowledgeable and supportive of the requirements and intent of clause 4.6 in the ISO 9000 Standards? (Measure of Effectiveness: 4.6) Interview key people in Purchasing and initiate whatever corrective action is necessary to resolve any of these problems.
4.7 Control of Customer Supplied Product / Service	
1	Has the faculty established a documented procedure(s) to control the verification, storage, and maintenance of any product or service supplied by the customer? (Clause 4.7) Check the procedure register and interview the operation personnel.
2	If any customer supplied product should become lost, damaged, or unsuitable for use, is the customer promptly notified. (Clause 4.7) Review the procedure, verify that complete and accurate records are generated?

4.7 Control of Customer Supplied Product / Service (continuing)	
3	Are storage areas for customer samples clearly identified? (Measure of Effectiveness: 4.7) Check in Receiving & Storage.
4	Are the conditions under which the faculty either inspects or does not inspect an incoming product defined and understood? Review the procedure and check clause 4.7 for understanding/ compliance.
4.8 Product/ Service Identification and Traceability	
1	Does the faculty have a Product/ Service Identification and Traceability Procedure that is clearly documented, understood, and consistently applied for identifying all services from receipt through all stages of service? (Clause 4.8) Check the procedure register, and look for identification by means of stamps, codes, applicable drawings, specifications, and other documents.
2	Can any lectures and courses be easily and correctly identified? (Measure of effectiveness: 4.8) Conduct a random sample
3	Does the course identification consistently match with the information stated on the course curriculum ? (Measure of Effectiveness: 4.8) Conduct a random sample for verifying.
4	Do the methods used for course identification allow for identifying the revision level under which it was re established and modified when appropriate? (Measure of Effectiveness: 4.8) Conduct a random sample of verification.
5	Are all materials and supplies indirectly used in faculty's service identified to allow for their proper application and use? (Measure of Effectiveness: 4.8) Check for proper identification on lubricants, materials, etc.
6	Does the documented procedure for traceability ensure that customers can be correctly supplied with replacement materials for existing products? (Clause 4.8) Review the procedure

4.8 Product/ Service Identification and Traceability (continuing)	
7	Are complete and accurate records kept of course traceability (when appropriate)? (Clause 4.8) Review the records and state the evidence.
8	Does the Product / Service Identification and Traceability Procedure specify how long traceability records are kept? (Clause 4.8) Review the procedure and verify effective compliance.
4.9 Process Control	
1	Are the servicing processes properly identified, planned, and carried out under controlled conditions? (Clause 4.9) Check for the plans, schedules, operation or routing sheets, and others.
2	What systematic approach is used to objectively determine if the absence of documented procedures or work instructions would adversely affect quality? (Clause 4.9 a) Interview the department heads and state the evidence.
3	In areas where documented work instructions (WI's) exist, are they accurate, complete, and up-to-date? (Measure of Effectiveness: 4.9 a) Review some WI's and interview the users to verify effectiveness.
4	Is the Issue and Control of Process Monitoring & Operating Instructions Procedure effective and consistently followed to generate and/or update work instructions? (Measure of Effectiveness: 4.9 a) Review the procedure and results.
5	Are all standards, codes, procedures, quality plans and other work instructions properly adhered to? (Clause 4.9 c) Verify that the documents are written so that academic staff can implement consistently understand and follow them.
6	Is there any evidence to suggest that the equipment and/or working environment is not suitable to achieve the required level of quality? (Clause 4.9 b) Check for reliable equipment, tooling, and good housekeeping practices and state the evidence.

4.9 Process Control (continuing)	
7	Do the process control work instructions clearly specify appropriate reference standards/codes and/or other pertinent information needed to properly operate or perform processes on servicing? (Measure of Effectiveness: 4.9 b) Review the documents.
8	Are the methods used to initially identify, monitor, and control the process parameters and characteristics (required to maintain quality during servicing) effective and consistently followed? (Clause 4.9 d) Review the documents and observe the operations.
9	Are the results of the control and monitoring activities of process parameters and characteristics during servicing properly documented? (Measure of Effectiveness: 4.9 d) Check for records and the results.
10	Are the criteria for service quality clearly defined via samples, illustrations, documents, etc., and regularly reviewed where such criteria are required to meet customer requirements? (Clause 4.9 f) Check areas where the criteria exist apply carefully.
11	Are the personnel responsible for performing work subject to workmanship requirements knowledgeable about those requirements? (Measure of Effectiveness: 4.9 f) Interview a sample of these personnel to verify.
12	Are all department heads aware of their responsibility to carry out suitable maintenance for the documentation equipment in their areas in order to ensure continuing process capability? (Clause 4.9 g) Interview these heads and state the evidence.
13	Are traceability schedules developed and results of courses recorded in all departments as required to ensure continuing process capability? (Measure of Effectiveness: 4.9 g) Sample department maintenance records and evaluate data on capability.
14	Has the faculty identified all the special processes in their operations? (Clause 4.9) Special processes are those for which the results cannot be fully verified by subsequent inspection and testing of the service, and where process deficiencies may become apparent only after the service is in use.)

4.9 Process Control (continuing)	
15	Are the established methods used for qualifying processes, courses, and personnel for special processes and determining their capability of meeting specified requirements well understood and effectively used? (Clause 4.9) Thoroughly check such processes etc.
16	Are documented instructions/ procedures developed to govern the continuous monitoring and control of special processes (to ensure that specified requirements are met)? (Clause 4.9) Check if there are any special processes that affect quality
17	Are the records for the qualified processes, courses, and students correctly stored and maintained? (Clause 4.9) Review some records to address this issue, and state the results.
4.10 Inspection and Testing	
1	Are all of the testing/ inspection activities used to verify service quality clearly documented in procedures, work instructions, and/or quality plans? (Clause 4.10.1) Check for the existence of such documentation at the place where verification activities are done.
2	Are the required amount and type of inspection and/or testing at receipt, during service clearly defined and understood by all verification personnel? (Clause 4.10.1) Check for proper documentation and interview verification personnel on these issues.
3	Do verification personnel understand the differences between inspection and audit in terms of application and requirements? (Measure of Effectiveness: 4.10.1) Interview a sample of verification personnel and state the results.
4	Are the Receiving Inspection and Testing Procedure and, or other quality plans effective in preventing the use of nonconforming incoming service? (Clause 4.10.2) Review the documentation and interview a sample of receiving verification personnel to verify compliance and effectiveness.

4.10 Inspection and Testing (continuing)	
5	Is the list of designated purchased materials which require a formal inspection or testing before they can be received into inventory well defined and easily accessible in Receiving? (Measure of Effectiveness: 4.10.2) Check for the existence of a list & verify that it is used effectively.
6	Does procedure specify different types and amounts of inspection to apply depending on subcontractor's performance or ranking, and the amounts of control and inspection exercised by the subcontractor? (Clause 4.10.2.2) Review the procedure & state the results.
7	Does the nonconforming service data indicate that Subcontractor problems are a significant problem? (Measures of Effectiveness: 4.10.2 and 4.6.2) Interview the relevant department Manager of Purchasing and Receiving Inspection & state the findings.
8	Does procedure address how to feedback information to Purchasing regarding the poor quality performance of a Subcontractor? (Measures of Effectiveness: 4.10.2 and 4.6.2) Review the procedure and interview the relevant department Heads of Purchasing and Receiving Inspection & state the findings.
9	For material that is released for urgent supply, does procedure address how to positively identify the material so that it may be easily recalled? (Clause 4.10.2.3) Review the procedure and interview with relevant department the Managers.
10	Are the In-process Inspection and Testing Procedure and, or other quality plans effective in preventing the use of nonconforming service? (Clause 4.10.2) Review the documentation and interview a sample of service verification personnel to verify compliance and effectiveness.
11	Do personnel sign off as documentation of in-process service conformance verification? (Clause 4.10.5) Check several in-process inspection records.

4.10 Inspection and Testing (continuing)	
12	Is there evidence to show that service is always held until the required in-process inspections and tests have been completed and the necessary reports have been received and verified? (Clause 4.10.3 b) Interview a sample of service verification personnel to verify compliance and effectiveness.
13	Are the acceptance criteria, specification requirements, and needed documentation readily available for performing inspection and testing of course evaluations? (Clause 4.10.4) Audit the inspection areas and interview these personnel.
14	Do personnel performing inspection always know what characteristics needed inspection and the acceptance criteria that apply? (Measure of Effectiveness: 4.10.4) Look for Specification sheets, checklists, quality plans, etc., and state how this information is known and communicated.
15	Do the inspection and test records clearly identify that the process has passed the required inspections/tests and the criteria used? (Clause 4.10.5) Sample several receiving, in-process, and final inspection records and state the evidence.
16	Are all inspection and test records signed/ initialled and dated by the inspectors? (Clause 4.10.5) See clause 4.16 for criteria and requirements & state the findings.
4.11 Control of Inspection, Measuring and Test Equipment	
1	Does the faculty have a documented Inspection, Measuring, and Test Equipment (IMTE) Maintenance and Calibration Procedure that is understood by all affected personnel? (Clause 4.11.1) Check the procedure register and interview with the relevant persons.
2	Are the responsibilities for controlling, calibrating, and maintaining IMTE used to demonstrate conformance to specified requirements well defined and understood by personnel involved with the calibration program? (Clause 4.11.1) Review the procedure register and interview various personnel.

4.11 Control of Inspection, Measuring and Test Equipment (continuing)	
3	Do personnel who use IMTE understand the calibration system? (Clause 4.11.1) Interview a sample of people involved with IMTE to verify.
4	Is the IMTE used in a manner that ensures the measurement uncertainty is known and is consistent with the required measurement capability? (Clause 4.11.1) Check for gauge and verify these results etc. tolerances of the equipment being verified.
5	Does the calibration system include any test software or hardware (jigs, fixtures, templates, patterns, etc.) that are used for verification, and are they calibrated and rechecked at regular intervals? (Clause 4.11.1) Check the calibration log.
6	Where IMTE technical data is required for verification of measuring equipment capability, is the data available to show that the equipment used is functionally adequate? (Clause 4.11.1) Review the faculty's procedure and check for these records.
7	Is there any evidence to show that the required measurements and the accuracy of those measurements have been correctly identified and defined? (Clause 4.11.1 a) Check for specified verifications and stated tolerances on the spec. sheets, prints, and other criteria used for verification decisions.
8	Does the faculty select and use IMTE that is capable of the accuracy and precision necessary to assure quality? (Clause 4.11.1 a) Verify that the equipment's measurement capability matches or exceeds the measurement requirements by a minimum. ratio.
9	Has the faculty identified and included all IMTE used to ensure conformance to requirements in an active calibration system? (Clause 4.11.1 b) Review the calibration records & interview with various personnel.
10	Does the established calibration system ensure that all IMTE is calibrated at established and appropriate time intervals? (Clause 4.11.1 b) Review the calibration records and evaluate the basis for the intervals.

4.11 Control of Inspection, Measuring and Test Equipment (continuing)	
11	Are all IMTE used to ensure equipment quality calibrated against certified equipment or standards known to be valid and traceable to nationally or internationally recognised standards? (Clause 4.11.1 b) Check for certified gauge blocks, weights, angles, etc. and state the evidence.
12	Where it is not possible or applicable to calibrate IMTE against national or international standards, has a calibration method been established that provides consistent results that meet requirements? (Clause 4.11.2 b) Check for a documented process.
13	Does the faculty have documented work instructions addressing "How to" calibrate the various types of IMTE in use? (Clause 4.11.1 c) Check to ensure that they exist and are effectively used.
14	Does procedure address each type of inspection, measuring, and test equipment and address such issues as equipment type, identification number, storage location, frequency of checks, method of checks, acceptance criteria, and action to be taken when calibration results are unsatisfactory? (Clause 4.11.2 c) Review the procedure and records.
15	Do personnel performing calibrations of IMTE understand the acceptance criteria and know what to do with equipment that fails calibration tests? (Measure of Effectiveness: 4.11.2) Interview several people who calibrate equipment and verify.
16	Is the calibration status of all inspection, measuring, and test equipment clearly marked on each piece of equipment? (Clause 4.11.2 d) Sample IMTE and look for logs showing this status.
17	Does the calibration procedure specify where and how long calibration records are kept? (Clause 4.11.2 e) Review the procedure and check that complete and accurate calibration records are kept for each piece of IMTE.
18	In cases where the equipment is found to be out of calibration, are there appropriate and effective methods or procedures used to assess and document the validity of previous inspection and test results? (Clause 4.11.2 f) Review documentation and interview personnel who perform calibrations.

4.11 Control of Inspection, Measuring and Test Equipment (continuing)	
19	Are all calibrations, and subsequent inspections, tests, and measurements carried out under suitable environmental conditions? (Clause 4.11.2.g) Check to ensure that temperatures, vibrations, or other physical conditions do not impair or adversely affect these activities.
20	Are all IMTE handled, preserved, and stored such that the accuracy and fitness of the equipment are maintained? (Clause 4.11.2 h) Audit various areas to assess these issues and look for a instructions
21	Does the faculty use safeguards to ensure that IMTE is not adjusted or "disturbed" during the calibration period? (Clause 4.11.2 i) Audit various areas to assess these issues and look for specific safeguards on the IMTE.
22	Does the faculty analyse data from calibration tests to identify trends, potential problems, and/or opportunities for improvement? (Measure of Effectiveness: 4.11.2) Interview with duty person(s) and assess the results if any are available.
4.12 Inspection and Test Status	
1	Are personnel who perform inspection and testing aware of their responsibility to identify the inspection and test status of all process in accordance with Inspection and Test Procedures and/or applicable quality plans? (Clause 4.12) Interview these people and look for inspection and test status.
2	Are the requirements and responsibilities to identify the inspection and test status adequately stated in the faculty's procedures and, or applicable quality plans? (Clause 4.12) Review the documents.
3	Is there any evidence to suggest that the inspection and test status of verified section is unknown? (Measure of Effectiveness: 4.12) Check a sample of course curriculum.

4.12 Inspection and Test Status (continuing)	
4	Does the method or means used to identify the inspection and test status ensure that only process that has passed the required inspections and tests, or has been authorised for concession is used or implemented ? (Clause 4.12) Review the methods used and check the results obtained.
4.13 Control of Nonconforming Product/ Service	
1	Does the faculty have a Nonconforming Product/ Service Review and Disposition Procedure that is effective in preventing the use of all nonconformance in all stages of process? (Clause 4.13.1) Check the procedure register and interview with the Management Representative and Department Heads.
2	Are criteria defined to specify under what circumstances procedure is initiated, and when the person can simply perform the necessary activities to conform to the specified requirements? (Measure of Effectiveness: 4.13) Review the procedure and verify that people agree when is nonconformance in-process.
3	Are nonconforming services being reported correctly? (Measure of Effectiveness: 4.13) Perform a random sample of nonconforming service reports and state the results.
4	Are all relevant personnel aware of a Stop Order (or some equivalent means to stop process on a given order when quality problems are identified)? (Measure of Effectiveness: 4.13.1) Interview personnel on this issue, and verify that it is effective.
5	Is the procedural requirement that non-conforming equipment or process be identified with a "do not use" tag (or equivalent) consistently followed? (Clause 4.13.1) Reference the appropriate step in procedure, state the evidence.
6	Is there any evidence to suggest that the review and disposition of nonconforming service are not being completed in a timely manner? (Measure of Effectiveness: 4.13.1) Review the NC records in Quality Assurance.

4.13 Control of Nonconforming Product/ Service (continuing)	
7	Does a procedure address what steps to follow in cases where nonconforming service is identified by a subcontractor at their facilities? (Measure of Effectiveness: 4.13.1) Review the procedure and evaluate its effectiveness on this issue.
8	Does the Nonconforming Product/ Service Review and Disposition Procedure address the responsibilities and steps to follow in order to identify and assemble personnel with appropriate knowledge, responsibility, and authority to determine process disposition? (Clause 4.13.2) Review the procedure and state the evidence.
9	Do the responsible personnel document disposition decisions clearly on the NCR? (Clause 4.13.2) State the evidence based upon a random sample of NCRs.
10	Are all nonconforming services that are reworked and modified then reinspected according to applicable inspection and test procedures or quality plans? (Clause 4.13.2) Check the procedures and interview the appropriate people.
11	When some part of process is regraded, is it properly documented and identified so that it will only be used in situations for which its new grade is specified? (Clause 4.13.2) Verify some regraded processes.
12	Are personnel who determine the disposition of nonconforming service knowledgeable about the criteria for rejecting the process? (Measure of Effectiveness: 4.13.2) Interview personnel and verify that this process is properly treated and identified as rejected process.
13	When required by the contract, is the proposed use or repair of material not conforming to specifications reported for concession to the customer? (Clause 4.13.2) Check several NCR for repaired or use-as material, and check that it is documented on the NCR.

4.13 Control of Nonconforming Product/ Service (continuing)	
14	In cases where process dispositions are to "use as is" or "modify under concession", does the NCR show (or does other documentation exist which denotes) the actual service conditions resulting from such disposition action? (Clause 4.13.2) Check several NCR
15	Does the faculty have a prioritised plan or method to reduce the occurrence of nonconforming process? (Measure of Effectiveness: 4.13.2) Interview the Management Representative and state the results.
4.14 Corrective and Preventive Action	
1	Does the faculty have a Corrective Action Procedure and a Preventive Action Procedure that are understood by all affected personnel? (Clause 4.14.1) Check the procedure register, and interview the Management Representative and other key department heads regarding the purpose and scope of each, and also the differences between the two QSPs.
2	Does senior management provide appropriate levels of resources to analyse problems and implement corrective action and preventive action? (Measure of Effectiveness: 4.14.1) Interview the people doing the corrective actions and preventive actions.
3	Is there any evidence of a lack of understanding or commitment on the part of management or their staff regarding corrective or preventive action? (Measure of Effectiveness: 4.14.1) Interview various people.
4	Does the faculty support department heads in cases where the required corrective or preventive action is beyond their level of competency? (Measure of Effectiveness: 4.14.1) Interview the Management Representative and other key department Heads regarding this issue.
5	Do department heads understand the difference between symptom and root cause, and do they use appropriate methods to investigate and determine root causes of a problem? (Clause 4.14.2 b) Interview the Management Representative and other key department managers regarding this issue.

4.14 Corrective and Preventive Action (continuing)	
6	Are the CA's & PA's as implemented appropriate to the magnitude of the problem and commensurate with the risks? (Clause 4.14.1) Verified closed CA's & PA's to see if the actions eliminated the nonconformities without excessive cost, time, or inconvenience.
7	When a corrective action or preventive action is implemented, are the appropriate changes to quality documentation made? (Clause 4.14.1) Review completed Corrective Action Requests (CARs) and Preventive Action Requests (PARs) to verify that the related documentation was updated.
8	Do the people responsible for taking corrective action (1)investigate the extent of the problem, (2) determine the root cause(s) of the problem, and (3) take action to prevent recurrence? (Clause 4.14.2) Interview the people doing the corrective actions.
9	Does the Management Representative (or his or her designee) review all "open" corrective action requests at regular intervals? (Clause 4.14.2 d) Interview the Manager of Quality and state the approach used to ensure that CA is taken.
10	Are customer complaints documented, circulated to appropriate departments, and considered for possible corrective action? (Clause 4.14.2 a) Verify that customer complaints are addressed in procedure and handled appropriately for CA.
11	Does the faculty address and resolve such situations where the department heads disagrees with the stated nonconformity and resulting corrective action request? (Measure of Effectiveness:4.14.2) Check if procedure addresses this issue, and verify that it is handled appropriately.
12	Does procedure provide for the investigation of service, process, or quality system nonconformities to determine the root cause? (Clause 4.14.2 b) Verify several CARs to see if the actual root causes were determined.

4.14 Corrective and Preventive Action (continuing)	
13	Are the results of CA investigations of non-conformities effectively documented? (Clause 4.14.2 c) Check several CARs to see if they include facts, conclusions, and recommendations for eliminating root causes of nonconformities, and look for an effective system for storing completed CA records.
14	Is there any evidence of a lack of resources or management commitment to address and successfully complete corrective action within time periods appropriate for the needed actions? (Measure of Effectiveness: 4.14.2) Review the open and completed CAR's and evaluate the findings.
15	When changes are made to procedures because of CA is there a follow-up to see if the new changes are effective? (Clause 4.14.2 d) Review procedure and interview the Management Representative.
16	Does the Preventive Action Procedure address the use of appropriate sources of information such as: 1. processes and work operations which affect quality, 2. concessions, 3. audit results, 4. quality records, 5. service reports, and 6. customer complaints to identify repetitive problems or trends that require the initiation of PA to detect, analyse and eliminate potential causes of nonconformities? (Clause 4.14.3 a) Review the procedure and the goodness of the results obtained.
17	Is there evidence to show that steps are taken to determine the underlying cause and deal with any problems requiring PA? (Clause 4.14.3 b) Review procedure and the records of closed PA's to determine the goodness of the results obtained.

4.14 Corrective and Preventive Action (continuing)	
18	Are preventive actions implemented and controls maintained to ensure that the actions taken are and remain effective? (Clause 4.14.3 c) Check that the documentation is updated or developed, and the closed out PA are verified as effective in internal audits, etc.
19	Are the results of the implemented preventive actions recorded and presented to management for review? (Clause 4.14.3 d) Verify that the latest Management Review (see clause 4.1.3) addressed the records from previously completed PA's.
20	Is there any evidence to show that CA and PA activities have reduced the level of process and system level nonconformances? (Measure of Effectiveness: 4.14.1) Look at various measure(s) of quality and look for positive trends showing ongoing improvement.
4.15 Handling, Storage, Packaing, Preservation and Delivery	
1	Are faculty secretary involved in handling, storage, materials and products aware of their responsibility for establishing and maintaining documented procedures for these activities in their areas? (Clause 4.15.1) Interview the relevant department Managers and review their documents.
2	Is the Handling, Storage, Packaging, Preservation, and Delivery Procedure or other documented methods adequate and effective to prevent damage or deterioration to materials and products? (Measure of Effectiveness: 4.15.1) Review the documents and look for evidence of damaged products.
3	Does the nonconforming product data indicate those quality defects caused by poor material handling are a problem? (Clause 4.15.2) Review the data and state findings.
4	Does the faculty utilise appropriate handling methods devices, to prevent damage and/or deterioration of all materials and products? (Clause 4.15.2) Observe handling methods, look for evidence of damaged product, and interview relevant personnel.

4.15 Handling, Storage, Packaing, Preservation and Delivery (continuing)	
5	Are the procedure or instructions for handling consistent with the characteristics of the materials and products and their likelihood of damage and/or deterioration? (Measure of Effectiveness: 4.15.2) Review the documents and state the findings.
6	Are appropriate storage areas used to prevent damage or deterioration of products pending use or delivery? (Clause 4.15.3) Review the facilities in these areas and state the findings.
7	Are the storage procedures appropriate and consistently followed for authorising receipt and dispatch to and from storage areas or stock rooms? (Clause 4.15.3) Review the procedures with Faculty Secretary in these areas & state the findings.
8	Do personnel perform assessments of stored materials at appropriate intervals to ascertain equipment deterioration or potential deterioration from a variety of different causes? (Clause 4.15.3) Review the records with Faculty Secretary in these areas & state the findings.
9	Does the faculty ensure "time in storage" for all products where quality is governed by shelf-life or equivalent factors? (Clause 4.15.3) Review the records with managers in these areas & state the findings.
4.16 Control of Quality Records	
1	Does the faculty have a Quality Records Maintenance Procedure that is understood by all affected personnel? (Clause 4.16) Check the procedure register and interview key persons about it.
2	Do faculty personnel identify, collect, index, file, store, and maintain quality records as a means to show conformance to specified requirements and demonstrate the effectiveness of the faculty's quality system? (Clause 4.16) Look for the existence of records as specified in the Standard and the faculty's documentation when auditing each area.

4.16 Control of Quality Records (continuing)	
3	Are the authority and method used to dispose of records defined for each type of record? (Clause 4.16) Check that retention times are established, recorded, understood and adhered to correctly.
4	Are personnel involved in collecting data for records given sufficient instructions and training to ensure that the data and records are generated correctly? (Measure of Effectiveness: 4.16) Check that personnel understood what records are needed and how to collect them correctly.
5	Do the faculty's records include pertinent subcontractors' data? (Clause 4.16) Check in Purchasing to verify the need & existence of such records.
6	Are all required quality records legible and indexed, filed, stored, and maintained in a manner that provides safe and secure storage and ready access/ retrievability? (Clause 4.16) Examine and evaluate a variety of records when auditing each area based on these requirements.
7	Is there any evidence that the quality system records are not an accurate and truthful representation of actual events documented in a timely manner? (Measure of Effectiveness: 4.16) Perform a random sample of records to verify that records are dated and initialled (or signed) by personnel responsible for the documented activity or outcome.
8	Does the faculty maintain an accurate and up-to-date master log showing what records are maintained, where they are kept, and for which retention period? (Measure of Effectiveness: 4.16) Check for the master record list and interview the Management Representative.
9	Do the procedures for records address the storage of different types of record media (tapes, disks, paper, microfiche, etc.)? (Measure of Effectiveness: 4.16) Check the procedure and interview the Management Representative.

4.16 Control of Quality Records (continuing)	
10	Do the relevant procedures and/or work instructions for the control of quality records address how to properly store quality records to prevent deterioration and loss? (Clause 4.16) Review various QSP's and QSWI's and state the findings.
11	Are quality records available for inspection and evaluation by the faculty's customers when specified in the contract? (Clause 4.16) Review various contracts and then verify the availability of these records for review by customers.
12	Do the relevant procedures and/or work instructions for the control of quality records provide for backup copies or other forms of data security for quality records kept on electronic media? (Measure of Effectiveness: 4.16) Review various QSP's and QSWI's and state the findings.
4.17 Internal Quality Audits	
1	Does the faculty have a documented Internal Quality Audit (IQA) Procedure that is understood by all affected personnel? (Clause 4.17) Check the procedure register and interview with the Management Representative.
2	Are the IQA's conducted by trained auditors? (Measure of Effectiveness: 4.17) Review recent audit reports and records of 2-day IQA training.
3	Are IQA records (such as the completed audit checklists, audit report, etc.) signed and dated by the responsible personnel? (Clauses 4.17 & 4.16) Review recent audit reports.
4	Are faculty personnel involved in the IQA well informed about the purpose and scope of the audit? (Measure of Effectiveness: 4.17) Interview recent auditees.
5	Does the faculty follow a formal audit schedule, and set IQA objectives based on the status and importance of the quality system activities? (Clause 4.17) Review of the long term audit plan and recent audit reports.

4.17 Internal Quality Audits (continuing)	
6	Are IQA's performed by personnel not having direct responsibility for the activities being audited, and not reporting to the department heads of the areas audited? (Clause 4.17) Review recent audit reports and their organisational positions.
7	Are predefined checklists and/or other established criteria consistently used in conducting IQA's?(Measure of Effectiveness: 4.17) Review recent audit reports and look for the checklists/criteria used. (Auditors may audit beyond the bounds of the checklists.
8	Do defined guidelines exist (in a procedure?) governing what records shall be kept to document the audit process and results? (Measure of Effectiveness: 4.17) Review the QSP and interview the person responsible for IQA's.
9	In cases where deficiencies or nonconformances are identified (in either lack of compliance with or effectiveness of the quality system), are timely corrective actions taken in accordance with the Corrective Action Procedure? (Clause 4.17) Review a recent IQA report and the CA status report, and interview the people responsible for IQA's.
10	Are the results of IQA's clearly documented and brought to the attention of faculty personnel having responsibility in the areas audited? (Clause 4.17) Review a recent IQA report and interview the auditees.
11	Do follow-up audit activities verify and record the implementation and effectiveness of prior corrective actions? (Clause 4.17) Review a recent IQA report and check that the investigation included audited closed out CA's.
12	Are senior management personnel actively involved in and concerned with the internal quality audit process? (Measure of Effectiveness and management commitment - 4.17) Review a recent IQA program and report, looking for a management closing meeting and management participation as auditors or observers.

4.17 Internal Quality Audits (continuing)	
13	Are the IQA's used as a means to identify opportunities for and drive improvements in the quality system? (Measure of Effectiveness and management commitment - 4.17) Review a recent report, looking for improvement ideas and effective follow through.
4.18 Training	
1	Does the faculty have a documented Training Assessment and Delivery Procedure focused on identifying the training needs and providing for the training of all personnel performing activities affecting quality, including new personnel? (Clause 4.18) Check the procedure register and interview with the person in charge of Training.
2	Are department heads and relevant personnel at all levels aware and knowledgeable regarding the Training Assessment and Delivery Procedure? (Measure of Effectiveness: 4.18) Interview personnel about the content of the procedure and its effective use as intended.
3	Is the faculty's commitment to training evident and consistent with the "quality objectives?" (Measure of Effectiveness: 4.18) Review both and state results.
4	Is "quality awareness training given to all new staff? (Measure of Effectiveness: 4.18) Review the policy or procedure and interview with the person in charge of Training.
5	Are the responsibilities for the planning, scheduling, and delivery of training well defined? (Measure of Effectiveness: 4.18) Review the procedure and interview with the person in charge of Training.
6	Is the content of staff training courses or on-the-job training sufficient to prevent or minimise quality problems? (Implied requirement of Clause 4.18, and a measure of effectiveness of these efforts) Review the nature of training and the results obtained, and interview with the person in charge of Training.

4.18 Training (continuing)	
7	Does the training program and/or procedure provide for qualifying personnel on the basis of education, training, and/or experience when they are assigned to perform specific tasks or work on special processes? (Clause 4.18) Review the training program and/or procedure and interview with the person in charge of Training.
8	Is there any evidence that personnel performing specific assigned tasks are not qualified to perform the task on the basis on appropriate education, training, and/or experience? (Measure of Effectiveness: 4.18) Audit the relevant areas carefully and state the evidence.
9	Is appropriate action taken when IQA's or nonconforming data show lack of employee skills is a major cause of nonconformity? (Clause 4.18) Review the system and interview with the person in charge of Training.
10	Does the faculty have a well defined and effective system to document the training given to all staff ? (Clause 4.18) Review the procedure and interview those personnel who provide training and keep records.
11	Does the faculty have "training records" listing the experience, education, and training for all staff - with a provision statement for training which occurred prior to the implementation of ISO 9000? (Clause 4.18) Interview with the person in charge of Training and review the records.
12	Does the faculty assess the effectiveness of training given to ensure that the objectives and needs for the training were met in a cost-effective manner? (Measure of Effectiveness: 4.18) Interview with the person in charge of Training and review the records.
4.20 Statistical Control	
1	Are systematic approaches used for identifying the need for statistical techniques for establishing and verifying process capabilities? (Clause 4.20.1) Interview with departmental managers and verify how the need was identified.

4.20 Statistical Control (continuing)	
2	Are systematic approaches used for identifying the need for statistical techniques for establishing, controlling, and verifying product characteristics? (Clause 4.20.1) Interview with departmental managers on their responsibility to identify the need for and define statistical techniques in their areas.
3	Does the faculty need statistical techniques for assessing, controlling, and improving the quality system and processes? (Clause 4.20.1) Observe and evaluate the findings.
4	Is the Set-up Verification (Statistical Pre-Control) Procedure needed and effectively used? (Clause 4.20.2) Interview personnel who use this QSP and check for understanding, compliance, and effectiveness.
5	Is the Process Capability Study Procedure properly and consistently used for the qualification of processes? (Clause 4.20.2) Interview personnel who use this QSP and check for understanding, compliance, and effectiveness.
6	Is the Statistical Sampling Procedure properly and consistently used to verify and characterise the acceptability of product characteristics? (Clause 4.20.2) Interview personnel who use this QSP and check for understanding, compliance, and effectiveness.
7	Is there evidence to show that decisions to solve quality problems are made on the basis of data instead of emotion, opinion, or past experience? (Measure of Effectiveness beyond the requirement of clause 4.20)
8	Does the faculty effectively use charts, graphs, and other formats to display data on quality performance and process improvement? (Measure of Effectiveness beyond the requirement of clause 4.20)
9	Are quality failure data collected and analysed for quality improvement projects? (Measure of Effectiveness beyond the requirement of clause 4.20)

Table B.2 ISO 14001 internal audit questionnaire

	4.2 Environmental Policy
1	Has top management defined and documented its environmental policy, including commitments to continual improvement and pollution prevention? (Clause 4.2b) Provide evidence that documents top management's commitment to their stated environmental policy.
2	Is the environmental policy appropriate to the nature, scale, and environmental impacts of the faculty's activities and services? (Clause 4.2a) Review the environmental policy, interview personnel, and state examples.
3	Do the environmental policy and environmental objectives influence staff's attitudes toward the environment and the manner in which they perform their duties? (Measure of Effectiveness for Clause 4.2) Provide specific examples and verify that every staff feels responsible for the environmental aspects of their job.
4	Does the environmental policy state the faculty's commitment to adherence to relevant environmental legislation, regulations, and other relevant EMS requirements?(Clause 4.2c) Review the policy and appropriate regulations and requirements, and state the evidence.
5	Does the environmental policy address the general approach to set and review environmental objectives and targets? (Clause 4.2d) Verify that the approach and framework is established, realistic, and understood by management.
6	Is the environmental policy effectively deployed to all levels of the organisation? (Clause 4.2e) Interview a sample of personnel to verify awareness of environmental issues and how their work may impact the environment.
7	Does the faculty have effective means to ensure that its EMS policy is made available to its public constituents? (Clause 4.2f) Ensure that the environmental policy is not designated as proprietary or confidential, and document what process is established to make it available upon request.

4.2 Environmental Policy (continuing)	
8	Is the environmental policy sufficiently clear so that it can be understood by internal and external interested parties? (Measure of Effectiveness for Clause 4.2f) Interview a sample of personnel to verify their understanding of the environmental policy.
9	Is the environmental policy periodically reviewed and revised to reflect changing conditions, regulations and/or legislation, and information? (Measure of Effectiveness for Clause 4.2) Interview top management and verify records of appropriate review, and state the evidence.
4.3 Planning	
1	Does the faculty maintain (a) meaningful procedure(s) to identify the environmental aspects (causes) of its operations that have or may have significant positive or negative environment impacts (effects)? (Clause 4.3.1) Verify that the procedure(s) identifies and addresses: 1. The faculty's meaningful activities, and services, 2. The environmental aspects of each activity, and service. 3. The environmental impacts for each aspect, and 4. A way to evaluate the significance of the impacts.
2	Has the faculty identified and evaluated the aspects of its operations which may have significant positive or negative impacts on the environment? (Clause 4.3.1) Verify that documented evidence exists which clearly define these issues, and discuss with management the use and value of this information.
3	When identifying environmental aspects, does the faculty consider abnormal operating conditions (ie., start-up, shut-down, special processing, emergency situations, etc.) and the potential impacts associated with them? (Measure of Effectiveness for Clause 4.3.1) Interview key management personnel, including the Management Representative, and state the results.

	4.3 Planning (continuing)
4	Are the environmental aspects related to significant environmental impacts considered in setting the faculty's environmental objectives and targets? (Clause 4.3.1) Interview top management to ensure that appropriate measures are used, and verify that the scale, severity, duration, and/or probability of occurrence for impacts were considered in selecting and setting the objectives and targets.
5	Are the environmental aspects, impacts, and objectives up-to-date? (Clause 4.3.1) Identify when the environmental aspects, impacts, and objectives were last reviewed and/or updated, verify that any recent changes or additions to operations have been evaluated for environmental effects, and ensure that the environmental planning procedure includes periodic reviews.
6	Does the faculty maintain (a) meaningful procedure(s) and a register to identify the legal, regulatory, and/or other requirements that apply to the environ-mental aspects of its operations? (Clause 4.3.2) Verify that the procedure(s) identifies and addresses: 1. How applicable legal requirements, industry codes of practice, agreements with public authorities, non-regulatory guidelines, etc. are identified. 2. How changes to such requirements are identified and addressed. 3. How relevant information is communicated to employees.
7	Has the faculty established and documented realistic environmental objectives and targets that consider and are consistent with its environmental policy, environmental aspects and impacts, technological options, financial, operational, requirements, and the views of its public constituents? (Clause 4.3.3) Identify the objectives and targets, compare them to the environmental policy, and comment on their applicability and feasibility.
8	Do objectives and targets include the prevention of pollution and take other preventative measures into account, where appropriate? (Measure of Effectiveness for Clause 4.3.3) Review the objectives and targets, identifying preventive measures such as environmental awareness training, preventative maintenance, for the environment, etc.

4.3 Planning (continuing)	
9	Are the environmental objectives specific and the targets measurable wherever applicable? (Measure of Effectiveness for Clause 4.3.3) Assess the clarity, effectiveness, and quantification of the objectives and targets.
10	Are environmental objectives and targets periodically reviewed and revised? (Measure of Effectiveness for Clause 4.3.3) Identify how progress toward the objectives and targets is tracked and when they were last reviewed and/or revised.
11	Does the faculty maintain a program for achieving all its environmental objectives/ targets? (Clause 4.3.4) Review the environmental program for specific priorities, schedules, designated resources, processes, training, measuring, responsibilities, and management oversight for each objective and target.
12	Is there evidence that the program has been properly and periodically amended in light of changes to environmental objectives and targets? (Clause 4.3.4) Look for appropriate changes to the program following reviews of the objectives and targets, and/or ensure that the environmental planning procedure addresses such changes.
13	Is there evidence that the program has been properly amended to include new developments, projects, and/or operations, and changes in relevant legislation or regulations? (Clause 4.3.4) Review the program, identifying when it was last revised or reviewed, and interview key management personnel to determine conformance.
14	Is the environmental program supported by management and effectively deployed to and understood by the entire organisation? (Measure of Effectiveness for Clause 4.3.4) Interview a sample of key personnel to assess their awareness of and roles in achieving the environmental objectives and targets.
15	Has the faculty identified and developed internal performance criteria where external standards do not meet the needs of the faculty or are non-existent? (Measure of Effectiveness for Clause 4.3) Look for evidence of internal performance criteria in the environmental objectives and targets and environmental program, and assess the need for such criteria in light of the faculty's environmental aspects.

4.4 Implementation and Operation	
1	Are roles, responsibilities, and authorities for the environmental management system defined, documented, and communicated to all appropriate personnel? (Clause 4.4.1) Review the documentation and interview key personnel to assess their understanding of their roles (including accountability and responsibility) in the EMS.
2	Has top management provided sufficient resources to implement and control the EMS? (Clause 4.4.1) Interview key personnel, including competence and capability in addressing the environmental objectives and targets.
3	Has top management appointed a specific Management Representative for the EMS? (Clause 4.4.1) Identify the Management Representative, and ensure that this individual has sufficient authority, competence, and resources to effectively implement and maintain the EMS in accordance with ISO 14001.
4	Does the Management Representative have defined roles, responsibilities, and authority for ensuring that the EMS is properly established, implemented, and maintained? (Clause 4.4.1) Review the documentation and interview the Management Representative to assess his understanding of these responsibilities.
5	Does the Management Representative have defined roles, responsibilities, and authority for reporting on the performance of the EMS to Dean for review and continuous improvement? (Clause 4.4.1) Review the documentation and interview the Management Representative to assess his understanding of these responsibilities.
6	Has the EMS been successfully integrated into the process as a whole? (Measure of Effectiveness for Clause 4.4.1) Interview key management personnel to assess how conflicts between environmental and service objectives are resolved and assess the degree to which the EMS is or is not a Appear exercise"

4.4 Implementation and Operation (continuing)	
7	Has a procedure been established to identify the training needs of departmental heads, and academic staff? (Clause 4.4.2) Identify how the training needs of specific job functions are analysed, and interview training personnel.
8	Does the faculty identify all personnel whose work may impact the environment, ensuring that they are competent on the basis of education, training, and/or experience? (Clause 4.4.2) Review training records to verify that personnel have received EMS awareness training, hazardous waste training, and prevention, preparedness, and emergency response training, as appropriate.
9	Does the faculty maintain (a) meaningful procedure(s) to ensure that EMS training needs throughout the organisation are met? (Clause 4.4.2) Verify that the procedure(s) addresses awareness of: 1. The importance of conforming to EMS policies and procedures, 2. The potential or actual environmental effects of individual work activities and the benefits of improved personal performance, 3. Individual roles and responsibilities within the EMS, including emergency preparedness and response, 4. Potential consequences of departure from OP's.
10	Does the faculty identify and address the environmental training needs of contractors and, or suppliers operating on-site? (Clause 4.4.2) Review training records and interview any on-site contractors and suppliers to assess their awareness of their environmental roles and responsibilities.
11	Are training programs reviewed and modified periodically in light of changes to legislation, regulation, and/or scope of operations? (Measure of Effectiveness for Clause 4.4.2) Identify how training programs are reviewed/revised by interviewing training personnel and reviewing training programs to ensure that they are up-to-date.
12	Are training records established and maintained? (Clause 4.4.2) Review a sample of training records to assess the competence and qualification of staff performing work that may affect the environment.

4.4 Implementation and Operation (continuing)	
13	Does the faculty maintain a procedure for receiving, responding to, and documenting communication from its public constituents and other external parties? (Clause 4.4.3) State how the concerns of external parties relating to environmental aspects and the EMS are addressed.
14	Has the faculty considered processes for external communication aspects to its public constituents and other external parties? Has the faculty recorded this decision? (Clause 4.4.3) Ensure that the appropriate planning procedure addresses this requirement, and review the records of related decisions.
15	Does the procedure for external communication address necessary communications with public authorities regarding emergency planning and other relevant issues? (Measure of Effectiveness for Clause 4.4.3) Review the procedure(s) and/or interview top management personnel. State the evidence.
16	Does the faculty maintain a procedure to identify the need for and manage internal communication throughout the organisation? (Clause 4.4.3) Verify that the procedure addresses: 1. Receiving and responding to employee concerns, 2. Raising awareness of policy, objectives, targets, and programs, 3. Communicating the results of audits and management reviews.
17	Has the faculty established and maintained documentation that describes the core elements of the EMS and their interactions? (Clause 4.4.4) Verify the existence of documents or information in electronic form that: 1. State the environmental policy, objectives, and targets, 2. Describe the means of achieving environmental objectives and targets, 3. State roles, responsibilities, policy and/or procedures for meeting the requirements of ISO 14001.

4.4 Implementation and Operation (continuing)	
18	Has the faculty established and maintained information that provides clear references to related EMS documentation (procedures, work instructions, legislation and regulatory codes, etc.)? (Clause 4.4.4) Trace through a sample of documents, ensuring that referenced documents exist and are available. State the results.
19	Has the faculty established procedures that define roles and responsibilities in creating, modifying, and controlling all documents and data that relate to the requirements of ISO 14001? (Clause 4.4.5) Check the procedure register and look for procedures governing the review, approval, revision, and distribution control of EMS documentation.
20	Do all EMS documents have evidence indicating proper review and approval by authorised personnel prior to issue, and a provision for indicating the revision status of the document including date of revision? (Clause 4.4.5) Review a sample of EMS documentation to verify.
21	Does a master list (or other equivalent means) exist to identify the current revision of all controlled EMS documents and their retention period, if applicable? (Clause 4.4.5) Verify that the system used is easily accessible and effective to preclude the use of invalid or obsolete documents.
22	Does a well-defined system exist to indicate the names or locations of all holders of controlled documents? (Clause 4.4.5) Verify that the system is up-to-date and effectively used by "tracing" a sample of controlled documents.
23	Does the faculty have pertinent EMS documents available to personnel at the locations where operations essential to the effective functioning of the EMS activities are performed? (Clause 4.4.5) Audit various locations and verify.
24	Is the approach used to identify the current revision of documents effective to preclude the use of non-applicable documents in all cases? (Clause 4.4.5) Verify that all documents are current & show the revision status.

4.4 Implementation and Operation (continuing)	
25	Does the faculty ensure that obsolete or invalid EMS documentation is promptly removed when new documents are issued? (Clause 4.4.5) Review the appropriate procedures and distribution lists and verify that all documents are current.
26	Are safeguards used to ensure that documents that are in circulation but are not complete, or documents that are used for planning or similar purposes, are clearly marked to prevent their use? (Measure of Effectiveness for Clause 4.4.5) Check to make sure that such documents are stamped "Draft" "For planning purposes only," "Preliminary," etc.
27	If obsolete or invalid quality system documents are retained for knowledge preservation or other purposes, are they properly marked to prevent their use for normal activities? (Clause 4.4.5) Ask department heads to show such documents and verify.
28	Is there any evidence that EMS documents have written changes or revisions that are not dated? (Measure of Effectiveness for Clause 4.4.5) Verify a sample of documentation and state the results.
29	Is all EMS documentation periodically reviewed and maintained in an orderly fashion? (Clause 4.4.5) Review a sample of documentation, looking for revision/review, review the document change files, and state the results.
30	Has the faculty identified operations and activities associated with its significant environmental aspects? (Clause 4.4.6) Interview key management personnel and look for evidence of a systematic approach to identify the environmental aspects of the faculty's operations and activities.
31	Are maintenance schedules developed and results recorded in all departments? (Clause 4.4.6) Sample department maintenance records and interview maintenance personnel to verify the existence of a defined maintenance program.

4.4 Implementation and Operation (continuing)	
32	Does the faculty maintain documented control procedures (including maintenance) to ensure that the environmental policy, objectives, and targets can be met? (Clause 4.4.6) Verify the existence of documented procedures in activities where their absence could lead to deviations from the environmental policy, objectives, and targets, including: -design and engineering -purchasing and contracting -material handling and storage -acquisition, construction, or modification of property/ facilities.
33	Are operating criteria clearly stated for activities and operations that are associated with significant environmental aspects? (Clause 4.4.6) Review key operations and state the results.
34	Does the faculty maintain documented control procedures for addressing the significant environmental aspects of goods and services purchased, subcontracted, and/or used by the faculty and for communicating requirements to the appropriate suppliers and subcontractors? (Clause 4.4.6) Verify that sufficient organisational control is maintained to ensure that the services, or activities of suppliers and subcontractors do not compromise the faculty's IMS.
35	Are all standards, codes, procedures, plans and other work instructions properly adhered to? (Measure of Effectiveness for Clause 4.4.6) Verify that the documents are written so that employees consistently understand and follow them.
36	Is there any evidence to suggest that the equipment and/or working environment is not suitable to achieve the defined environmental objectives and targets? (Measure of Effectiveness for Clause 4.4.6) Look for reliable equipment, fixtures, and good housekeeping practices.
37	Do the operational control work instructions clearly specify appropriate reference standards/codes and/or other pertinent information needed to properly operate equipment or perform processes? (Measure of Effectiveness for Clause 4.4.6) Review the documents and verify that personnel are aware of and can locate the documents/ data.

4.4 Implementation and Operation (continuing)	
38	Are all department heads aware of their responsibility to carry out suitable traceability in their areas in order to ensure continuing operational control? (Clause 4.4.6) Interview these departmental heads and state the evidence.
39	Does the faculty maintain meaningful procedures and plans to identify the potential for and respond to accidents and emergency situations? (Clause 4.4.7) Verify that the procedures/plans address such issues as: emergency organisation and responsibilities, -a list of key personnel details of emergency services available, internal and external communication plans, actions taken for different types of emergencies, training programs and testing procedures.
40	Does the faculty maintain meaningful procedures to prevent and mitigate the environmental impacts that may be associated with accidents and emergency situations? (Clause 4.4.7) Verify that the procedures/plans identify and address clean-up services, methods and responsibilities for precautionary evacuations of surrounding areas, etc.
41	Does the faculty periodically review and revise its emergency preparedness and response procedures, particularly after the occurrence of an accident or emergency situation? (Clause 4.4.7) Interview appropriate personnel, and review the procedure(s) and related documentation to identify their revision status.
42	Does the faculty periodically test their emergency preparedness and response procedures? (Clause 4.4.7) Review the appropriate procedure(s) and interview management personnel.
4.5 Checking and Corrective Action	
1	Does the faculty maintain (a) meaningful documented procedure(s) to regularly monitor and measure actual performance against their environmental objectives and targets? (Clause 4.5.1) Specify the performance indicators established, review documented performance records and relevant operational controls, and evaluate conformance with the faculty's environmental objectives and targets as well as applicable legislation and regulation.

4.5 Checking and Corrective Action (continuing)	
2	Does the faculty periodically identify and review appropriate indicators used to track environmental performance? (Measure of Effectiveness for Clause 4.5.1) Identify how the indicators are chosen, reviewed, and revised, and ensure that they are objective, verifiable, cost-effective, and consistent with the environmental policy.
3	Does the faculty maintain (a) meaningful procedure(s) to calibrate and maintain monitoring equipment? (Clause 4.5.1) Verify that the procedure identifies and addresses: 1. The key monitoring equipment to be calibrated and maintained, 2. A system identifying the frequency, means, and methods of calibration and maintenance, 3. Calibration standards that are traceable to (where applicable), 4. Generation and maintenance of appropriate calibration records.
4	Is monitoring equipment appropriately calibrated and maintained? (Clause 4.5.1) Evaluate a sample of monitoring equipment, identifying when the equipment was last calibrated, when it is next scheduled to be calibrated, and the appropriate records of calibration/maintenance.
5	Does the faculty maintain (a) meaningful documented procedure(s) to periodically evaluate compliance with relevant environmental legislation and regulations? (Clause 4.5.1) Verify that the procedure identifies and addresses: 1. The means and methods to identify current and applicable legislation/regulation, 2. Investigations into recent or relatively certain future environmental legislation and regulation, 3. The means and methods to come into compliance with applicable legislation/regulation.

	4.5 Checking and Corrective Action (continuing)
6	Is there any evidence of a lack of resources or management commitment to address and successfully complete corrective action within time periods appropriate for the needed actions? (Measure of Effectiveness for Clause 4.5.2) Review the open and completed CA's, interview the personnel performing the corrective actions, and evaluate the findings.
7	Does the faculty maintain (a) meaningful procedure(s) that defines responsibility and authority for investigating and correcting actual and potential nonconformances? (Clause 4.5.2) Verify that the procedure(s) identifies and addresses: 1. Means for identifying the root cause of the nonconformance, 2. Identifying and implementing the necessary corrective or preventive action, 3. Implementing or modifying controls to avoid recurrence of the nonconformance, 4. Recording any changes in procedures and other documentation as a result of the corrective or preventive action.
8	Is there any evidence of a lack of understanding or commitment on the part of management or their staff regarding corrective or preventive action? (Measure of Effectiveness for Clause 4.5.2) Interview various people to assess their understanding and commitment to the corrective and preventive action processes.
9	Does the faculty support department heads in cases where the required corrective or preventive action is beyond their level of competency and/or authority? (Measure of Effectiveness for Clause 4.5.2) Interview key management personnel regarding this issue.
10	Do department heads understand the difference between symptoms and root cause, and do they use appropriate methods to investigate and determine root causes of a problem? (Measure of Effectiveness for Clause 4.5.2) Interview key management personnel regarding this issue.

4.5 Checking and Corrective Action (continuing)	
11	Are corrective actions and preventive actions as implemented appropriate to the magnitude of the problem and comparable with the environmental impact encountered and/or possible? (Clause 4.5.2) Verified closed CA's and PA's to see if the actions eliminated the nonconformities without excessive cost, time, or inconvenience.
12	When a corrective action or preventive action is implemented, are the appropriate changes to EMS documentation made? (Clause 4.5.2) Review completed corrective actions and preventive actions to verify that the affected documentation was updated.
13	Does the appropriate management personnel review all "open" corrective action requests at regular intervals? (Measure of Effectiveness for Clause 4.5.2) Verify that the corrective action procedure addresses this issue, interview key management personnel, and state the approach used to ensure that CA is taken, completed, and effective.
14	Are the results of corrective and preventive actions recorded and presented to management for review? (Measure of Effectiveness for Clause 4.5.2) Verify that the latest Management Review addressed the records from previously completed corrective and preventive actions.
15	Are customer complaints documented, circulated to appropriate departments, and considered for possible corrective action? (Measure of Effectiveness for Clause 4.5.2) Verify that customer complaints are addressed in the corrective action procedure(s) and interview a sample of management personnel to assess their awareness of recent customer complaints.
16	Are the results of corrective action investigations effectively documented? (Measure of Effectiveness for Clause 4.5.2) Check several corrective actions to see if they include facts, conclusions, and recommendations for eliminating root causes of nonconformities, and look for an effective system for storing completed CA records.
17	When changes are made to procedures because of corrective or preventive action, is there a follow-up to see if the new changes are effective? (Measure of Effectiveness for Clause 4.5.2) Review the corrective action procedure and interview key management personnel to assess this issue.

4.5 Checking and Corrective Action (continuing)	
18	Does the faculty maintain (a) meaningful procedure(s) for the identification, maintenance, and disposition of EMS records? (Clause 4.5.3) Verify that the procedure(s) identifies and addresses: 1. The records maintained for the implementation and operation of the EMS, 2. Responsibilities for maintaining and disposing of records, 3. Means and methods of EMS record identification, storage, and maintenance, 4. Specification of retention times and means of disposal for each EMS record.
19	Are personnel involved in collecting data for records given sufficient instructions and training to ensure that the data and records are generated correctly? (Measure of Effectiveness for Clause 4.5.3) Check that personnel understand what records are needed and how to collect them correctly.
20	Does the faculty identify, collect, index, file, store, and maintain appropriate environmental records? (Clause 4.5.3) Look for the existence of: 1. Information on applicable laws or other requirements, 2. Complaint records, 3. Training records, 4. Process information, 5. Inspection, maintenance, records, 6. Contractor and supplier information, 7. Incident and CA reports, 8. Emergency preparedness and response information, 9. Audits and management review results.

4.5 Checking and Corrective Action (continuing)	
21	Are all required environmental records legible, identifiable, and traceable to the activity or service involved? (Clause 4.5.3) Examine and evaluate a variety of records when auditing each area based on these requirements.
22	Are all required environmental records indexed, filed, stored, and maintained in a manner that provides safe and secure storage and ready access/ retrievability? (Clause 4.5.3) Examine and evaluate a variety of records when auditing each area based on these requirements.
23	Is there any evidence that the environmental records are not an accurate and truthful representation of actual events documented in a timely manner? (Measure of Effectiveness for Clause 4.5.3) Perform a random sample of records to verify that records are dated and initialled (or signed) by personnel responsible for the documented activity or outcome.
24	Does the faculty maintain an accurate and up-to-date master log showing what records are maintained, where they are kept, and for which retention period? (Measure of Effectiveness for Clause 4.5.3) Check for the master record list and verify a sample of records from this list.
25	Do the procedures for records address the storage of different types of record media (tapes, disks, paper etc.)? (Measure of Effectiveness for Clause 4.5.3) Check the procedure and interview the Management Representative.
26	Do the relevant procedures and/or work instructions for the control of environmental records address how to properly store environmental records to prevent damage, deterioration, and loss? (Clause 4.5.3) Review various procedures and work instructions and assess the appropriateness of record storage areas/facilities.
27	Do the relevant procedures and/or work instructions for the control of environmental records provide for backup copies or other forms of data security for environmental records kept on electronic media? (Measure of Effectiveness for Clause 4.5.3) Review various procedures and work instructions and state the findings.

4.5 Checking and Corrective Action (continuing)	
28	Does the faculty maintain (a) meaningful procedure(s) for planning and performing environmental management system audits? (Clause 4.5.4) Verify that the procedure(s) identifies and addresses: 1. The activities and areas to be audited, 2. The frequency of audits, 3. The responsibilities for planning, managing, and performing audits, 4. The communication of audit results, 5. Auditor competence and training, 6. How audits will be conducted.
29	Are the audits conducted by trained and qualified auditors? (Measure of Effectiveness for Clause 4.5.4) Review recent audit reports and records of EMS audit training.
30	Are audit records (such as the completed audit checklists, audit report, etc.) signed and dated by the responsible personnel? (Clauses 4.5.3 and 4.5.4) Review recent audit reports and associated records and state the findings.
31	Are faculty staff involved in the audit well informed about the purpose and scope of the audit? (Measure of Effectiveness for Clause 4.5.4) Interview recent auditees to assess their understanding of and their roles in the audit process.
32	Does the faculty follow a formal audit program and schedule, and set audit objectives based on the potential impact of the activity concerned and the results of previous audits? (Clause 4.5.4) Review the audit program and schedule and recent audit reports.
33	Does the audit procedure and program cover the audit scope, frequency, methodologies, and responsibilities and requirements for conducting audits and reporting results? (Clause 4.5.4) Review the auditing procedure and recent audit program to assess these issues.

4.5 Checking and Corrective Action (continuing)	
34	Do defined guidelines exist (eg., in a procedure) governing what records shall be kept to document the audit process and results? (Measure of Effectiveness for Clause 4.5.4) Interview the personnel responsible for audits to assess their knowledge of required audit records and review the audit procedure.
35	In cases where deficiencies or nonconformances are identified (in either lack of conformance with or effectiveness of the EMS), are timely corrective actions taken in accordance with the established procedure? (Clause 4.5.4) Review a recent audit report and the corrective action status report, and interview the people responsible for audits.
36	Are the results of audits clearly documented and brought to the attention of faculty personnel having responsibility in the areas audited? (Measure of Effectiveness for Clause 4.5.4) Review a recent audit report and interview the people audited.
37	Do follow-up audit activities verify and record the implementation and effectiveness of prior corrective actions? (Measure of Effectiveness for Clause 4.5.4) Review a recent audit report and check that the investigation included audited closed out CAs.
38	Are senior management personnel actively involved in and concerned with the audit process? (Measure of Effectiveness for Clause 4.5.4) Review the audit program, schedule, and report, looking for a management closing meeting and management participation as auditors or observers.
39	Are the audits used as a means to identify opportunities for and drive improvements in the environmental management system? (Measure of Effectiveness for Clause 4.5.4) Review a recent report, looking for improvement ideas and effective follow through.
40	Is a formal audit report submitted to the Management Representative and/or other appropriate personnel? (Clause 4.5.4) Interview the Management Representative and identify the distribution process of the audit report.

4.6 Management Review	
1	Does the faculty's top management periodically review the entirety of the environmental management system to ensure its continuing suitability, adequacy, and effectiveness? (Clause 4.6) Verify that management reviews address: 1. Reviews of environmental objectives, targets, and environmental performance, 2. Findings of EMS audits, 3. An evaluation of EMS effectiveness, 4. An evaluation of the continuing suitability of the EMS considering changing legislation and other requirements, changes in or activities, advances in science & technology, etc.
2	Have all management personnel with executive responsibility for the environmental management system been directly and actively involved in the management review process? (Clause 4.6) Review the records to identify the participants in management reviews and state the evidence.
3	Do all management personnel understand the purpose and value of the management review? (Measure of Effectiveness for Clause 4.6) Interview management personnel to assess their understanding of and commitment to the scope, purpose, and desired results of management reviews.
4	Do all department heads involved in the management review have sufficient records, data, and other information to conduct the review effectively? (Clause 4.6) Interview personnel to verify that results of audits, appropriate performance indicator data, customer and other external complaints/concerns, and corrective action data are available and considered in management reviews.
5	Do records exist for the management reviews clearly stating who was involved, what factors were considered, what conclusions were reached, and what actions were taken? (Clause 4.6) Review records of the latest review to assess these criteria.

4.6 Management Review (continuing)	
6	Are the management reviews conducted at appropriately defined intervals? (Clause 4.6) Assess the appropriateness of the defined intervals considering: 1. The extent to which the EMS is developed and implemented, 2. The significance of potential or actual environmental aspects and impacts.
7	Does the management review address the possible need for changes to policy, objectives, and other elements of the EMS in light of EMS audit results, changing circumstances, and a commitment to continual improvement? (Clause 4.6) Review the records from the last management review, looking for these issues on the review agenda and the initiation, completion, and follow-up of appropriate corrective action.
8	Do the management reviews include an investigation into the extent to which environmental objectives and targets have been met? (Clause 4.6) Review the records from the last management review, looking for these issues on the review agenda and the initiation, completion, and follow-up of appropriate corrective action.
9	Do the management reviews include an investigation into concerns communicated by the faculty's staff and public constituents? (Clause 4.6) Review the records from the last management review, looking for these issues on the review agenda and the initiation, completion, and follow-up of appropriate corrective action.
10	Are necessary corrective actions generated and implemented as a result of the Management Review? (Clause 4.6) Interview key management personnel and review the records of the Management Review and resulting corrective actions.

APPENDIX C. MANAGEMENT REVIEW REPORT MAIN FORMAT

The following report summarises the results of a Management Review of the Department. The review was conducted over the time period from _____ to _____.

Specifically, this review was conducted on the performance of İ.T.Ü Maritime Faculty's Integrated Management System (IMS) to address the following four-fold purpose:

1. To assess the effectiveness of the Integrated Management System (IMS) in satisfying the requirements of the International Standard (ISO 9002 - 1994 and ISO 14001-1996), complying with relevant environmental legislation and regulations, and achieving the faculty's quality and environmental policies, objectives, and targets as stated in the IMS Manual.

2. To evaluate compliance to any legal or other environmental requirements.

3. To assess likely future requirements to ensure that the IMS will remain suitable and effective.

4. To review the status of departmental documentation, results from internal audits, status and results from corrective and preventive actions, data on customers' complaints, reported service defects, environmental assessments, and any additional quality - and/or environment-related information.

This report was prepared by _____ and is respectfully submitted to the Management Representative at İ.T.Ü Maritime Faculty on _____.

MANAGEMENT REVIEW PROCESS

The overall review was conducted as a departmental team effort involving the following people in the review activities shown in Table C.1.

Table C.1 Integrated review activity - element chart

IMS REVIEW ACTIVITY/ELEMENT						
PERSONNEL (NAME) (TITLE)	AUDIT RESULTS	CORRECTIVE & PREVENTIVE ACTIONS	WORK INST.	NCMR	ENVIRON-MENT	ONE YEAR ACTION PLAN

"X" indicates that the person had an active role in conducting the departmental review of the listed IMS activity and/or element. The team effort included the following percentage breakdown of the process activities shown below:*

_____ Team meetings/discussion based on opinions.

_____ Individual analysis of data and quality and environmental reports.

_____ Team meetings/discussion based on analysis of data and quality and environmental reports.

_____ other

* Total must equal 100%

MANAGEMENT REVIEW RESULTS

Management System Audits

I. This management review report addresses the results of the following management system audits:

Internal Audits:	External Audits:
Date of Audit __/__/__	Date of Audit __/__/

II. The audits identified a total of ___ serious and ___ minor nonconformances for the department. (The specifics of these nonconformances are discussed in the next section of this report.) Based on the audit results, the following conclusions can be stated regarding the status and effectiveness of the IMS in the department:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Corrective/Preventive Actions

III. During the time period covered by this management review, the status of Corrective Action Requests (CARs) and Preventive Action Requests (PARs) changed as follows:

New CARs/PARs generated by:

_____ internal audits

_____ external audits

_____ environmental issues

_____ other

Number of CARs/PARs completed:

_____ on or before scheduled completion date

_____after scheduled completion date

Number of CARs/PARs outstanding:

_____ on schedule for completion

_____ anticipated to be completed late

_____ currently past scheduled completion date

IV. As a result of the department's successfully completed CARs/PARs, the following specific benefits have been achieved:

_____

_____

_____

_____

_____

5. Overall, the success of the department in efficiently using the PLAN-DO-CHECK-ACT (PDCA) approach to address CARs can be summarized by the following conclusions:

_____

_____

_____

V. Based on the department's current levels of success with and status of corrective action activities, the following one year plan of action and recommendations are given:

_____

_____

_____

_____

Work Instructions

VI. Based upon a thorough review of the status of the work instructions in the department, the review team came to the following consensus ratings for the factors listed below:

_____ Work instructions used in "service" are complete and accurate.

_____ Work instructions used in "service" are readable, clear, legible, and understandable.

_____ Work instructions used in "service" are reviewed and approved.

_____ Existing work instructions are available to all personnel who perform the work.

_____ Obsolete work instructions are not present in the area or available to personnel.

_____ Personnel who develop work instructions have the knowledge and skills necessary.

_____ Criteria are defined to determine when work instructions are necessary.

_____ Meetings are regularly scheduled to assess the status and effectiveness of work instructions.

_____ Work instructions are currently available in cases where their absence would adversely affect quality and/or the environment.

Table C.2 Work instructions scoring system

SCORING SYSTEM	
SCORE	**DESCRIPTION**
5	Fully Meeting Requirements (Good - Very Good)
4	Close to Meeting Requirements (Fair - Good)
3	Marginally Meeting Requirements (Poor - Fair)
2	Not Meeting Requirements (Failure - Poor)
1	Requirements have not yet been considered

VII. Based on the overall assessment of work instruction development and use/adherence in the department, the following conclusions can be stated with confidence:

_____

_____

_____

_____

VIII. To improve the department's success in work instruction development and use/adherence, the following one year plan of action and recommendations are given:

_____

_____

_____

_____

_____

ADDITIONAL COMMENTS:

In summary, the management review shows that the effectiveness of the IMS in the

_____department is:

_____

_____

_____

_____

_____

In summary, based upon likely future requirements, the following must be addressed in order to ensure that the IMS will remain suitable and effective.

_____

_____

_____

_____

_____

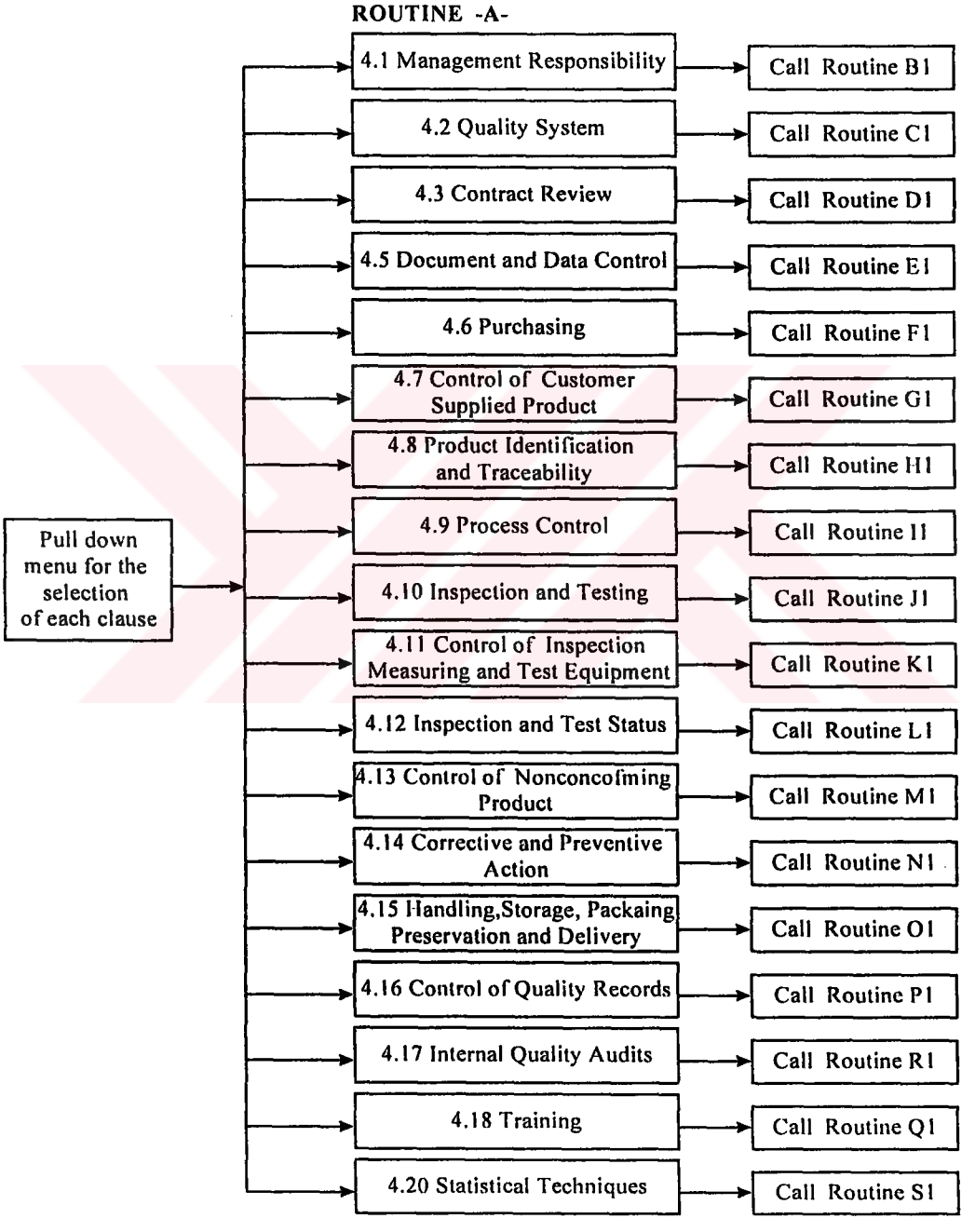
In summary, the management review shows that the following education and training is required in the _____ department:

To complete the goals defined in one year plan throughout this report, it is important for the Management Representative to be aware of the following additional factors:

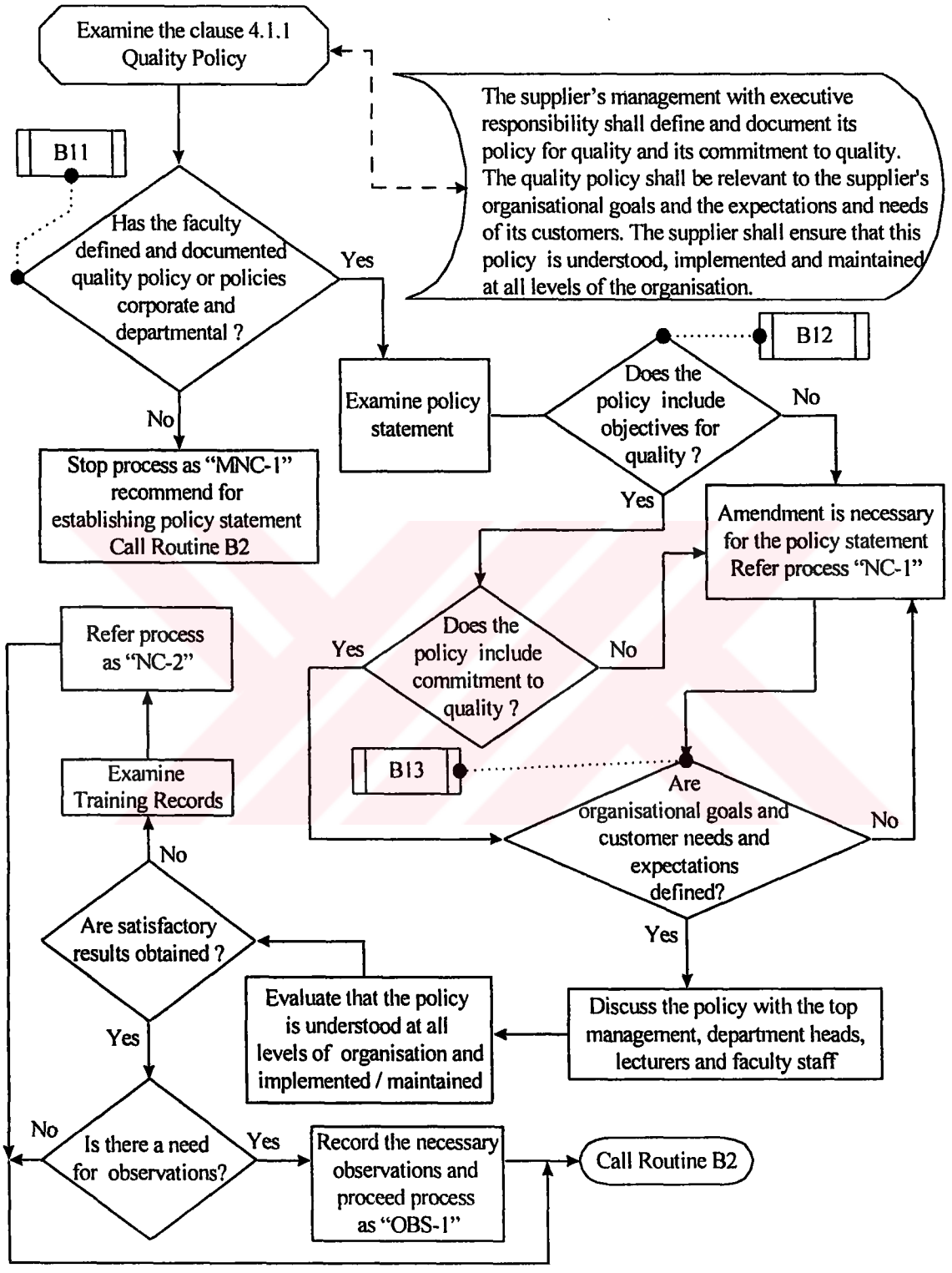
As executive manager of the IMS in my department, I look forward to:

Signature **Date**

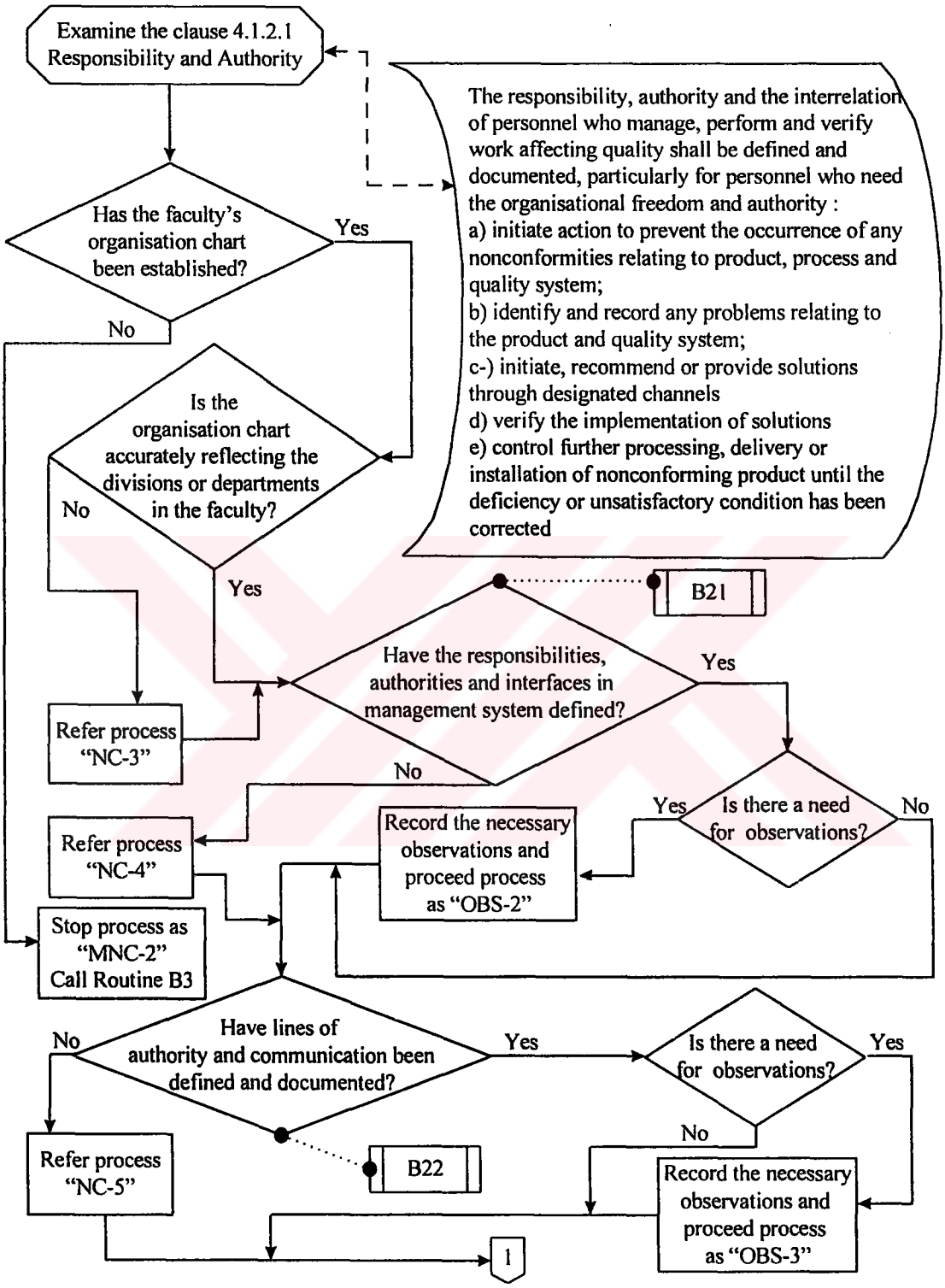
APPENDIX D. QMS INTEGRATION PLAN



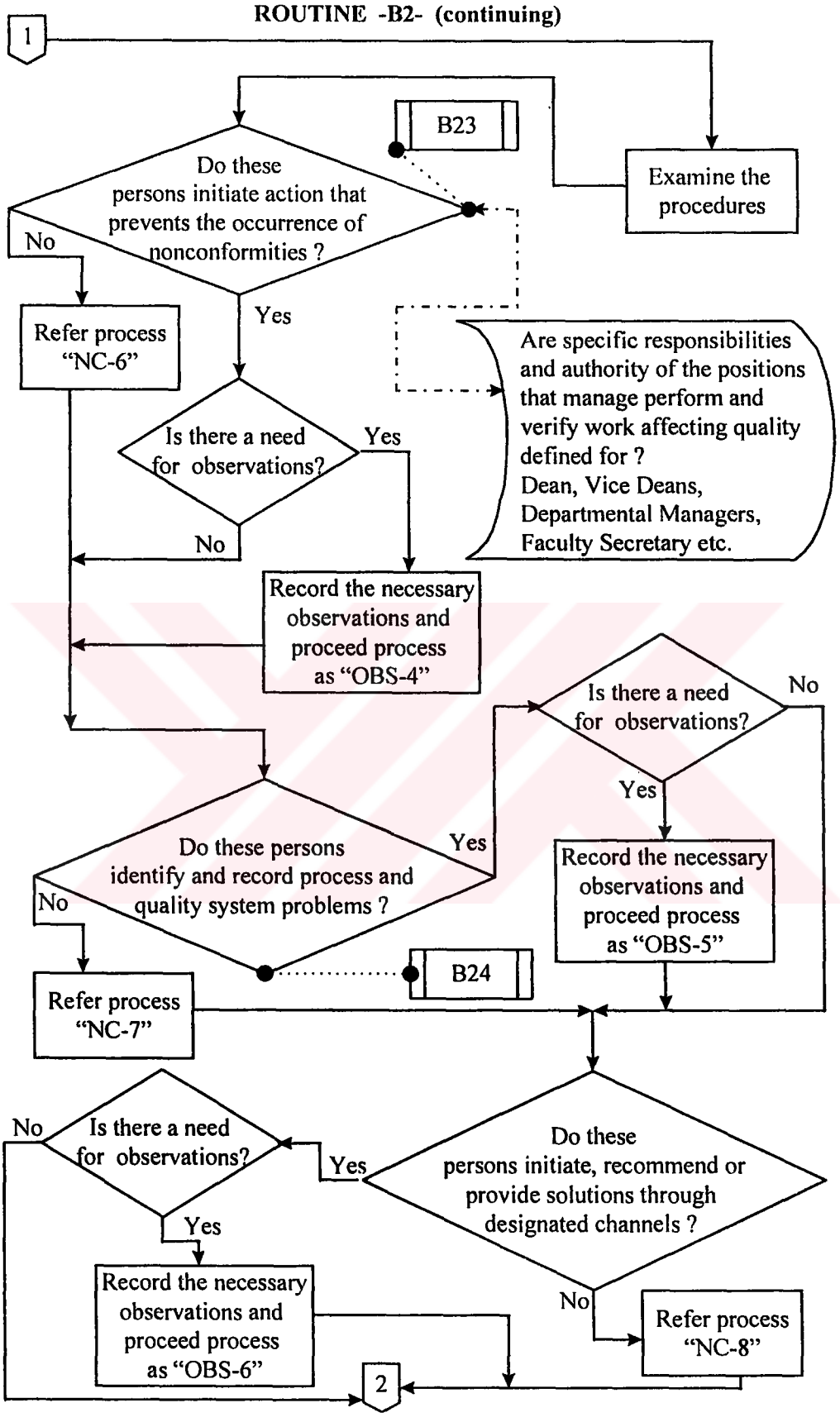
ROUTINE -B1-

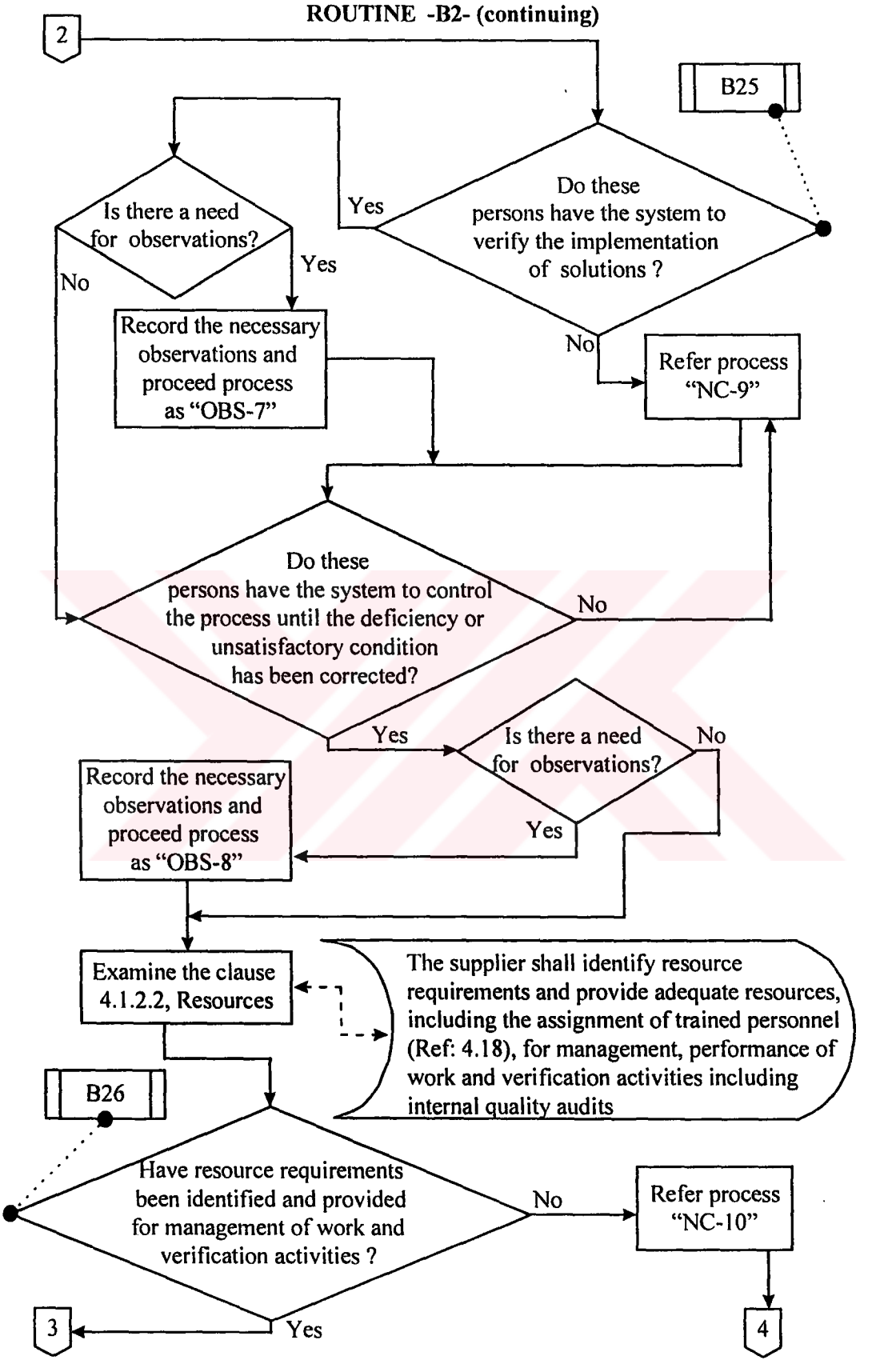

Examine the clause 4.1.1 Quality Policy
The supplier's management with executive responsibility shall define and document its policy for quality and its commitment to quality. The quality policy shall be relevant to the supplier's organisational goals and the expectations and needs of its customers. The supplier shall ensure that this policy is understood, implemented and maintained at all levels of the organisation.
B11
Has the faculty defined and documented quality policy or policies corporate and departmental ?
Yes
No
Stop process as "MNC-1" recommend for establishing policy statement Call Routine B2
Examine policy statement
B12
Does the policy include objectives for quality ?
No
Yes
Amendment is necessary for the policy statement Refer process "NC-1"
Does the policy include commitment to quality ?
Yes
No
Refer process as "NC-2"
B13
Are organisational goals and customer needs and expectations defined?
No
Yes
Examine Training Records
No
Are satisfactory results obtained ?
Yes
Evaluate that the policy is understood at all levels of organisation and implemented / maintained
Discuss the policy with the top management, department heads, lecturers and faculty staff
No
Is there a need for observations?
Yes
Record the necessary observations and proceed process as "OBS-1"
Call Routine B2

ROUTINE -B2-

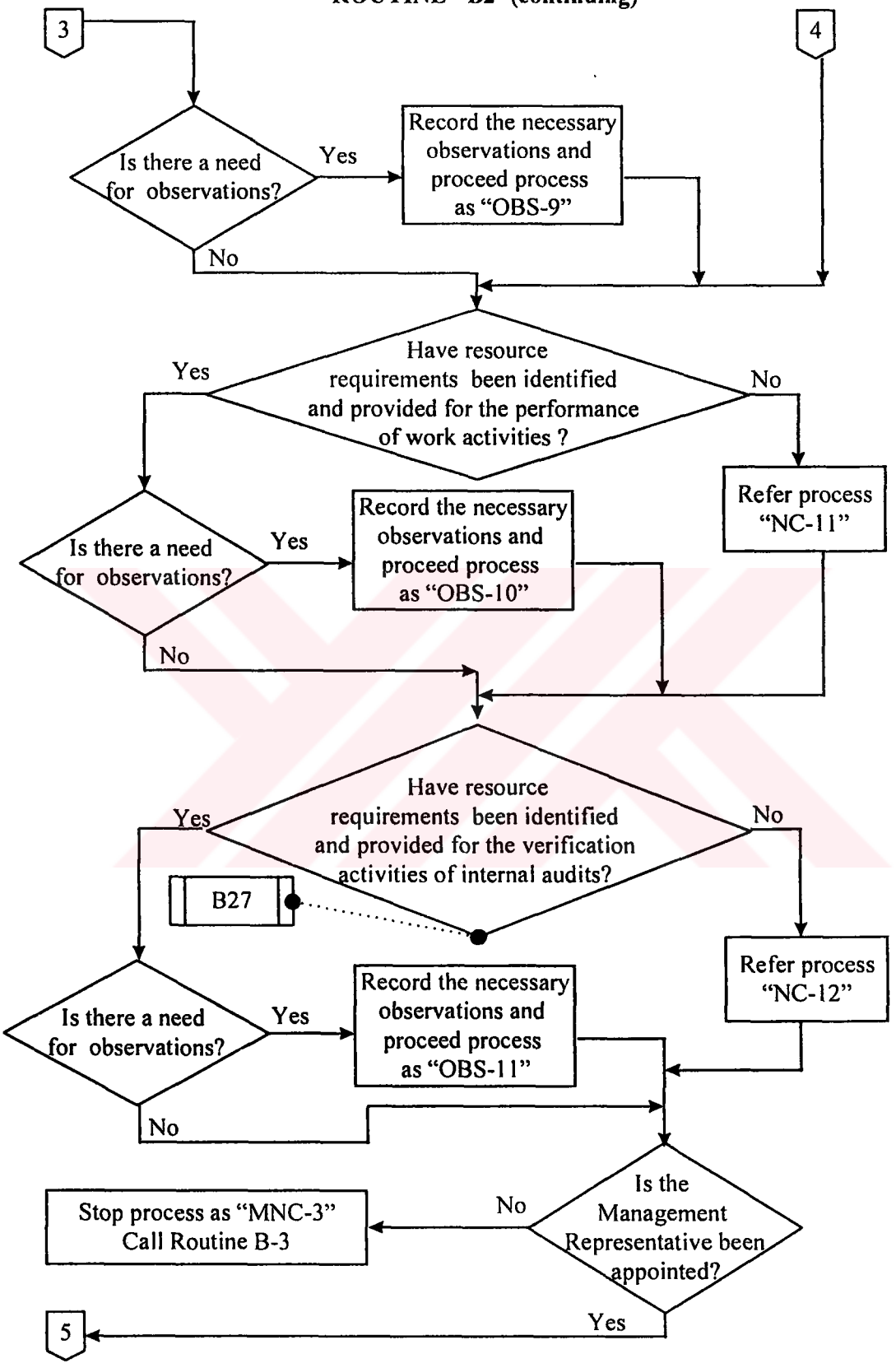

Examine the clause 4.1.2.1 Responsibility and Authority
The responsibility, authority and the interrelation of personnel who manage, perform and verify work affecting quality shall be defined and documented, particularly for personnel who need the organisational freedom and authority :
a) initiate action to prevent the occurrence of any nonconformities relating to product, process and quality system;
b) identify and record any problems relating to the product and quality system;
c-) initiate, recommend or provide solutions through designated channels
d) verify the implementation of solutions
e) control further processing, delivery or installation of nonconforming product until the deficiency or unsatisfactory condition has been corrected
Has the faculty's organisation chart been established?
Yes
No
Is the organisation chart accurately reflecting the divisions or departments in the faculty?
No
Yes
B21
Have the responsibilities, authorities and interfaces in management system defined?
Yes
No
Refer process "NC-3"
Refer process "NC-4"
Is there a need for observations?
Yes
No
Record the necessary observations and proceed process as "OBS-2"
Stop process as "MNC-2" Call Routine B3
Have lines of authority and communication been defined and documented?
No
Yes
Is there a need for observations?
Yes
No
Refer process "NC-5"
B22
Record the necessary observations and proceed process as "OBS-3"
1

ROUTINE -B2- (continuing)

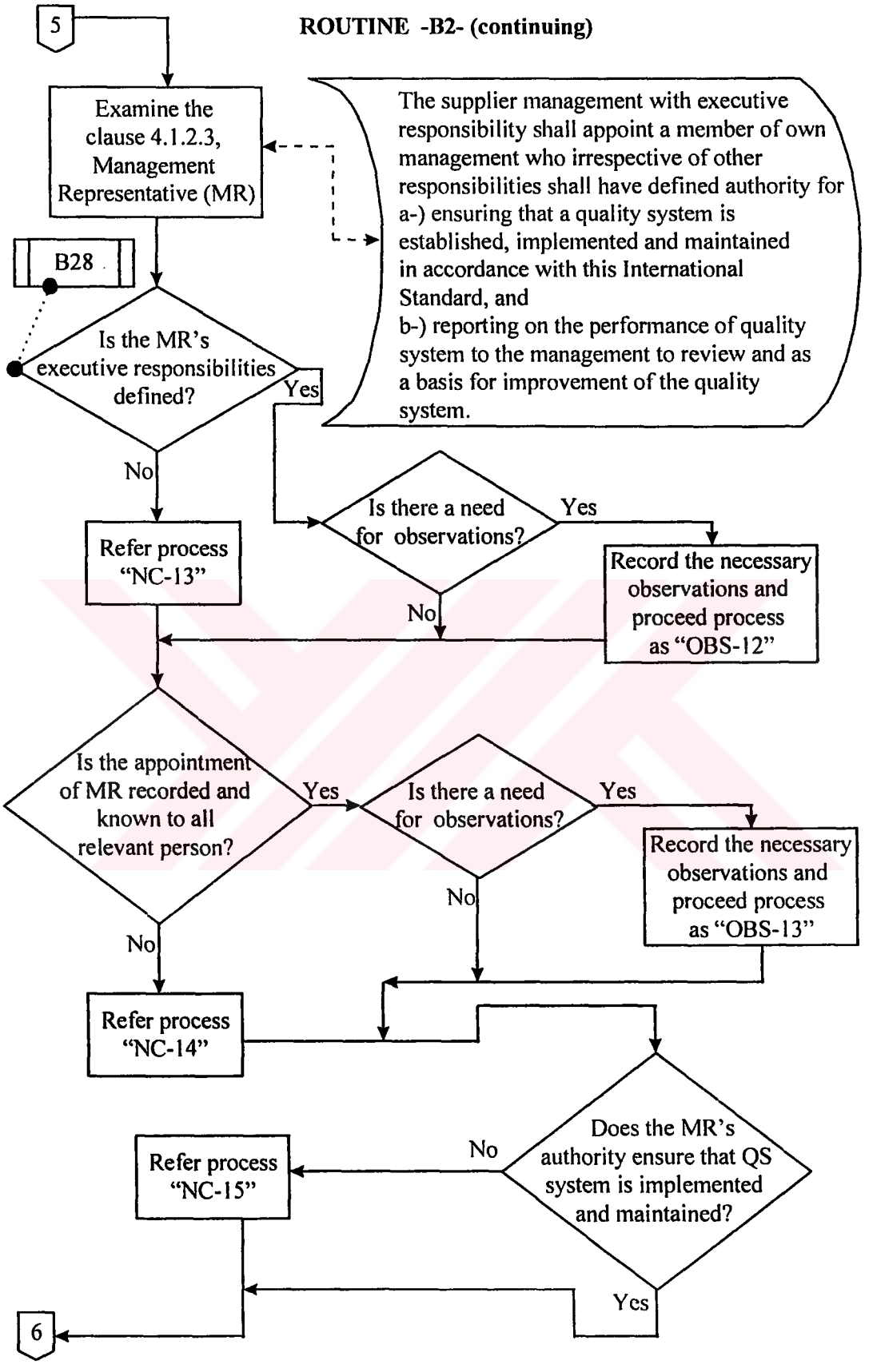



ROUTINE -B2- (continuing)
2
B25
Is there a need for observations?
Yes
No
Do these persons have the system to verify the implementation of solutions ?
Yes
No
Record the necessary observations and proceed process as "OBS-7"
Refer process "NC-9"
Do these persons have the system to control the process until the deficiency or unsatisfactory condition has been corrected?
No
Yes
Is there a need for observations?
No
Yes
Record the necessary observations and proceed process as "OBS-8"
Examine the clause 4.1.2.2, Resources
The supplier shall identify resource requirements and provide adequate resources, including the assignment of trained personnel (Ref: 4.18), for management, performance of work and verification activities including internal quality audits
B26
Have resource requirements been identified and provided for management of work and verification activities ?
No
Refer process "NC-10"
3
Yes
4

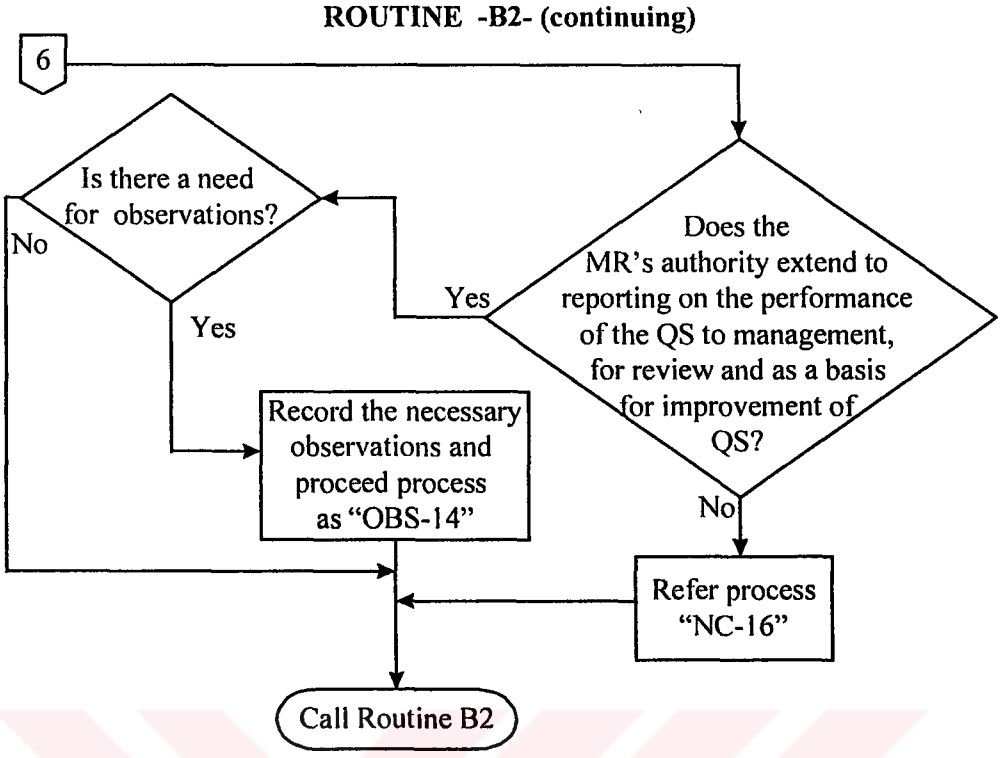
ROUTINE -B2- (continuing)



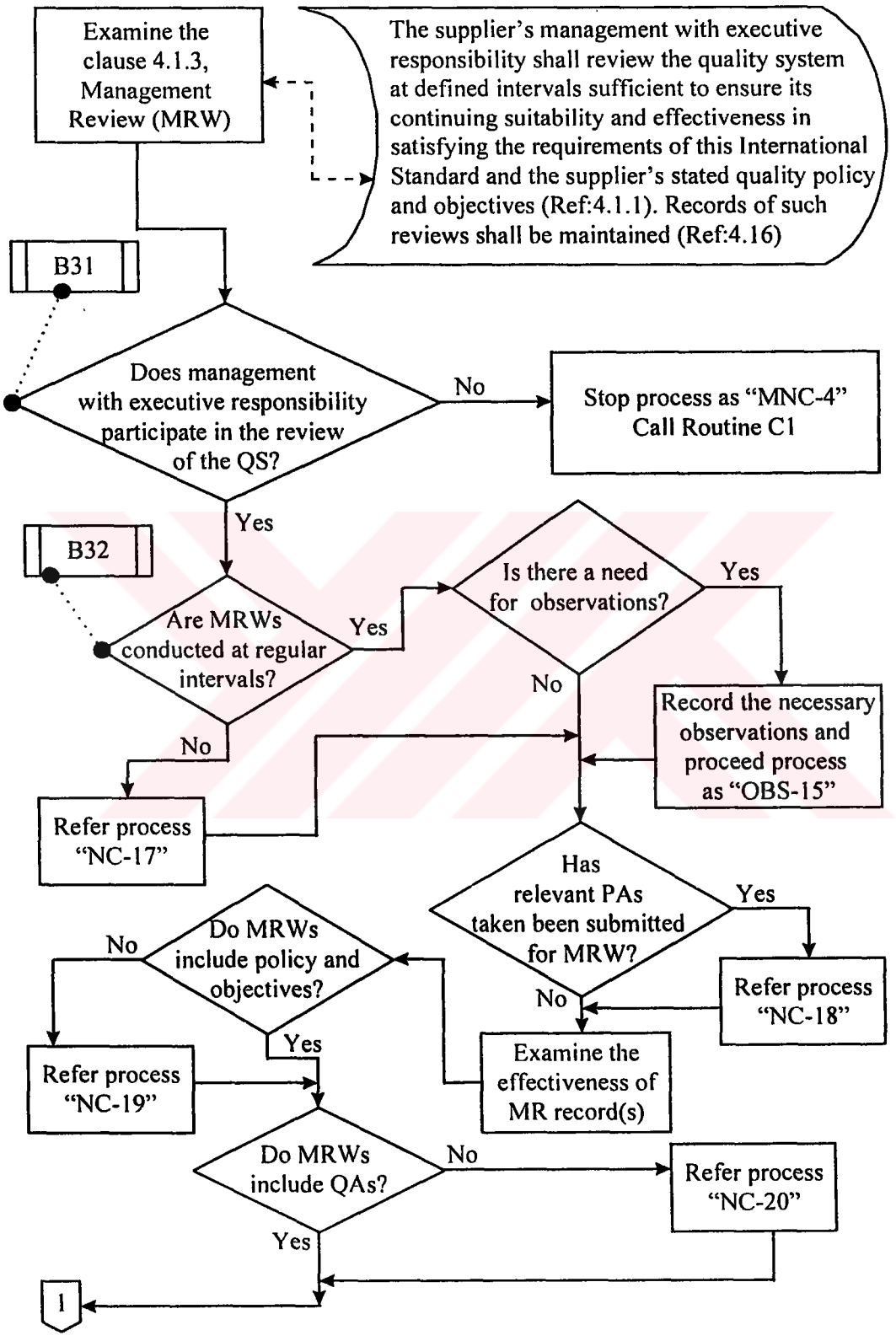
ROUTINE -B2- (continuing)



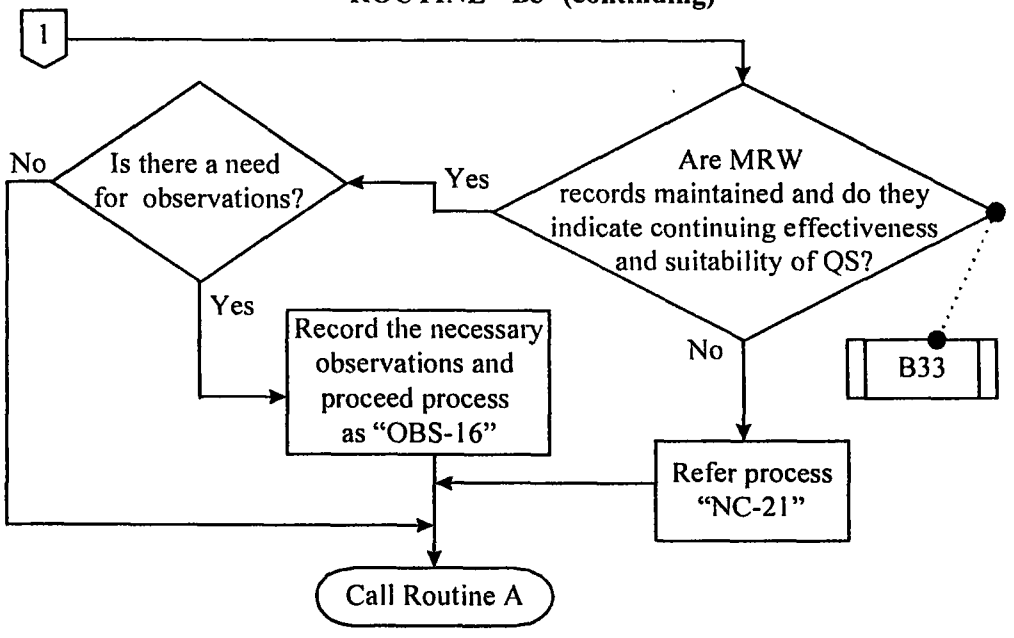
ROUTINE -B2- (continuing)



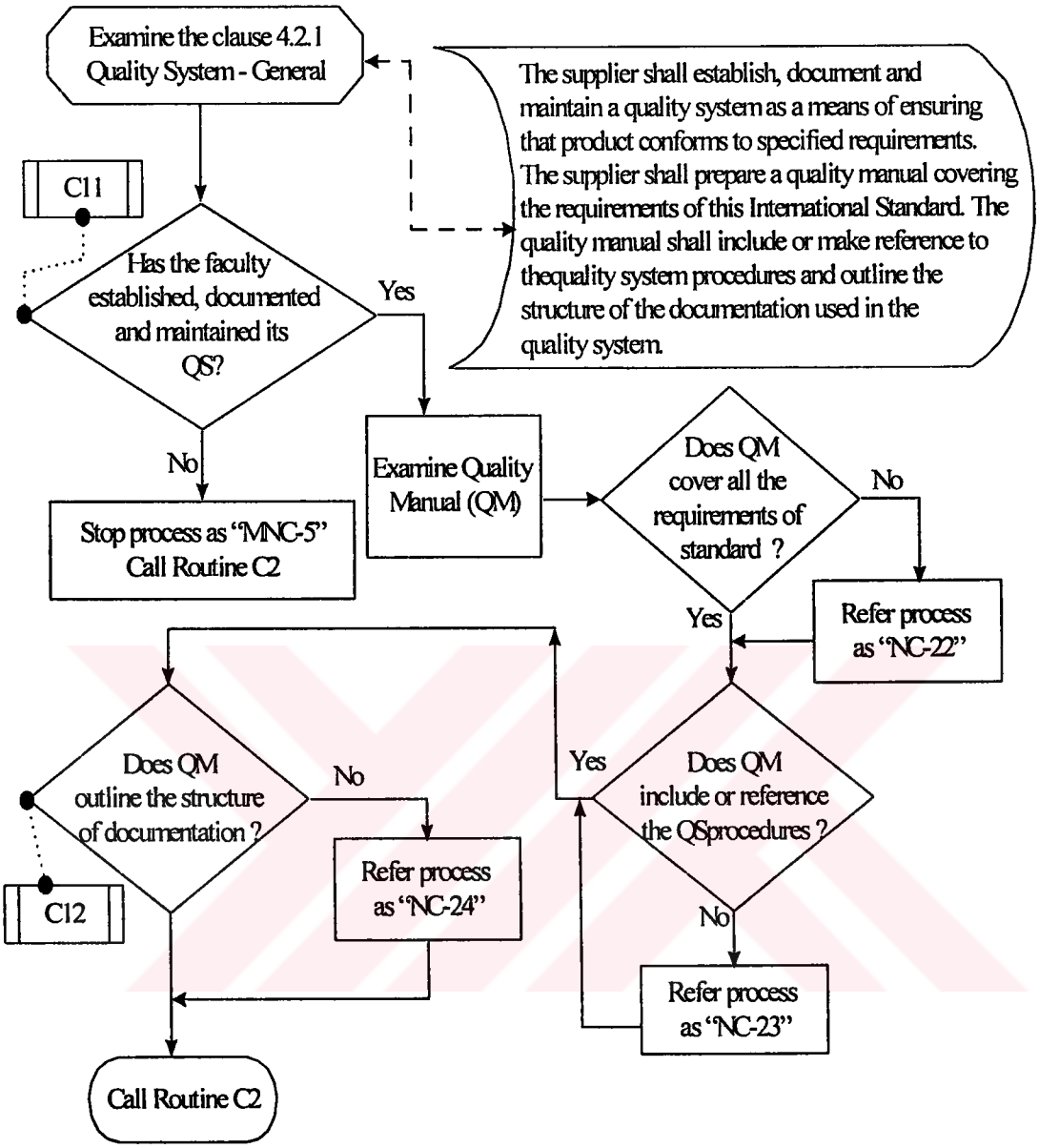
ROUTINE -B3-


Examine the clause 4.1.3, Management Review (MRW)
The supplier's management with executive responsibility shall review the quality system at defined intervals sufficient to ensure its continuing suitability and effectiveness in satisfying the requirements of this International Standard and the supplier's stated quality policy and objectives (Ref:4.1.1). Records of such reviews shall be maintained (Ref:4.16)
B31
Does management with executive responsibility participate in the review of the QS?
No
Stop process as "MNC-4" Call Routine C1
Yes
B32
Are MRWs conducted at regular intervals?
Yes
Is there a need for observations?
Yes
No
Record the necessary observations and proceed process as "OBS-15"
No
Refer process "NC-17"
Has relevant PAs taken been submitted for MRW?
Yes
No
Refer process "NC-18"
Do MRWs include policy and objectives?
No
Yes
Refer process "NC-19"
Examine the effectiveness of MR record(s)
Do MRWs include QAs?
No
Refer process "NC-20"
Yes
1

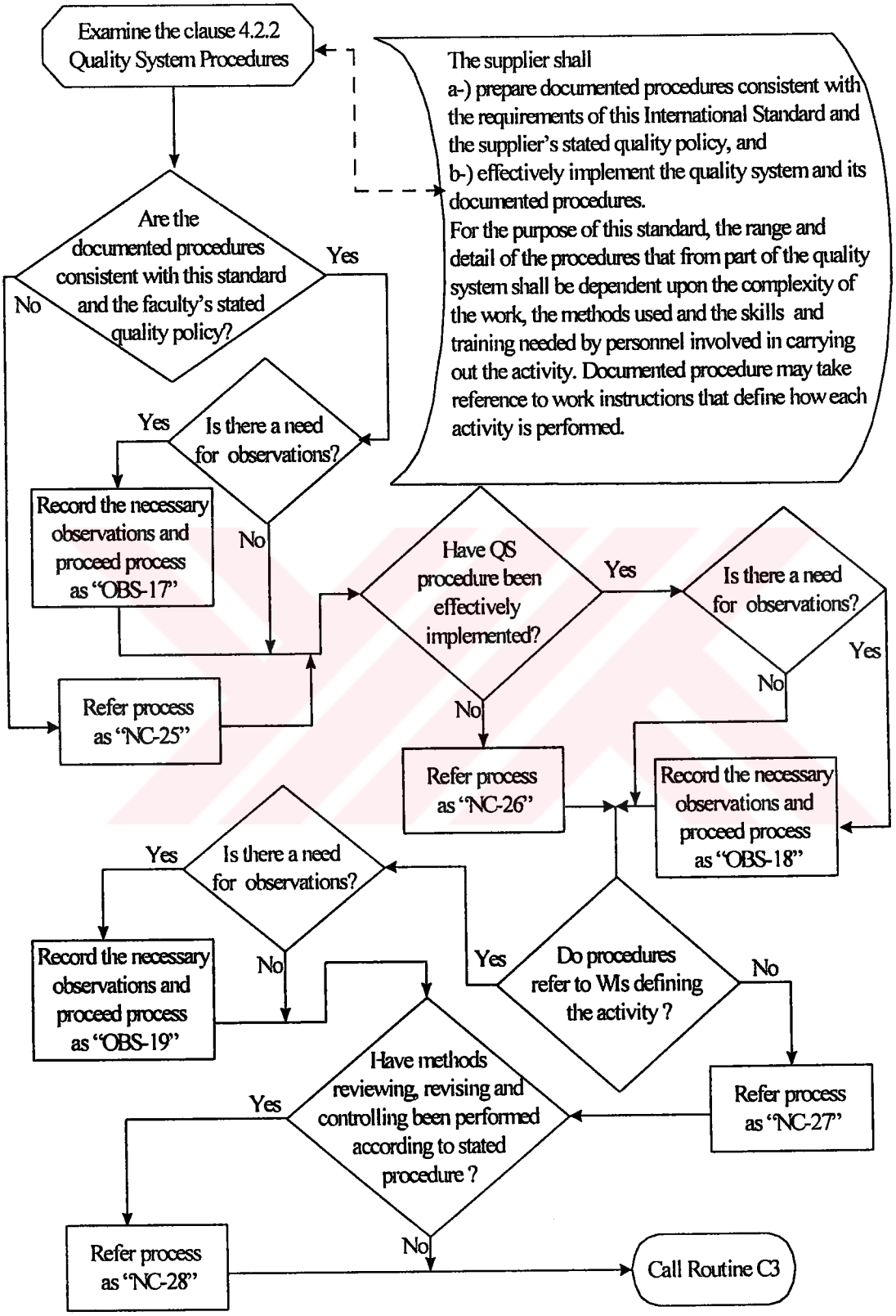
ROUTINE -B3- (continuing)



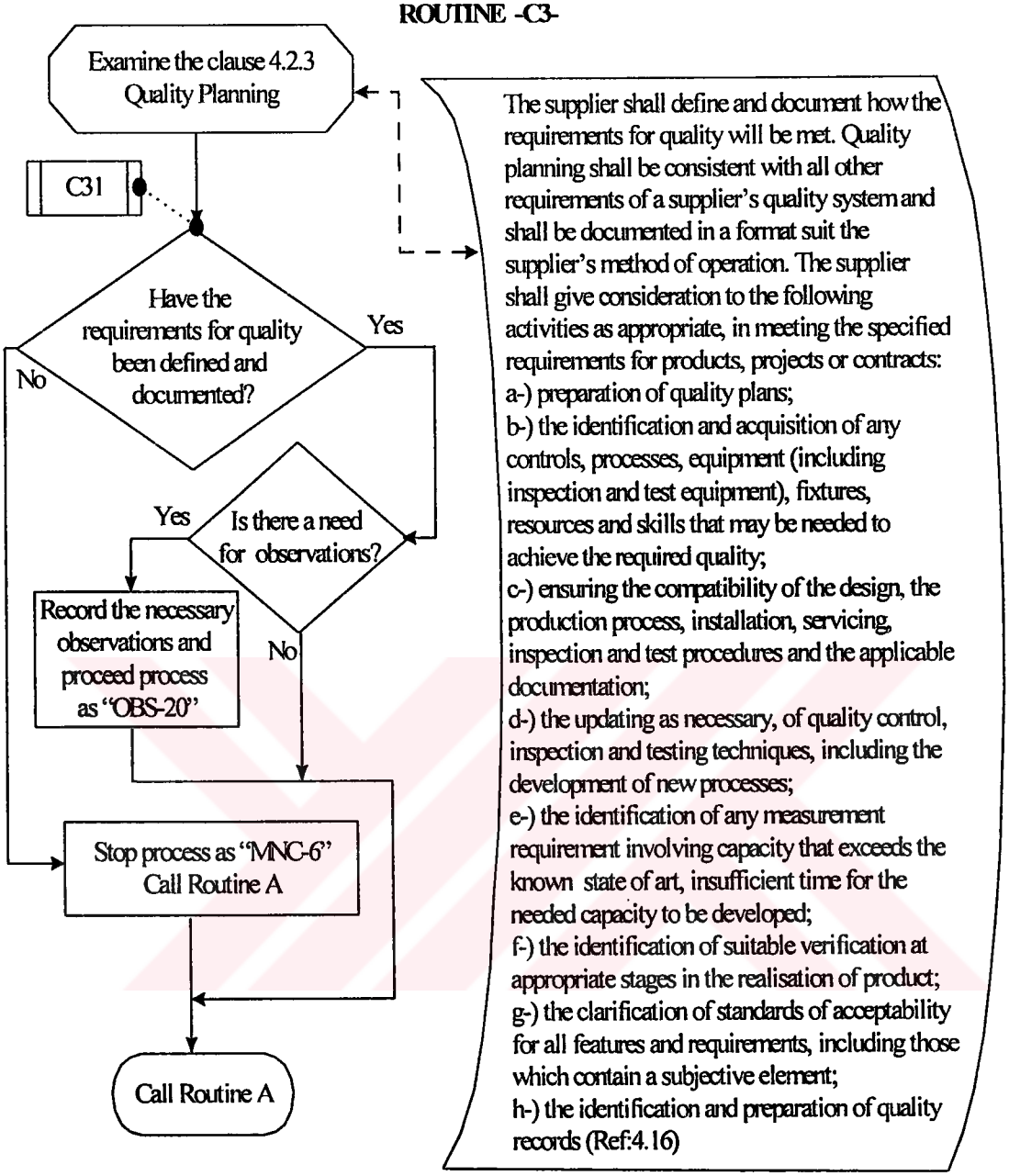
ROUTINE -C1-

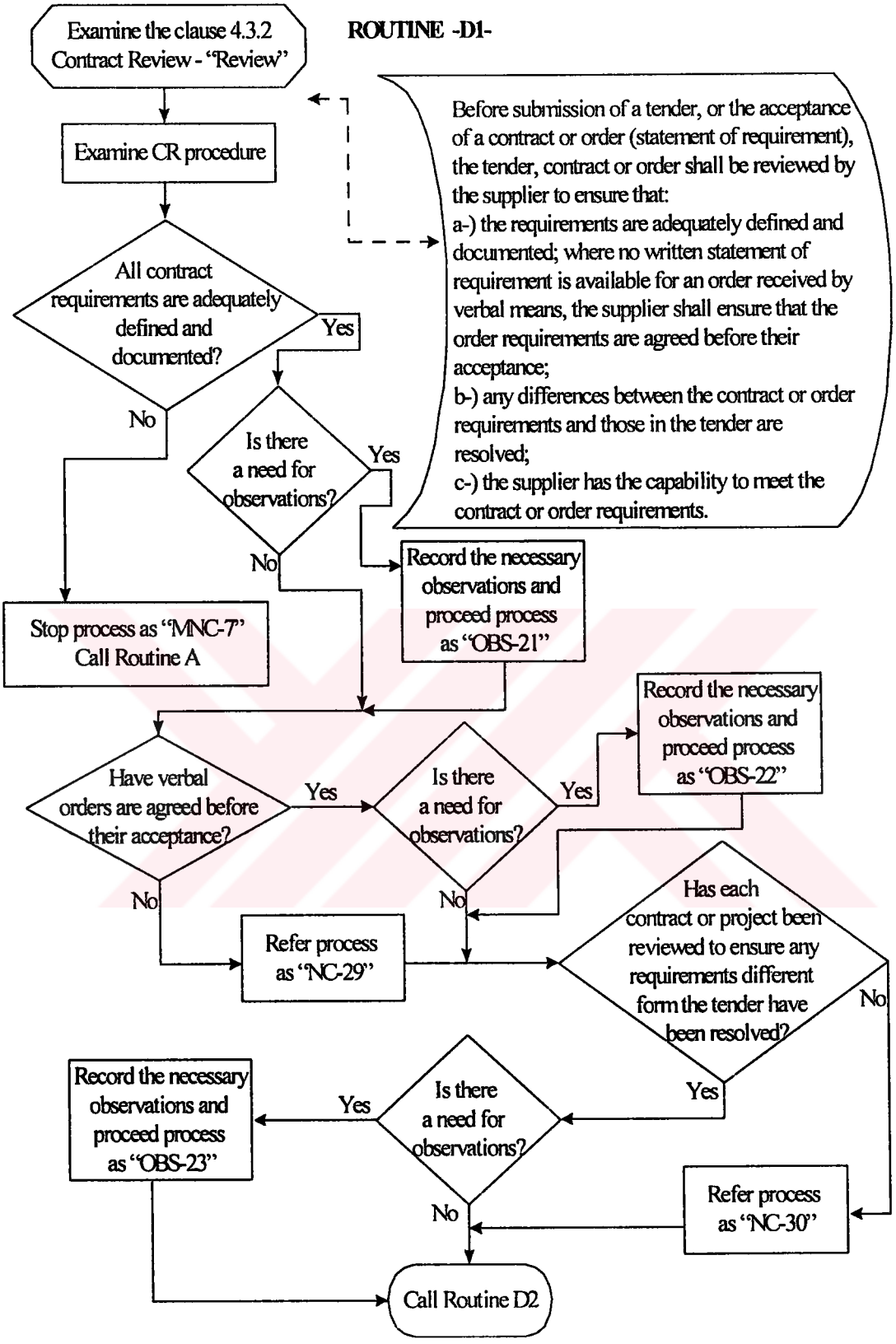

Examine the clause 4.2.1
Quality System - General
The supplier shall establish, document and maintain a quality system as a means of ensuring that product conforms to specified requirements. The supplier shall prepare a quality manual covering the requirements of this International Standard. The quality manual shall include or make reference to thequality system procedures and outline the structure of the documentation used in the quality system.
C11
Has the faculty established, documented and maintained its QS?
Yes
No
Stop process as "MNC-5" Call Routine C2
Examine Quality Manual (QM)
Does QM cover all the requirements of standard ?
No
Refer process as "NC-22"
Yes
Does QM outline the structure of documentation ?
No
Refer process as "NC-24"
C12
Yes
Does QM include or reference the QSprocedures ?
No
Refer process as "NC-23"
Call Routine C2

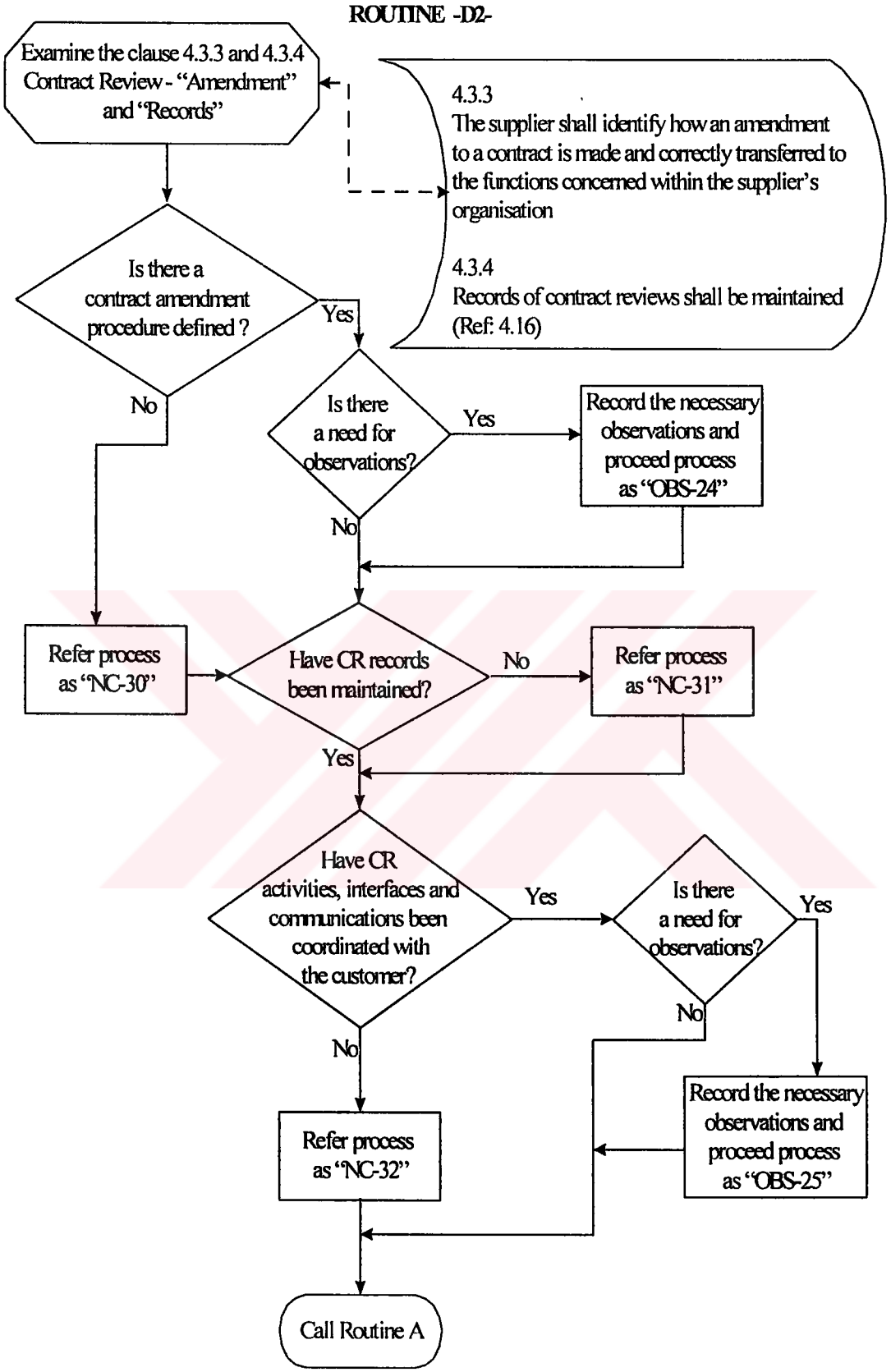
ROUTINE -C2-


Examine the clause 4.2.2 Quality System Procedures
The supplier shall
a-) prepare documented procedures consistent with the requirements of this International Standard and the supplier's stated quality policy, and
b-) effectively implement the quality system and its documented procedures.
For the purpose of this standard, the range and detail of the procedures that from part of the quality system shall be dependent upon the complexity of the work, the methods used and the skills and training needed by personnel involved in carrying out the activity. Documented procedure may take reference to work instructions that define how each activity is performed.
Are the documented procedures consistent with this standard and the faculty's stated quality policy?
Yes
No
Is there a need for observations?
Yes
No
Record the necessary observations and proceed process as "OBS-17"
Refer process as "NC-25"
Have QS procedure been effectively implemented?
Yes
No
Is there a need for observations?
Yes
No
Refer process as "NC-26"
Record the necessary observations and proceed process as "OBS-18"
Is there a need for observations?
Yes
No
Record the necessary observations and proceed process as "OBS-19"
Do procedures refer to WIs defining the activity ?
Yes
No
Refer process as "NC-27"
Have methods reviewing, revising and controlling been performed according to stated procedure ?
Yes
No
Refer process as "NC-28"
Call Routine C3

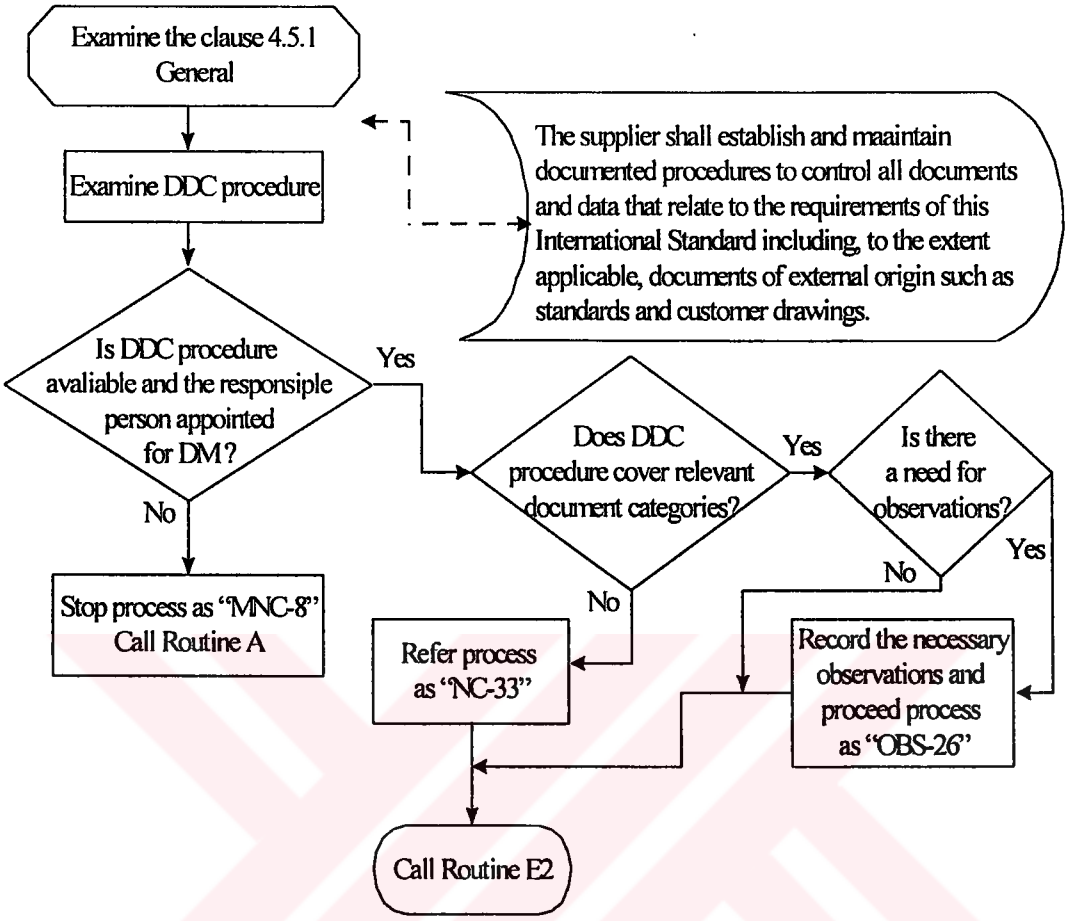
ROUTINE -C3-


Examine the clause 4.2.3
Quality Planning
C31
Have the requirements for quality been defined and documented?
Yes
No
Is there a need for observations?
Yes
No
Record the necessary observations and proceed process as "OBS-20"
Stop process as "MNC-6"
Call Routine A
Call Routine A
The supplier shall define and document how the requirements for quality will be met. Quality planning shall be consistent with all other requirements of a supplier's quality system and shall be documented in a format suit the supplier's method of operation. The supplier shall give consideration to the following activities as appropriate, in meeting the specified requirements for products, projects or contracts:
a-) preparation of quality plans;
b-) the identification and acquisition of any controls, processes, equipment (including inspection and test equipment), fixtures, resources and skills that may be needed to achieve the required quality;
c-) ensuring the compatibility of the design, the production process, installation, servicing, inspection and test procedures and the applicable documentation;
d-) the updating as necessary, of quality control, inspection and testing techniques, including the development of new processes;
e-) the identification of any measurement requirement involving capacity that exceeds the known state of art, insufficient time for the needed capacity to be developed;
f-) the identification of suitable verification at appropriate stages in the realisation of product;
g-) the clarification of standards of acceptability for all features and requirements, including those which contain a subjective element;
h-) the identification and preparation of quality records (Ref:4.16)

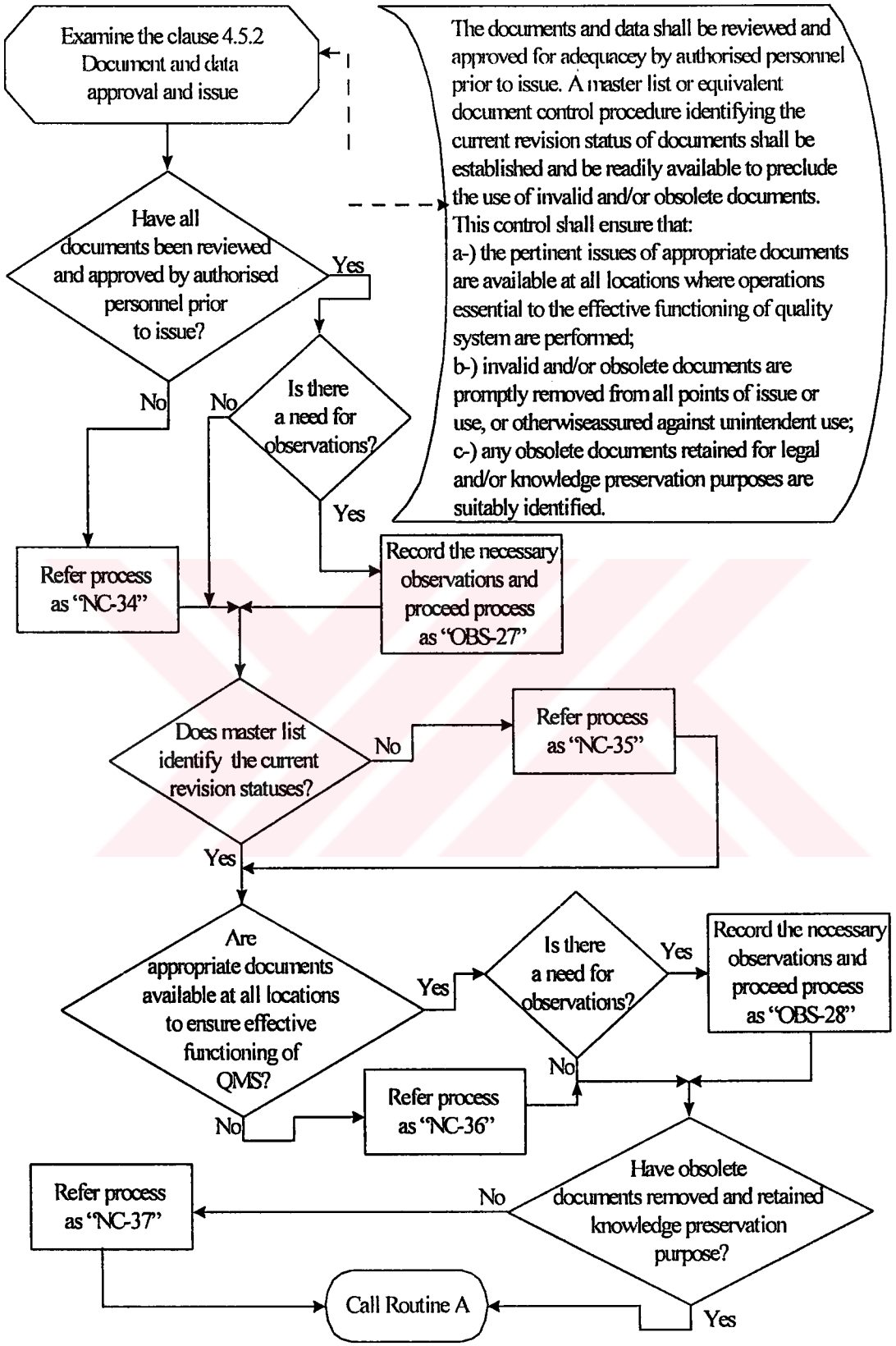

Examine the clause 4.3.2
Contract Review - "Review"
ROUTINE -D1-
Examine CR procedure
Before submission of a tender, or the acceptance of a contract or order (statement of requirement), the tender, contract or order shall be reviewed by the supplier to ensure that:
a-) the requirements are adequately defined and documented; where no written statement of requirement is available for an order received by verbal means, the supplier shall ensure that the order requirements are agreed before their acceptance;
b-) any differences between the contract or order requirements and those in the tender are resolved;
c-) the supplier has the capability to meet the contract or order requirements.
All contract requirements are adequately defined and documented?
Yes
No
Is there a need for observations?
Yes
No
Record the necessary observations and proceed process as "OBS-21"
Stop process as "MNC-7" Call Routine A
Have verbal orders are agreed before their acceptance?
Yes
No
Is there a need for observations?
Yes
No
Record the necessary observations and proceed process as "OBS-22"
Refer process as "NC-29"
Has each contract or project been reviewed to ensure any requirements different form the tender have been resolved?
Yes
No
Is there a need for observations?
Yes
No
Record the necessary observations and proceed process as "OBS-23"
Refer process as "NC-30"
Call Routine D2


ROUTINE -D2-
Examine the clause 4.3.3 and 4.3.4 Contract Review - "Amendment" and "Records"
4.3.3
The supplier shall identify how an amendment to a contract is made and correctly transferred to the functions concerned within the supplier's organisation
4.3.4
Records of contract reviews shall be maintained (Ref: 4.16)
Is there a contract amendment procedure defined ?
Yes
No
Is there a need for observations?
Yes
Record the necessary observations and proceed process as "OBS-24"
No
Refer process as "NC-30"
Have CR records been maintained?
No
Refer process as "NC-31"
Yes
Have CR activities, interfaces and communications been coordinated with the customer?
Yes
Is there a need for observations?
Yes
No
No
Record the necessary observations and proceed process as "OBS-25"
Refer process as "NC-32"
Call Routine A

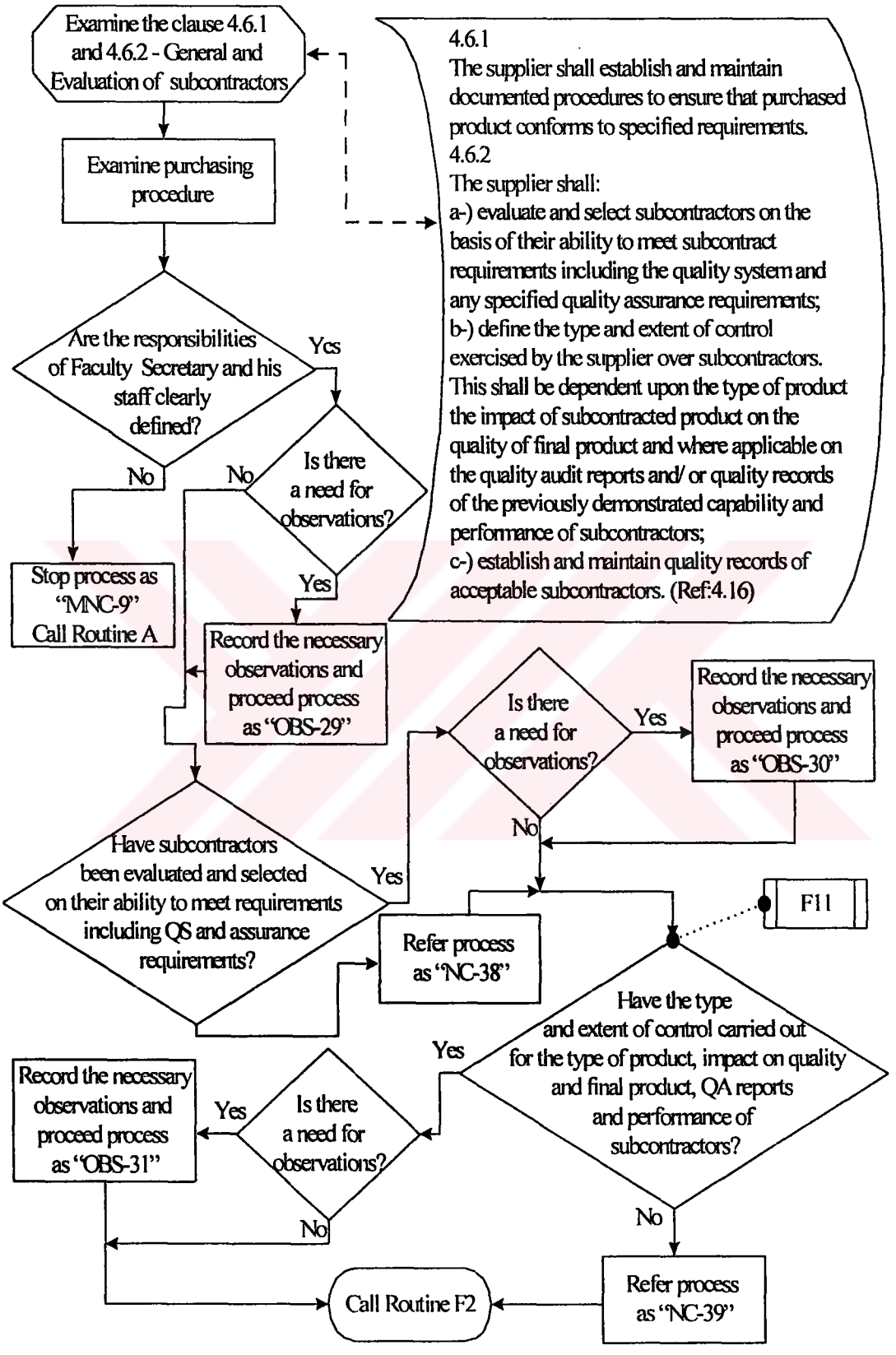
ROUTINE -E1-


Examine the clause 4.5.1 General
Examine DDC procedure
The supplier shall establish and maaintain documented procedures to control all documents and data that relate to the requirements of this International Standard including, to the extent applicable, documents of external origin such as standards and customer drawings.
Is DDC procedure avaliable and the responsiple person appointed for DM?
Yes
No
Stop process as "MNC-8" Call Routine A
Does DDC procedure cover relevant document categories?
Yes
No
Refer process as "NC-33"
Is there a need for observations?
Yes
No
Record the necessary observations and proceed process as "OBS-26"
Call Routine E2

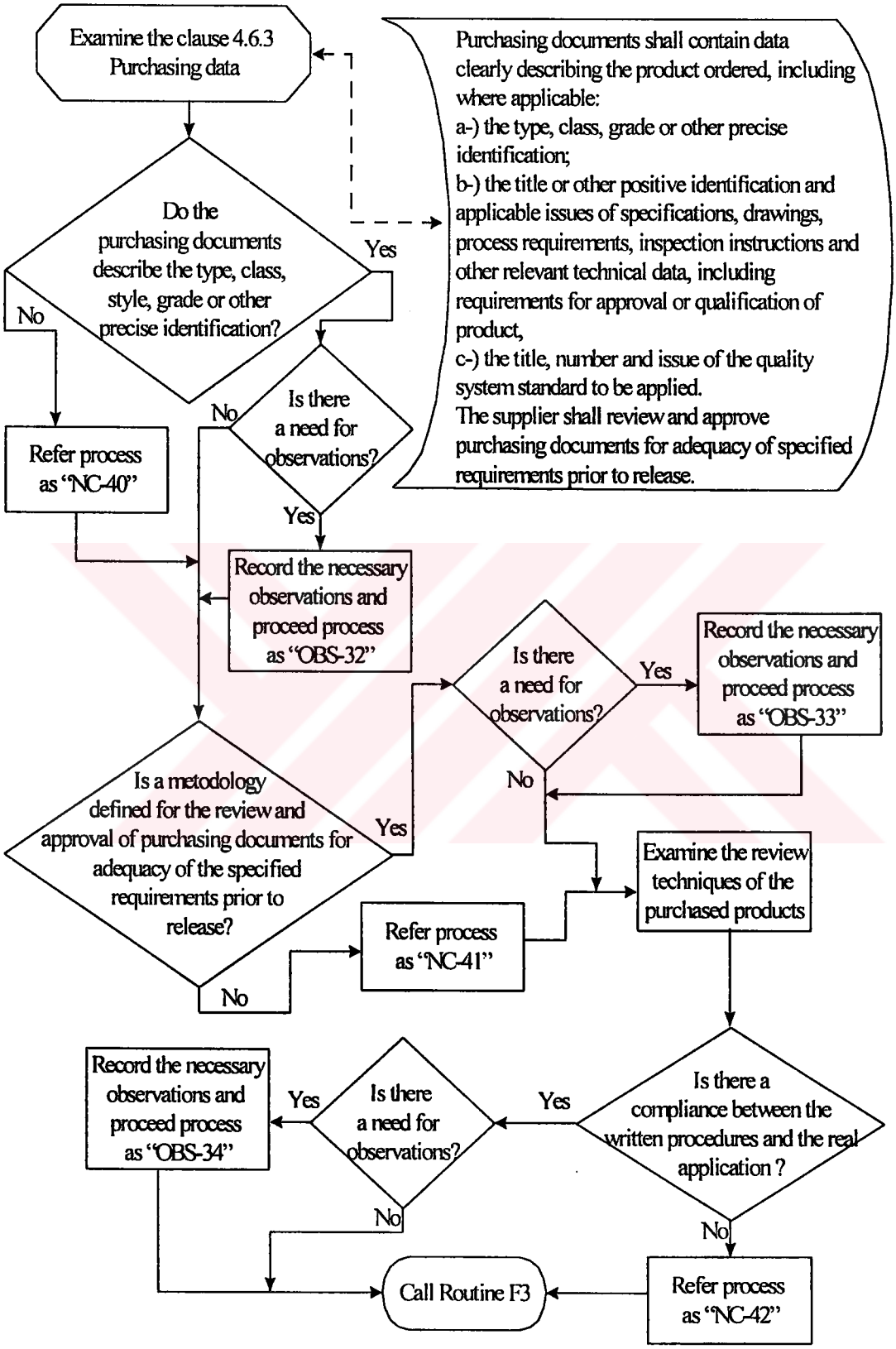
ROUTINE -E2-


Examine the clause 4.5.2 Document and data approval and issue
The documents and data shall be reviewed and approved for adequacey by authorised personnel prior to issue. A master list or equivalent document control procedure identifying the current revision status of documents shall be established and be readily available to preclude the use of invalid and/or obsolete documents. This control shall ensure that:
a-) the pertinent issues of appropriate documents are available at all locations where operations essential to the effective functioning of quality system are performed;
b-) invalid and/or obsolete documents are promptly removed from all points of issue or use, or otherwiseassured against unintendent use;
c-) any obsolete documents retained for legal and/or knowledge preservation purposes are suitably identified.
Have all documents been reviewed and approved by authorised personnel prior to issue?
Yes
No
Is there a need for observations?
No
Yes
Refer process as "NC-34"
Record the necessary observations and proceed process as "OBS-27"
Does master list identify the current revision statuses?
No
Refer process as "NC-35"
Yes
Are appropriate documents available at all locations to ensure effective functioning of QMS?
Yes
Is there a need for observations?
Yes
Record the necessary observations and proceed process as "OBS-28"
No
No
Refer process as "NC-36"
Refer process as "NC-37"
No
Have obsolete documents removed and retained knowledge preservation purpose?
Call Routine A
Yes

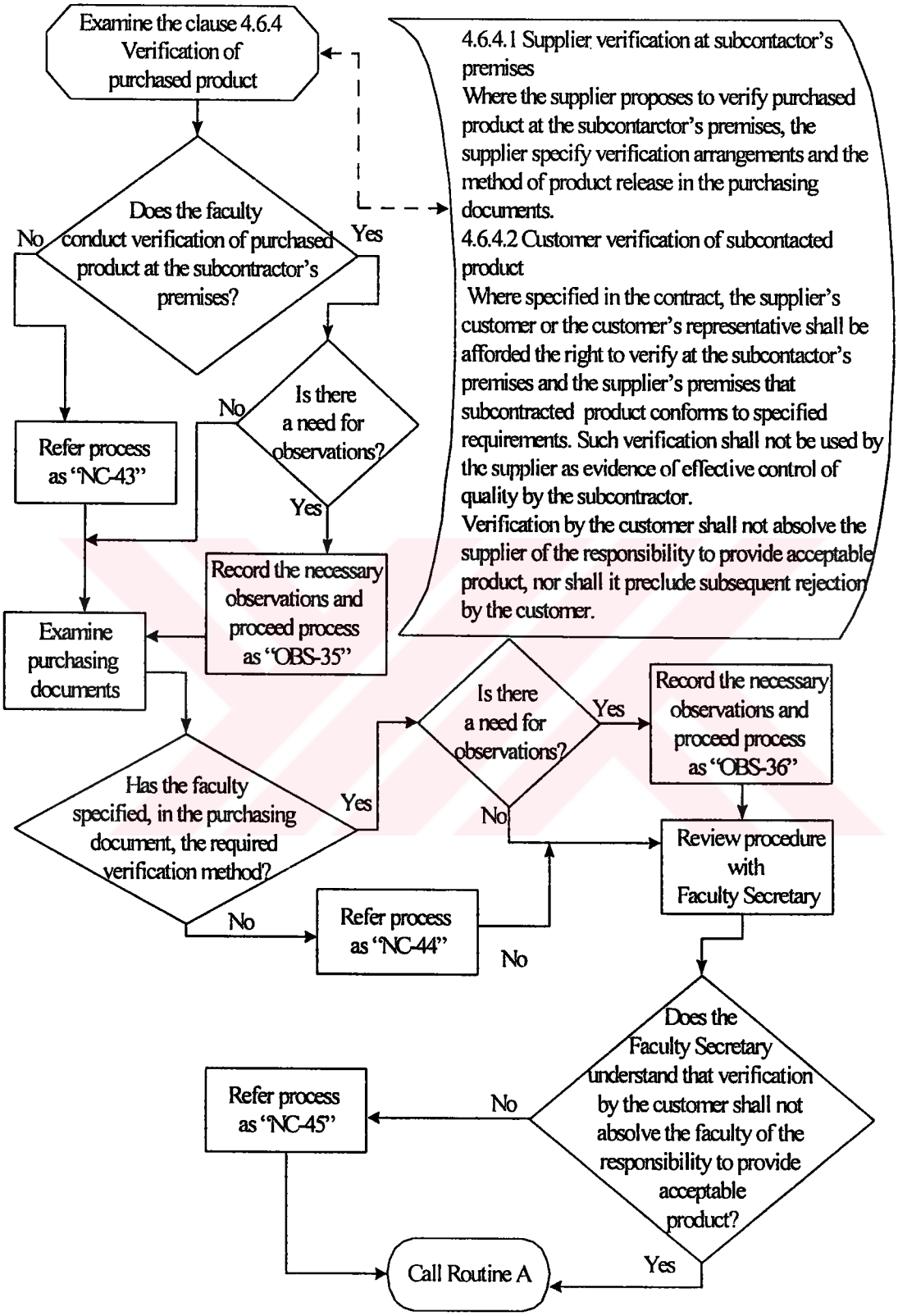
ROUTINE -F1-


Examine the clause 4.6.1 and 4.6.2 - General and Evaluation of subcontractors
4.6.1
The supplier shall establish and maintain documented procedures to ensure that purchased product conforms to specified requirements.
4.6.2
The supplier shall:
a-) evaluate and select subcontractors on the basis of their ability to meet subcontract requirements including the quality system and any specified quality assurance requirements;
b-) define the type and extent of control exercised by the supplier over subcontractors. This shall be dependent upon the type of product the impact of subcontracted product on the quality of final product and where applicable on the quality audit reports and/ or quality records of the previously demonstrated capability and performance of subcontractors;
c-) establish and maintain quality records of acceptable subcontractors. (Ref:4.16)
Examine purchasing procedure
Are the responsibilities of Faculty Secretary and his staff clearly defined?
Yes
No
Is there a need for observations?
No
Yes
Stop process as "MNC-9" Call Routine A
Record the necessary observations and proceed process as "OBS-29"
Is there a need for observations?
Yes
Record the necessary observations and proceed process as "OBS-30"
No
Have subcontractors been evaluated and selected on their ability to meet requirements including QS and assurance requirements?
Yes
Refer process as "NC-38"
F11
Have the type and extent of control carried out for the type of product, impact on quality and final product, QA reports and performance of subcontractors?
Yes
Record the necessary observations and proceed process as "OBS-31"
Yes
Is there a need for observations?
No
No
Refer process as "NC-39"
Call Routine F2

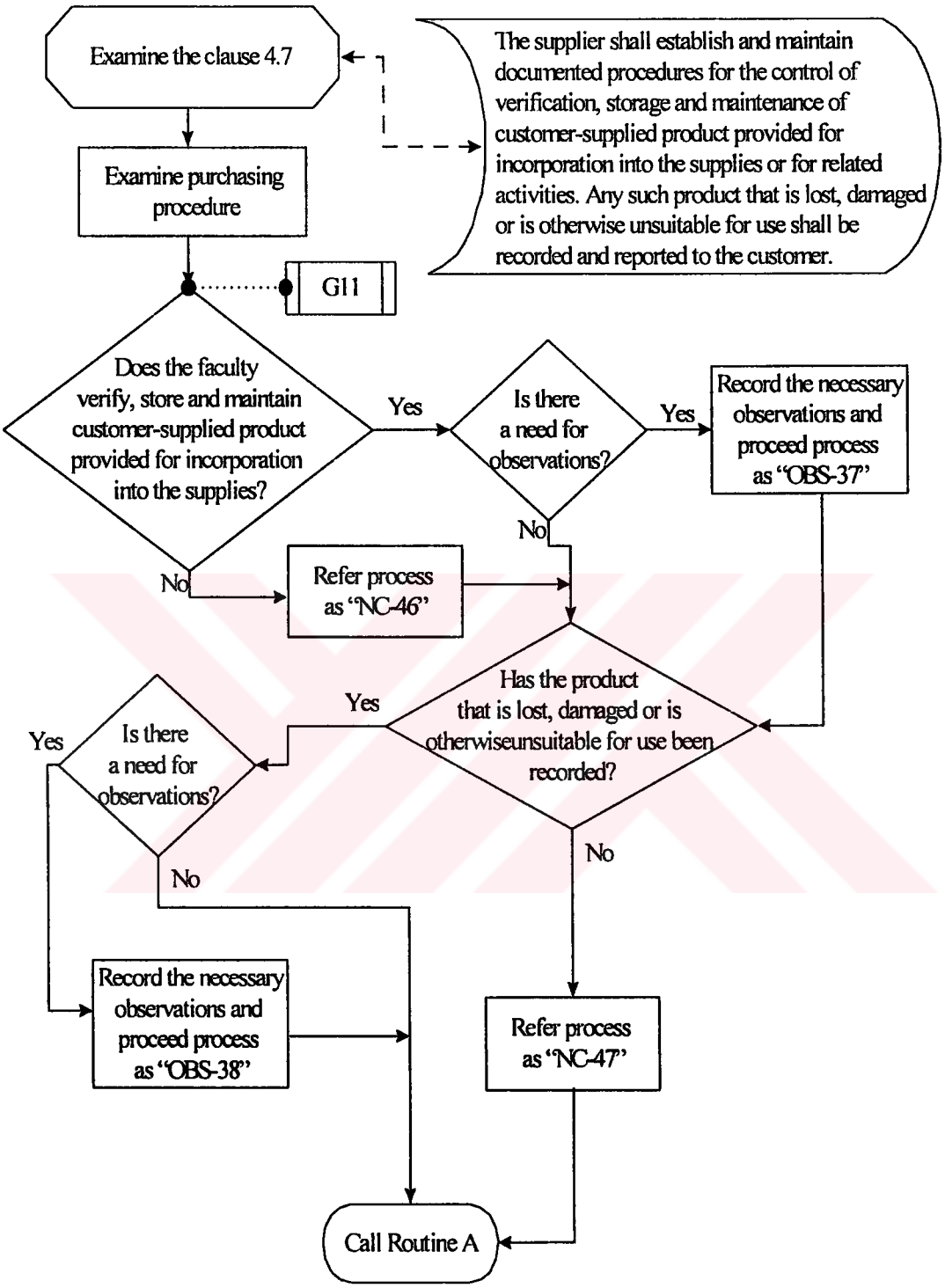
ROUTINE -F2-


Examine the clause 4.6.3 Purchasing data
Purchasing documents shall contain data clearly describing the product ordered, including where applicable:
a-) the type, class, grade or other precise identification;
b-) the title or other positive identification and applicable issues of specifications, drawings, process requirements, inspection instructions and other relevant technical data, including requirements for approval or qualification of product,
c-) the title, number and issue of the quality system standard to be applied.
The supplier shall review and approve purchasing documents for adequacy of specified requirements prior to release.
Do the purchasing documents describe the type, class, style, grade or other precise identification?
Yes
No
Refer process as "NC-40"
Is there a need for observations?
No
Yes
Record the necessary observations and proceed process as "OBS-32"
Is a metodology defined for the review and approval of purchasing documents for adequacy of the specified requirements prior to release?
Yes
No
Is there a need for observations?
Yes
Record the necessary observations and proceed process as "OBS-33"
No
Examine the review techniques of the purchased products
Refer process as "NC-41"
Is there a compliance between the written procedures and the real application ?
Yes
No
Is there a need for observations?
Yes
No
Record the necessary observations and proceed process as "OBS-34"
Refer process as "NC-42"
Call Routine F3

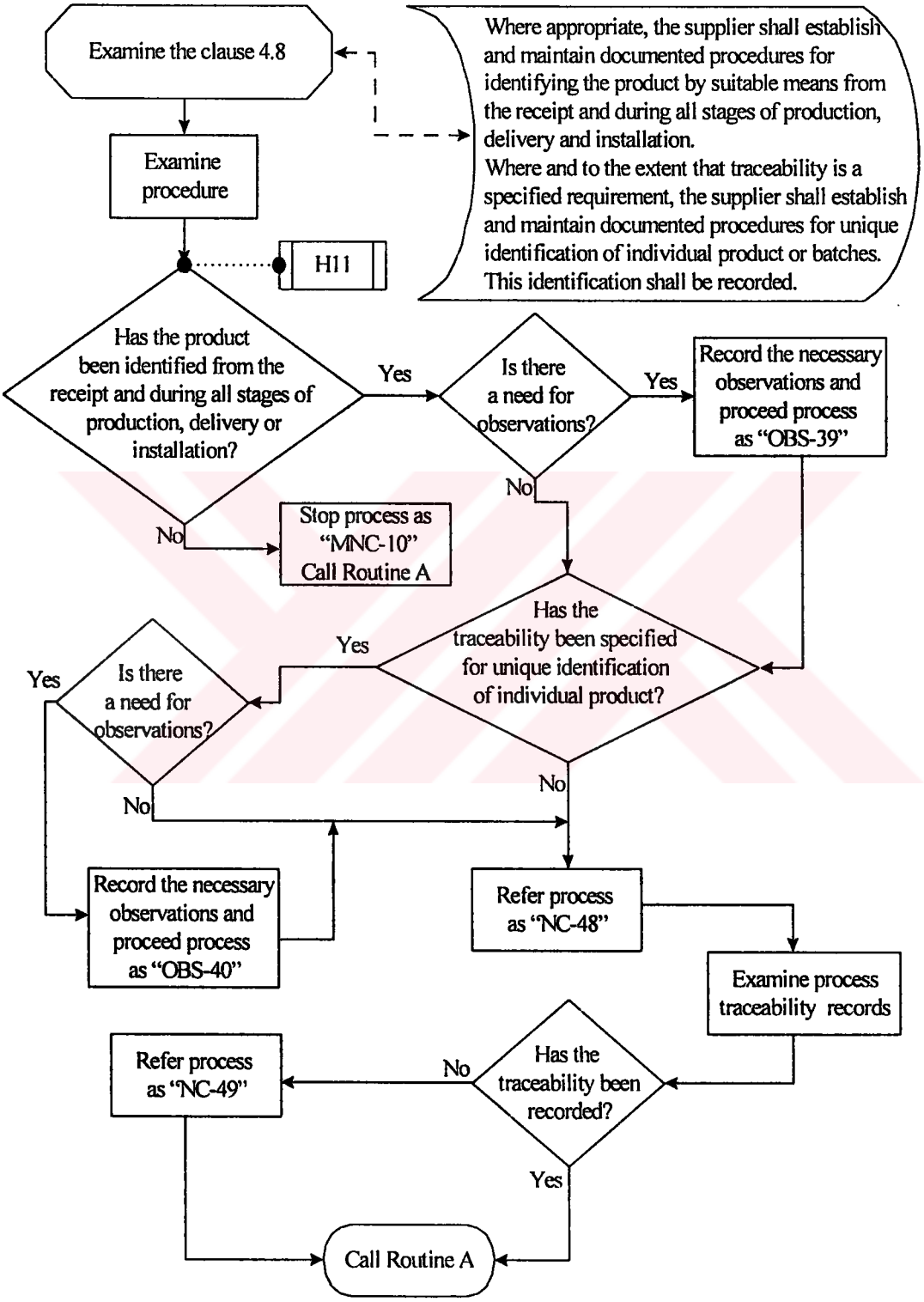
ROUTINE -F3-


Examine the clause 4.6.4 Verification of purchased product
4.6.4.1 Supplier verification at subcontactor's premises
Where the supplier proposes to verify purchased product at the subcontarctor's premises, the supplier specify verification arrangements and the method of product release in the purchasing documents.
4.6.4.2 Customer verification of subcontacted product
Where specified in the contract, the supplier's customer or the customer's representative shall be afforded the right to verify at the subcontactor's premises and the supplier's premises that subcontracted product conforms to specified requirements. Such verification shall not be used by the supplier as evidence of effective control of quality by the subcontractor.
Verification by the customer shall not absolve the supplier of the responsibility to provide acceptable product, nor shall it preclude subsequent rejection by the customer.
Does the faculty conduct verification of purchased product at the subcontractor's premises?
No
Yes
Refer process as "NC-43"
Is there a need for observations?
No
Yes
Record the necessary observations and proceed process as "OBS-35"
Examine purchasing documents
Has the faculty specified, in the purchasing document, the required verification method?
Yes
No
Refer process as "NC-44"
Is there a need for observations?
Yes
Record the necessary observations and proceed process as "OBS-36"
No
Review procedure with Faculty Secretary
No
Does the Faculty Secretary understand that verification by the customer shall not absolve the faculty of the responsibility to provide acceptable product?
No
Refer process as "NC-45"
Yes
Call Routine A

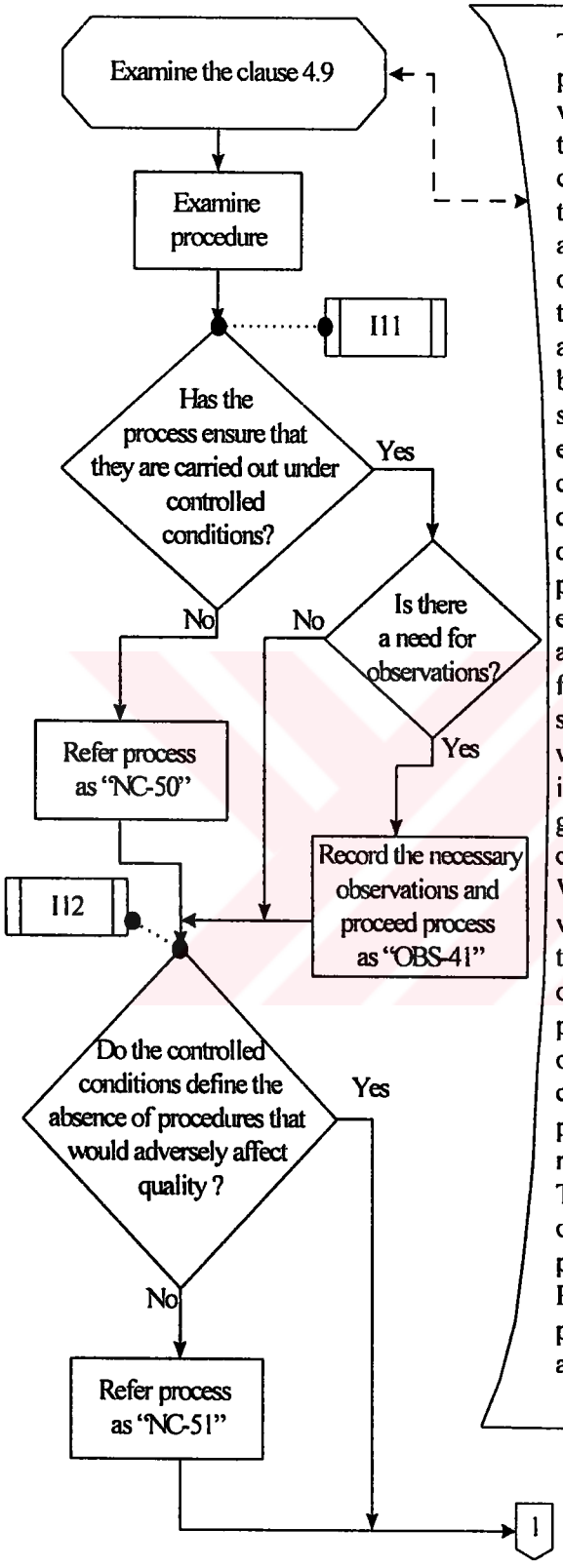
ROUTINE -G1-


Examine the clause 4.7
The supplier shall establish and maintain documented procedures for the control of verification, storage and maintenance of customer-supplied product provided for incorporation into the supplies or for related activities. Any such product that is lost, damaged or is otherwise unsuitable for use shall be recorded and reported to the customer.
Examine purchasing procedure
G11
Does the faculty verify, store and maintain customer-supplied product provided for incorporation into the supplies?
Yes
Is there a need for observations?
Yes
Record the necessary observations and proceed process as "OBS-37"
No
No
Refer process as "NC-46"
Has the product that is lost, damaged or is otherwiseunsuitable for use been recorded?
Yes
Is there a need for observations?
Yes
No
No
Record the necessary observations and proceed process as "OBS-38"
Refer process as "NC-47"
Call Routine A

ROUTINE -H1-


Examine the clause 4.8
Where appropriate, the supplier shall establish and maintain documented procedures for identifying the product by suitable means from the receipt and during all stages of production, delivery and installation.
Where and to the extent that traceability is a specified requirement, the supplier shall establish and maintain documented procedures for unique identification of individual product or batches.
This identification shall be recorded.
Examine procedure
H11
Has the product been identified from the receipt and during all stages of production, delivery or installation?
Yes
Is there a need for observations?
Yes
Record the necessary observations and proceed process as "OBS-39"
No
No
Stop process as "MNC-10" Call Routine A
Has the traceability been specified for unique identification of individual product?
Yes
Is there a need for observations?
Yes
No
No
Record the necessary observations and proceed process as "OBS-40"
Refer process as "NC-48"
Examine process traceability records
Refer process as "NC-49"
No
Has the traceability been recorded?
Yes
Call Routine A

ROUTINE -I1-



The supplier shall identify and plan the production, installation and servicing process which directly affect quality and shall ensure that these processes are carried out under controlled conditions. Controlled conditions shall include the following:

a-) documented procedures defining the manner of production, installation and servicing, where the absenceof such procedures could adversely affect quality;

b-) use of suitable production, installation and servicing equipment and a suitable working environment;

c-) compliancewith reference standards/codes, quality plans and/or documented procedures;

d-) monitoring and control of suitable process parameters and product characteristics;

e-) the approval of processes and equipment, as appropriate;

f-) criteria for workmanship, which shall be stipulated in the clearest practical manner (e.g: written standards, representative samples or illustrations)

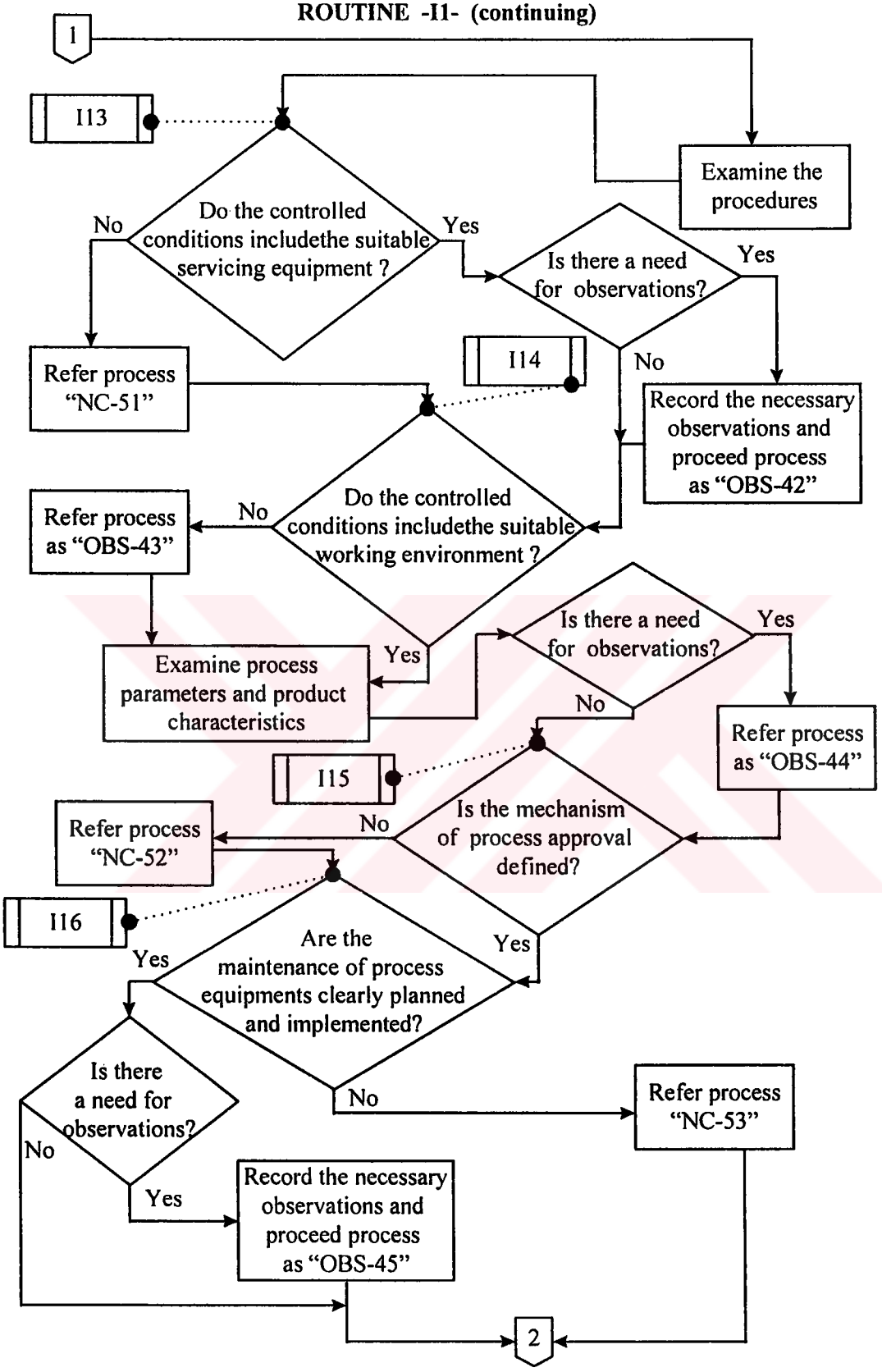
g-) suitable maintenance of equipment to ensure continuing process capability.

Where the results of process can not be fully verified by subsequent inspection and testing of the product and where, for example processing deficiencies may become apparent only after the product is in use, the processes shall be carried out by qualified operators and/ or shall require continuous monitoring and control of process parameters to ensure that the specified requirements are met.

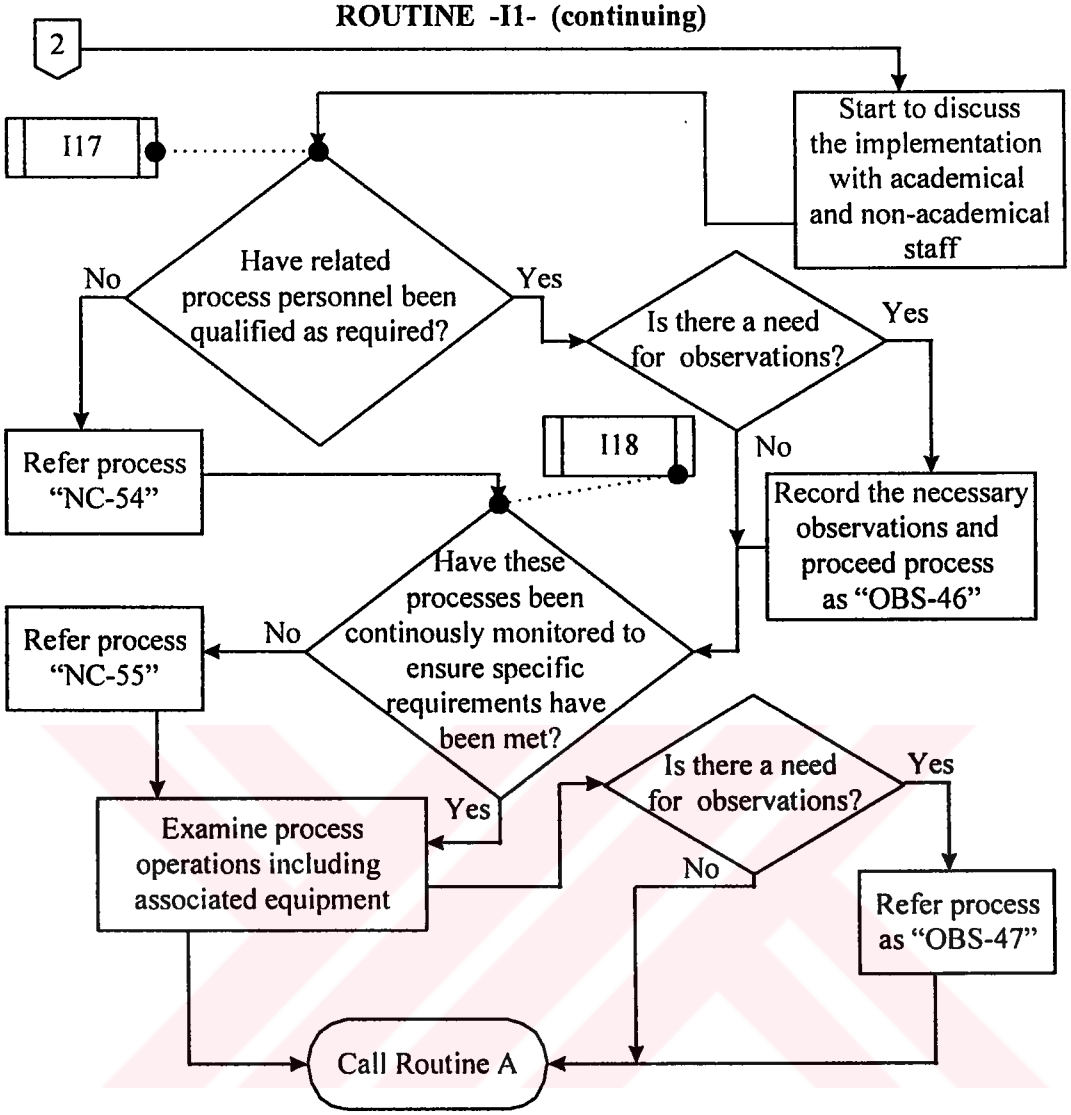
The requirements for any qualification of process operations including associated equipment and personnel (Ref: 4.18) shall be specified.

Records shall be maintained for qualified processes, equipment and personnel, as appropriate (Ref: 4.16).

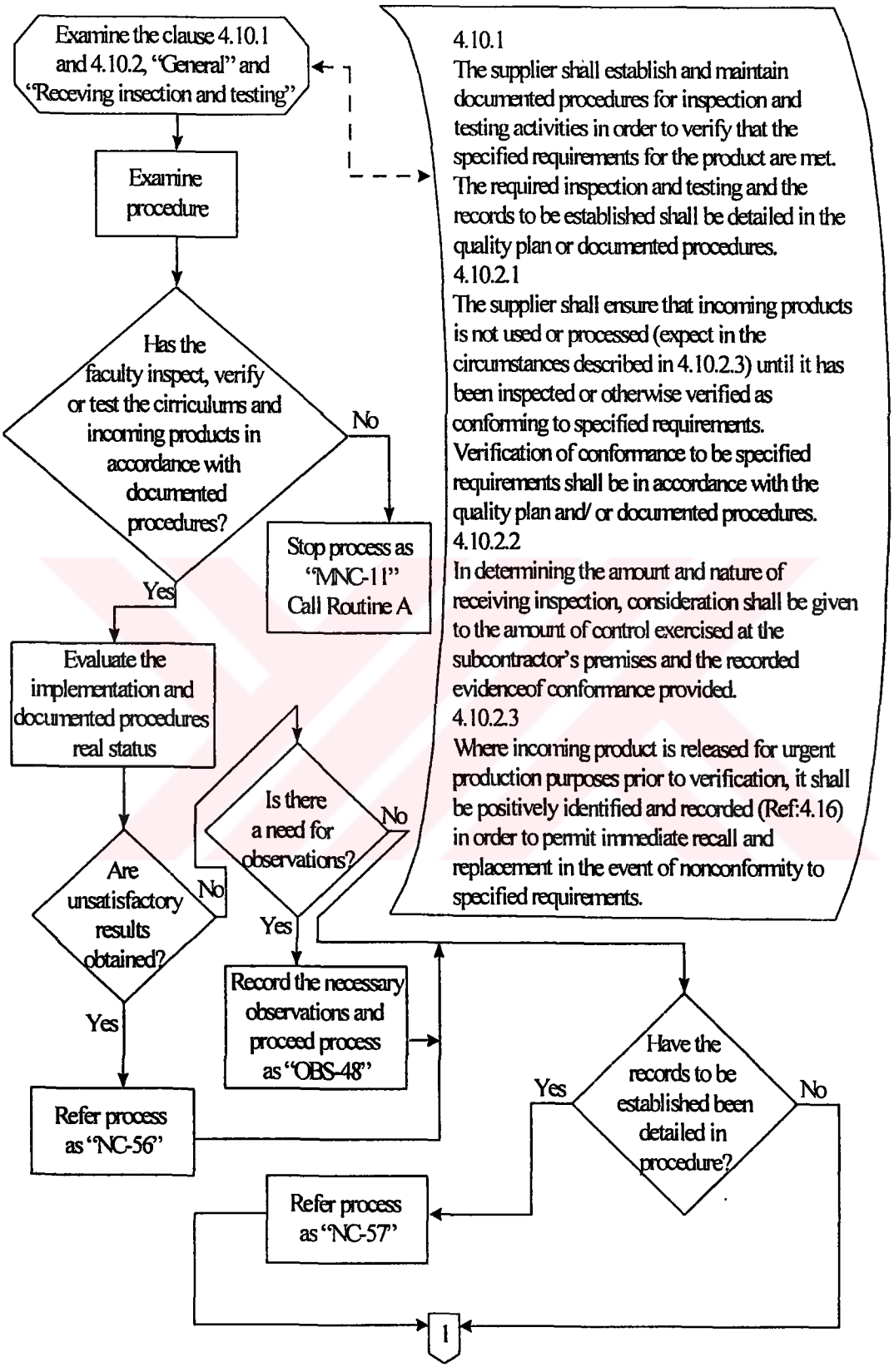
ROUTINE -I1- (continuing)



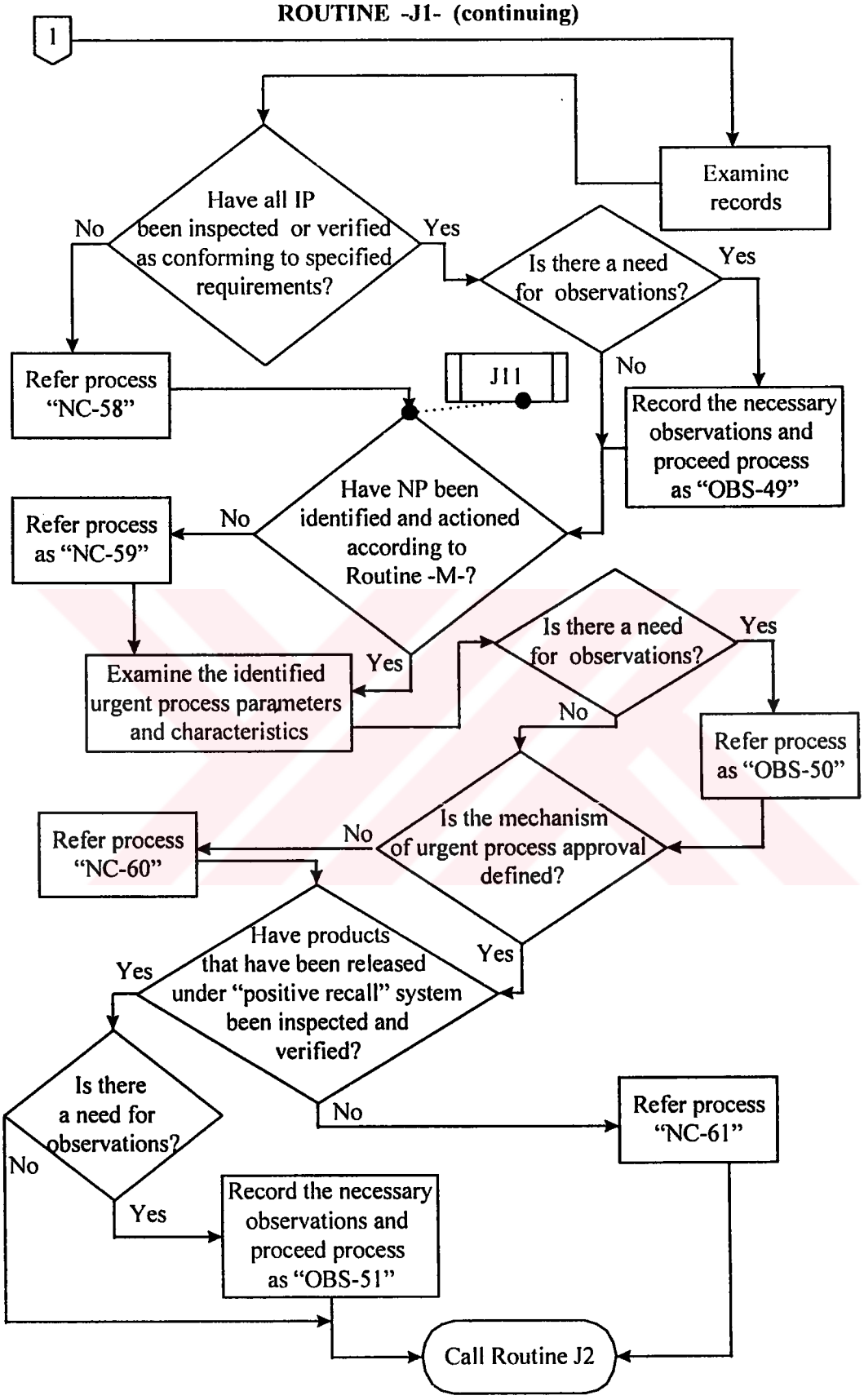
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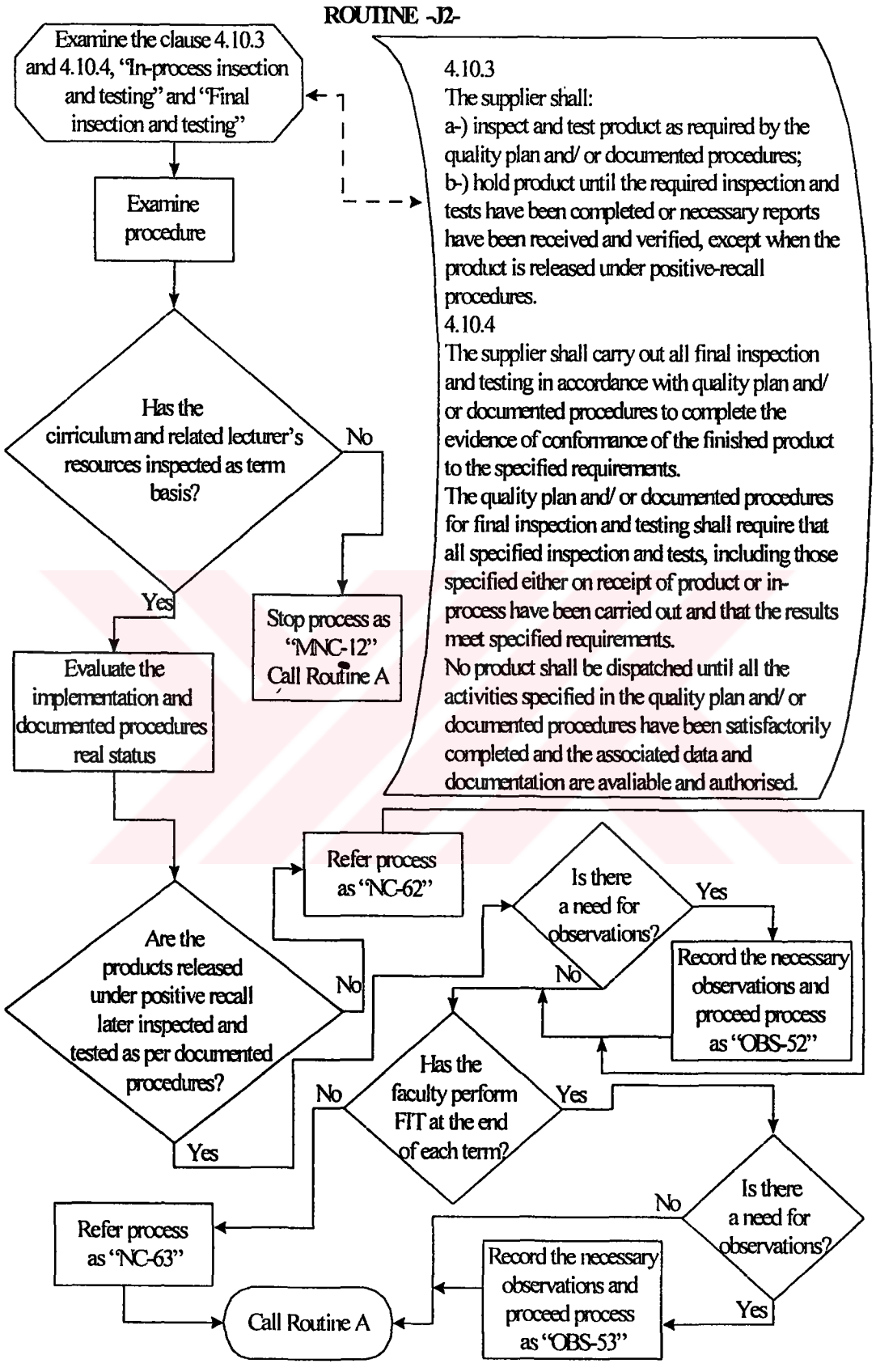


ROUTINE -J1-

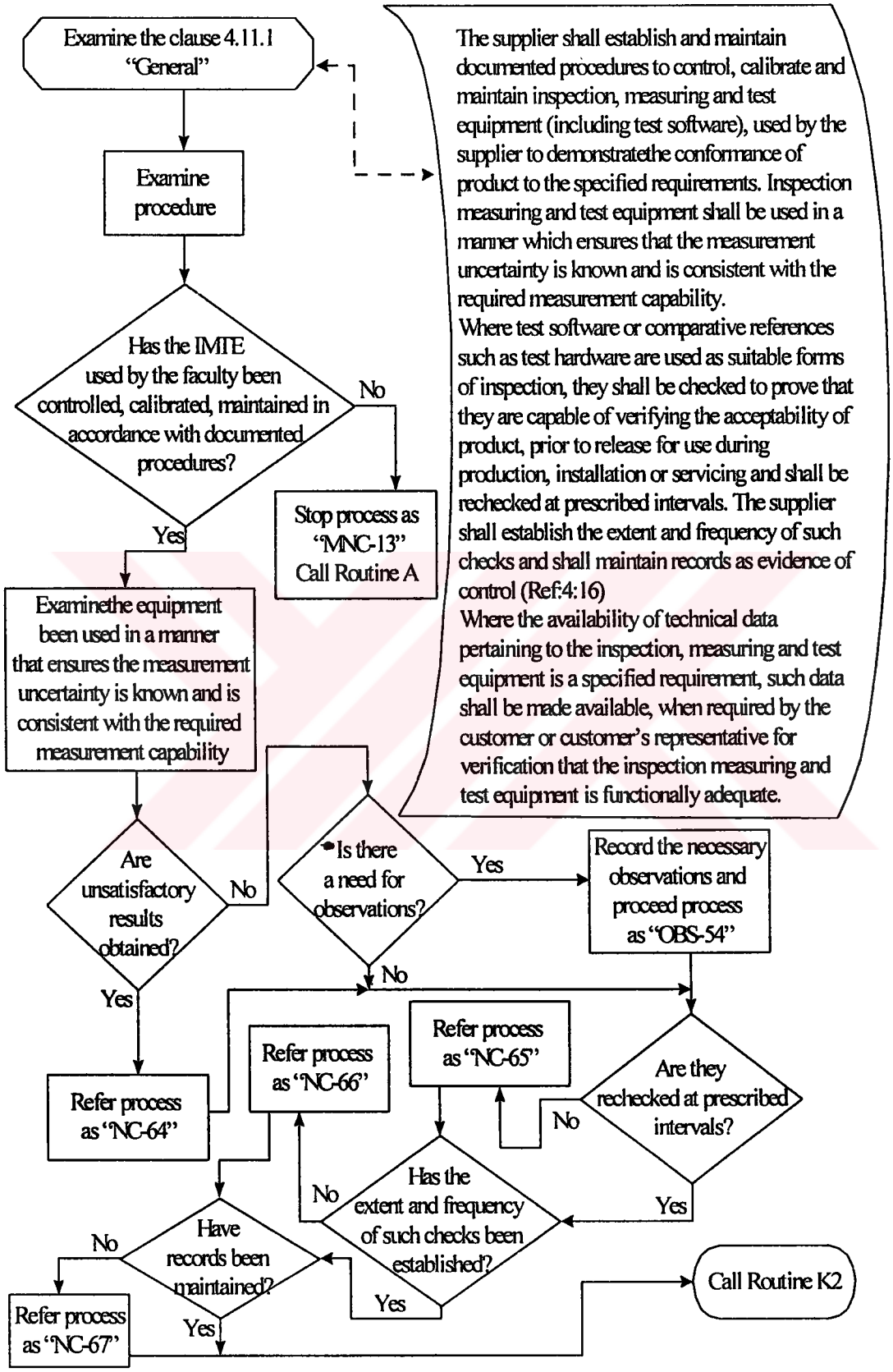

Examine the clause 4.10.1 and 4.10.2, "General" and "Receving insection and testing"
Examine procedure
Has the faculty inspect, verify or test the cirriculums and incoming products in accordance with documented procedures?
No
Yes
Stop process as "MNC-11" Call Routine A
Evaluate the implementation and documented procedures real status
Are unsatisfactory results obtained?
No
Yes
Refer process as "NC-56"
Is there a need for observations?
No
Yes
Record the necessary observations and proceed process as "OBS-48"
Have the records to be established been detailed in procedure?
Yes
No
Refer process as "NC-57"
1
4.10.1
The supplier shall establish and maintain documented procedures for inspection and testing activities in order to verify that the specified requirements for the product are met. The required inspection and testing and the records to be established shall be detailed in the quality plan or documented procedures.
4.10.2.1
The supplier shall ensure that incoming products is not used or processed (expect in the circumstances described in 4.10.2.3) until it has been inspected or otherwise verified as conforming to specified requirements. Verification of conformance to be specified requirements shall be in accordance with the quality plan and/ or documented procedures.
4.10.2.2
In determining the amount and nature of receiving inspection, consideration shall be given to the amount of control exercised at the subcontractor's premises and the recorded evidenceof conformance provided.
4.10.2.3
Where incoming product is released for urgent production purposes prior to verification, it shall be positively identified and recorded (Ref:4.16) in order to permit immediate recall and replacement in the event of nonconformity to specified requirements.

ROUTINE -J1- (continuing)

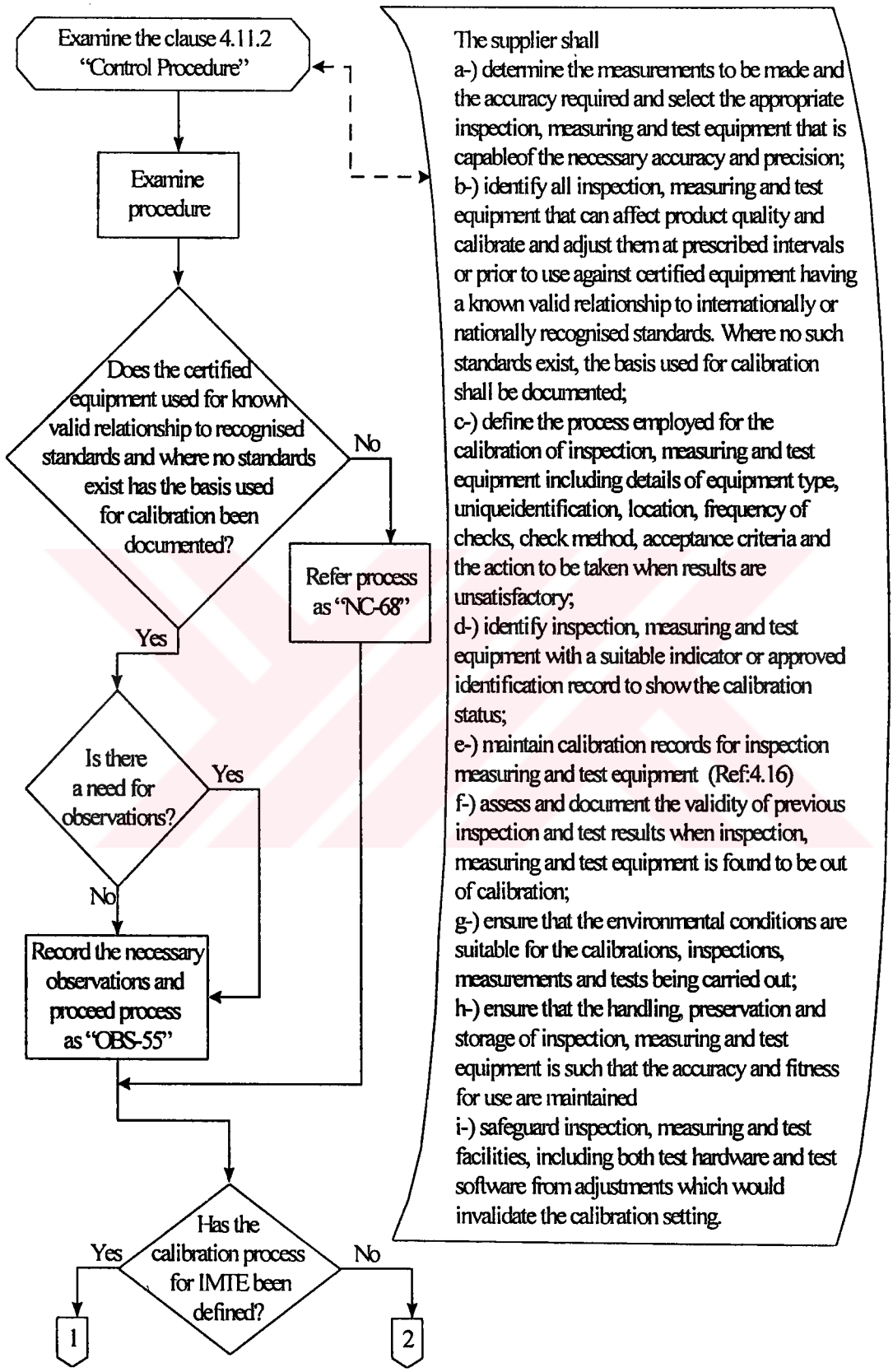



ROUTINE -J2-
Examine the clause 4.10.3 and 4.10.4, "In-process insection and testing" and "Final insection and testing"
4.10.3
The supplier shall:
a-) inspect and test product as required by the quality plan and/ or documented procedures;
b-) hold product until the required inspection and tests have been completed or necessary reports have been received and verified, except when the product is released under positive-recall procedures.
4.10.4
The supplier shall carry out all final inspection and testing in accordance with quality plan and/ or documented procedures to complete the evidence of conformance of the finished product to the specified requirements.
The quality plan and/ or documented procedures for final inspection and testing shall require that all specified inspection and tests, including those specified either on receipt of product or in-process have been carried out and that the results meet specified requirements.
No product shall be dispatched until all the activities specified in the quality plan and/ or documented procedures have been satisfactorily completed and the associated data and documentation are avaliable and authorised.
Examine procedure
Has the cirriculum and related lecturer's resources inspected as term basis?
No
Yes
Stop process as "MNC-12" Call Routine A
Evaluate the implementation and documented procedures real status
Refer process as "NC-62"
Is there a need for observations?
Yes
No
Record the necessary observations and proceed process as "OBS-52"
Are the products released under positive recall later inspected and tested as per documented procedures?
No
Yes
Has the faculty perform FIT at the end of each term?
No
Yes
Refer process as "NC-63"
Is there a need for observations?
No
Yes
Record the necessary observations and proceed process as "OBS-53"
Call Routine A

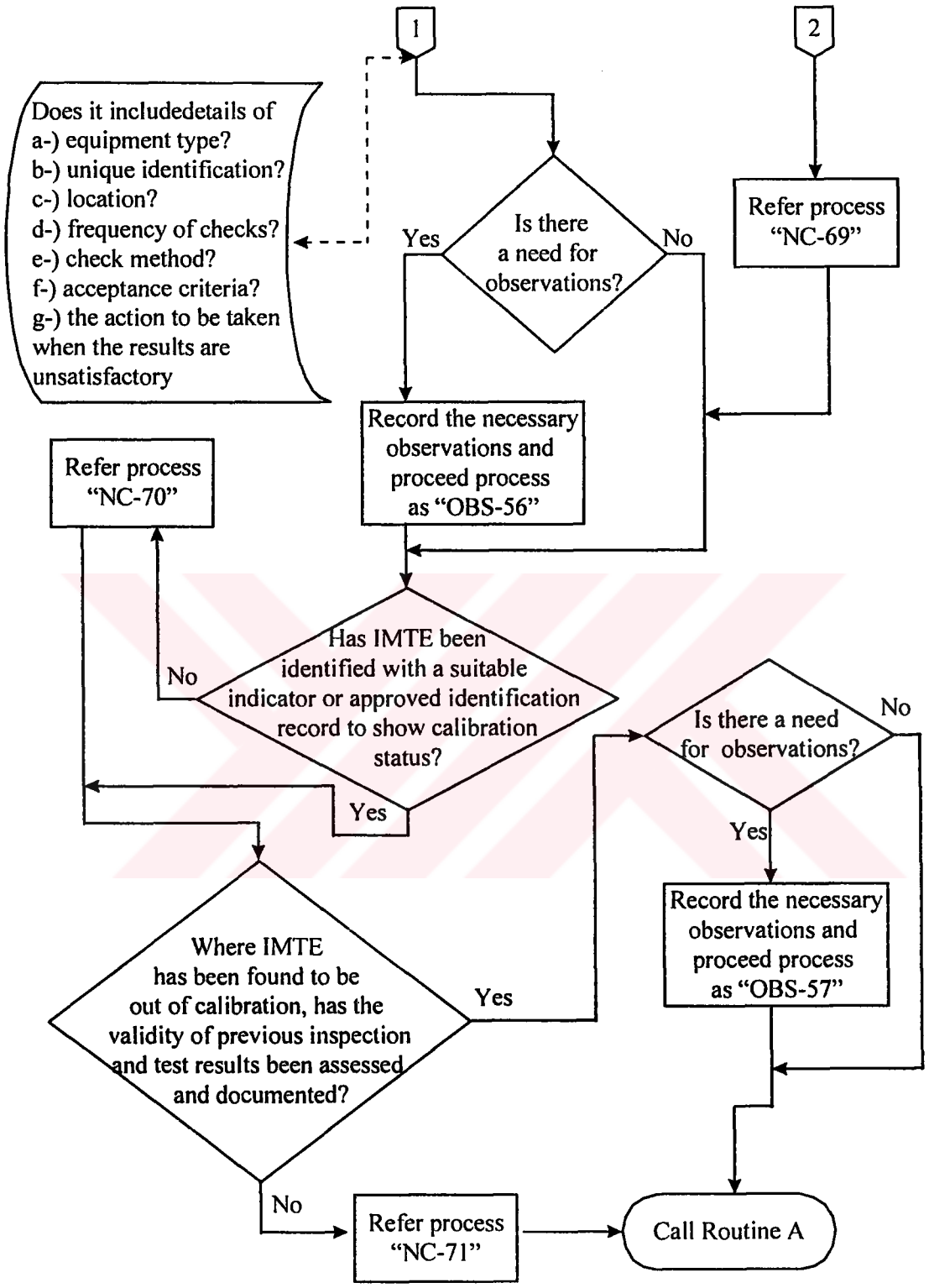
ROUTINE -K1-


Examine the clause 4.11.1 "General"
Examine procedure
Has the IMTE used by the faculty been controlled, calibrated, maintained in accordance with documented procedures?
No
Yes
Stop process as "MNC-13" Call Routine A
Examinethe equipment been used in a manner that ensures the measurement uncertainty is known and is consistent with the required measurement capability
Are unsatisfactory results obtained?
No
Yes
Refer process as "NC-64"
Is there a need for observations?
Yes
No
Record the necessary observations and proceed process as "OBS-54"
Refer process as "NC-66"
Refer process as "NC-65"
Are they rechecked at prescribed intervals?
No
Yes
Has the extent and frequency of such checks been established?
No
Yes
Have records been maintained?
No
Yes
Refer process as "NC-67"
Call Routine K2
The supplier shall establish and maintain documented procedures to control, calibrate and maintain inspection, measuring and test equipment (including test software), used by the supplier to demonstratethe conformance of product to the specified requirements. Inspection measuring and test equipment shall be used in a manner which ensures that the measurement uncertainty is known and is consistent with the required measurement capability.
Where test software or comparative references such as test hardware are used as suitable forms of inspection, they shall be checked to prove that they are capable of verifying the acceptability of product, prior to release for use during production, installation or servicing and shall be rechecked at prescribed intervals. The supplier shall establish the extent and frequency of such checks and shall maintain records as evidence of control (Ref:4:16)
Where the availability of technical data pertaining to the inspection, measuring and test equipment is a specified requirement, such data shall be made available, when required by the customer or customer's representative for verification that the inspection measuring and test equipment is functionally adequate.

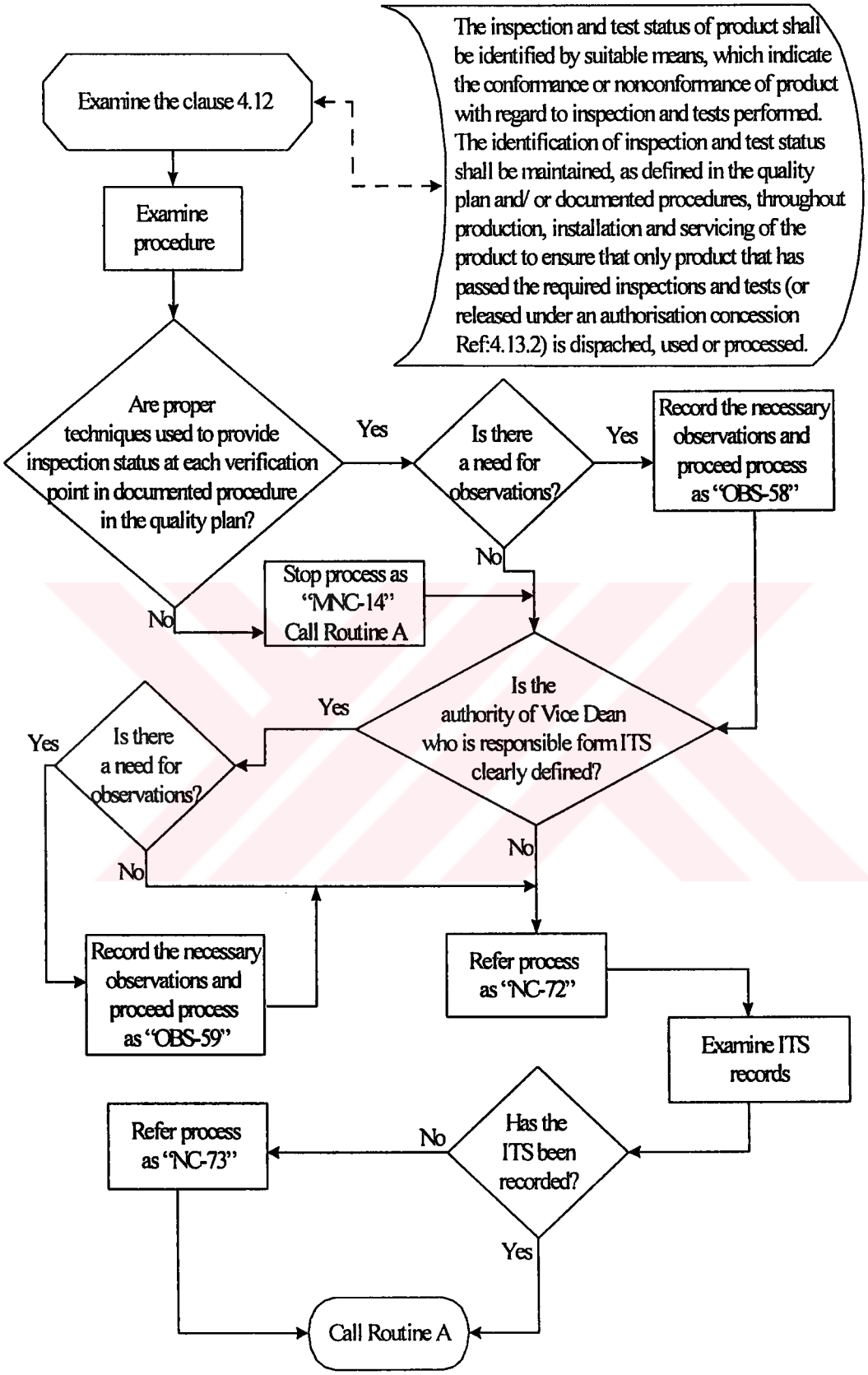
ROUTINE -K2-

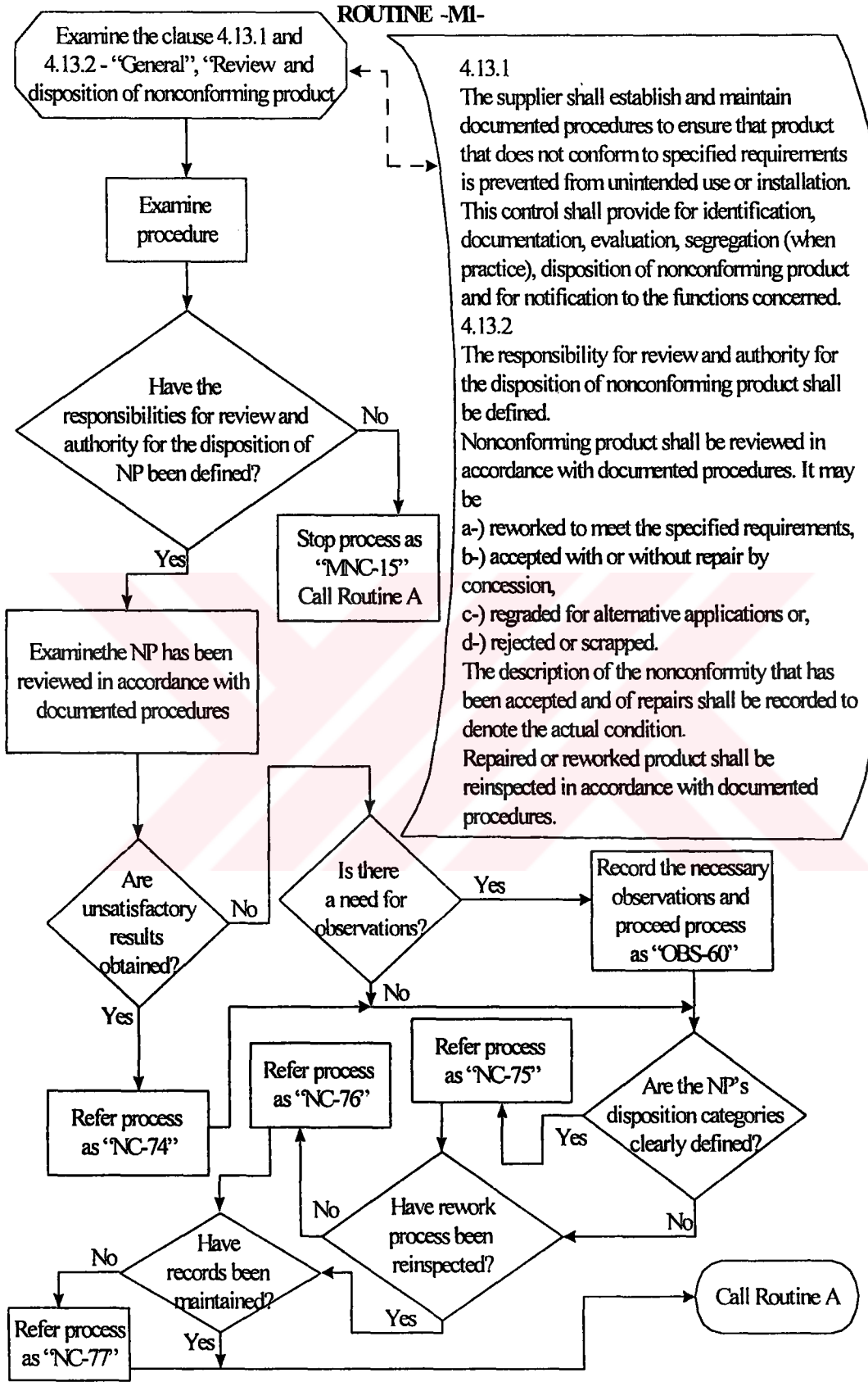

Examine the clause 4.11.2 "Control Procedure"
Examine procedure
Does the certified equipment used for known valid relationship to recognised standards and where no standards exist has the basis used for calibration been documented?
No
Refer process as "NC-68"
Yes
Is there a need for observations?
Yes
No
Record the necessary observations and proceed process as "OBS-55"
Has the calibration process for IMTE been defined?
Yes
No
1
2
The supplier shall
a-) determine the measurements to be made and the accuracy required and select the appropriate inspection, measuring and test equipment that is capableof the necessary accuracy and precision;
b-) identify all inspection, measuring and test equipment that can affect product quality and calibrate and adjust them at prescribed intervals or prior to use against certified equipment having a known valid relationship to internationally or nationally recognised standards. Where no such standards exist, the basis used for calibration shall be documented;
c-) define the process employed for the calibration of inspection, measuring and test equipment including details of equipment type, uniqueidentification, location, frequency of checks, check method, acceptance criteria and the action to be taken when results are unsatisfactory;
d-) identify inspection, measuring and test equipment with a suitable indicator or approved identification record to showthe calibration status;
e-) maintain calibration records for inspection measuring and test equipment (Ref:4.16)
f-) assess and document the validity of previous inspection and test results when inspection, measuring and test equipment is found to be out of calibration;
g-) ensure that the environmental conditions are suitable for the calibrations, inspections, measurements and tests being carried out;
h-) ensure that the handling, preservation and storage of inspection, measuring and test equipment is such that the accuracy and fitness for use are maintained
i-) safeguard inspection, measuring and test facilities, including both test hardware and test software from adjustments which would invalidate the calibration setting.

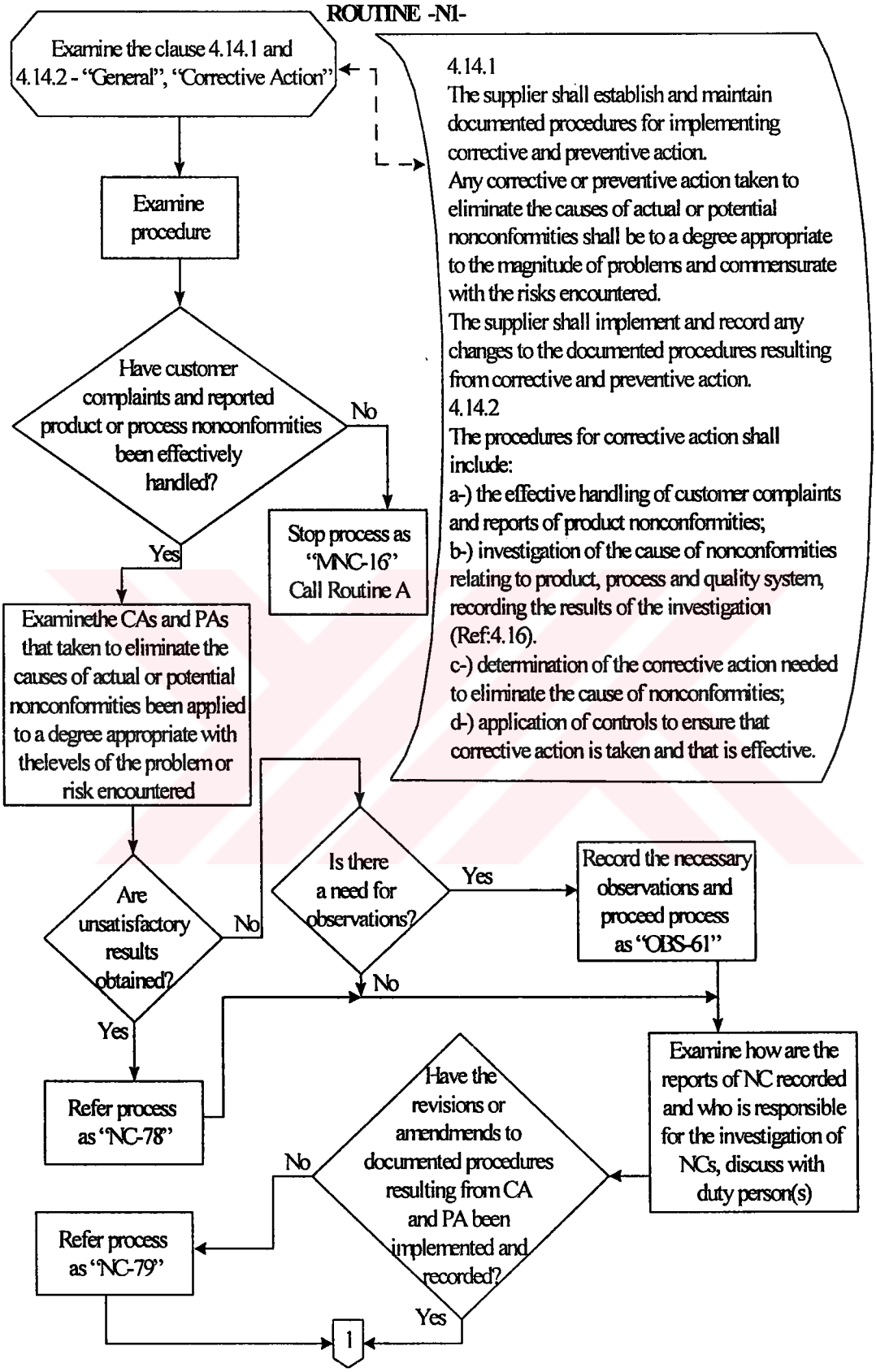
ROUTINE - K2 - (continuing)



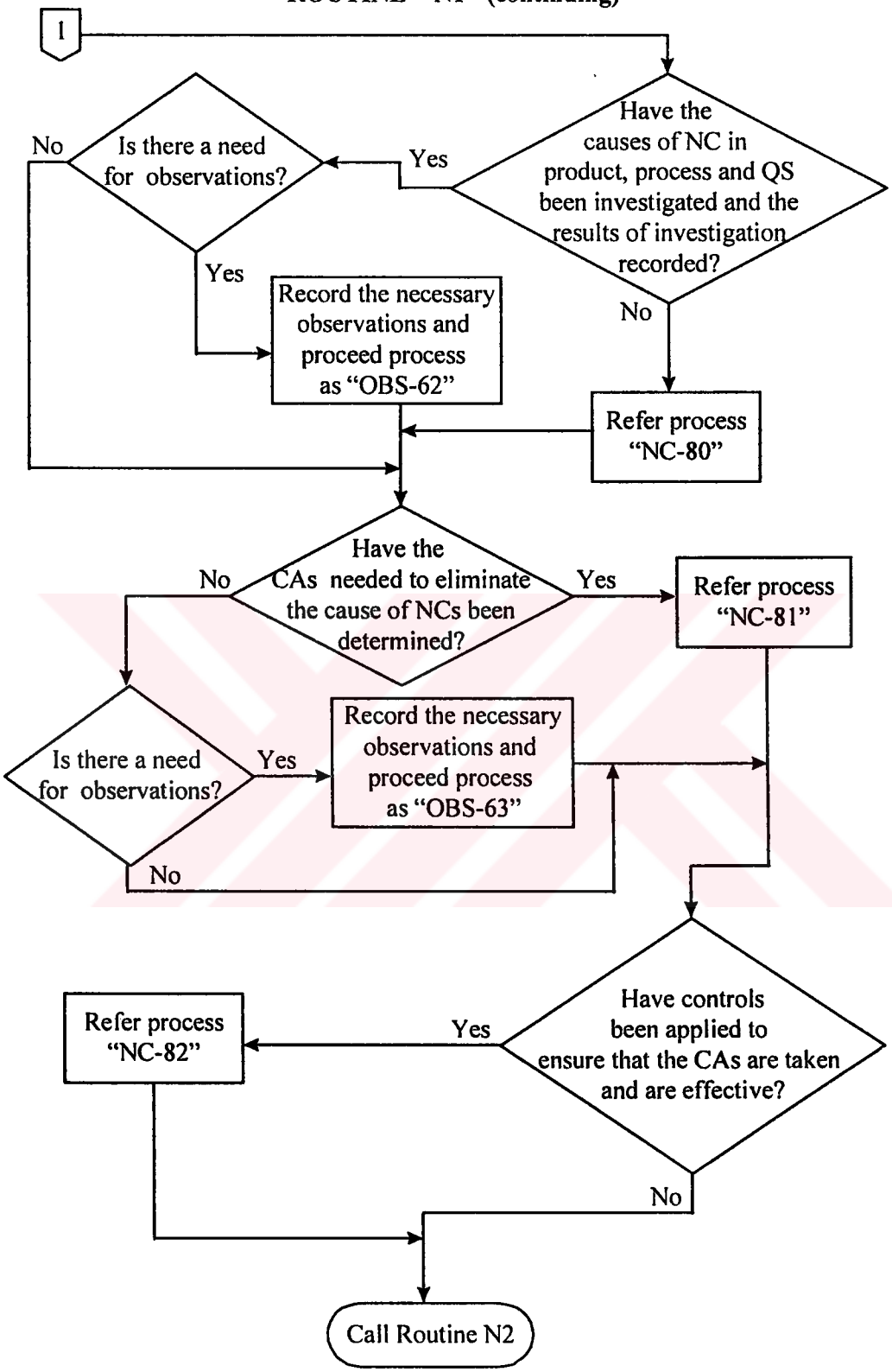
ROUTINE -L1-


Examine the clause 4.12
The inspection and test status of product shall be identified by suitable means, which indicate the conformance or nonconformance of product with regard to inspection and tests performed. The identification of inspection and test status shall be maintained, as defined in the quality plan and/ or documented procedures, throughout production, installation and servicing of the product to ensure that only product that has passed the required inspections and tests (or released under an authorisation concession Ref:4.13.2) is dispached, used or processed.
Examine procedure
Are proper techniques used to provide inspection status at each verification point in documented procedure in the quality plan?
Yes
Is there a need for observations?
Yes
Record the necessary observations and proceed process as "OBS-58"
No
No
Stop process as "MNC-14" Call Routine A
Is the authority of Vice Dean who is responsible form ITS clearly defined?
Yes
Is there a need for observations?
Yes
No
No
Record the necessary observations and proceed process as "OBS-59"
Refer process as "NC-72"
Examine ITS records
Has the ITS been recorded?
No
Refer process as "NC-73"
Yes
Call Routine A

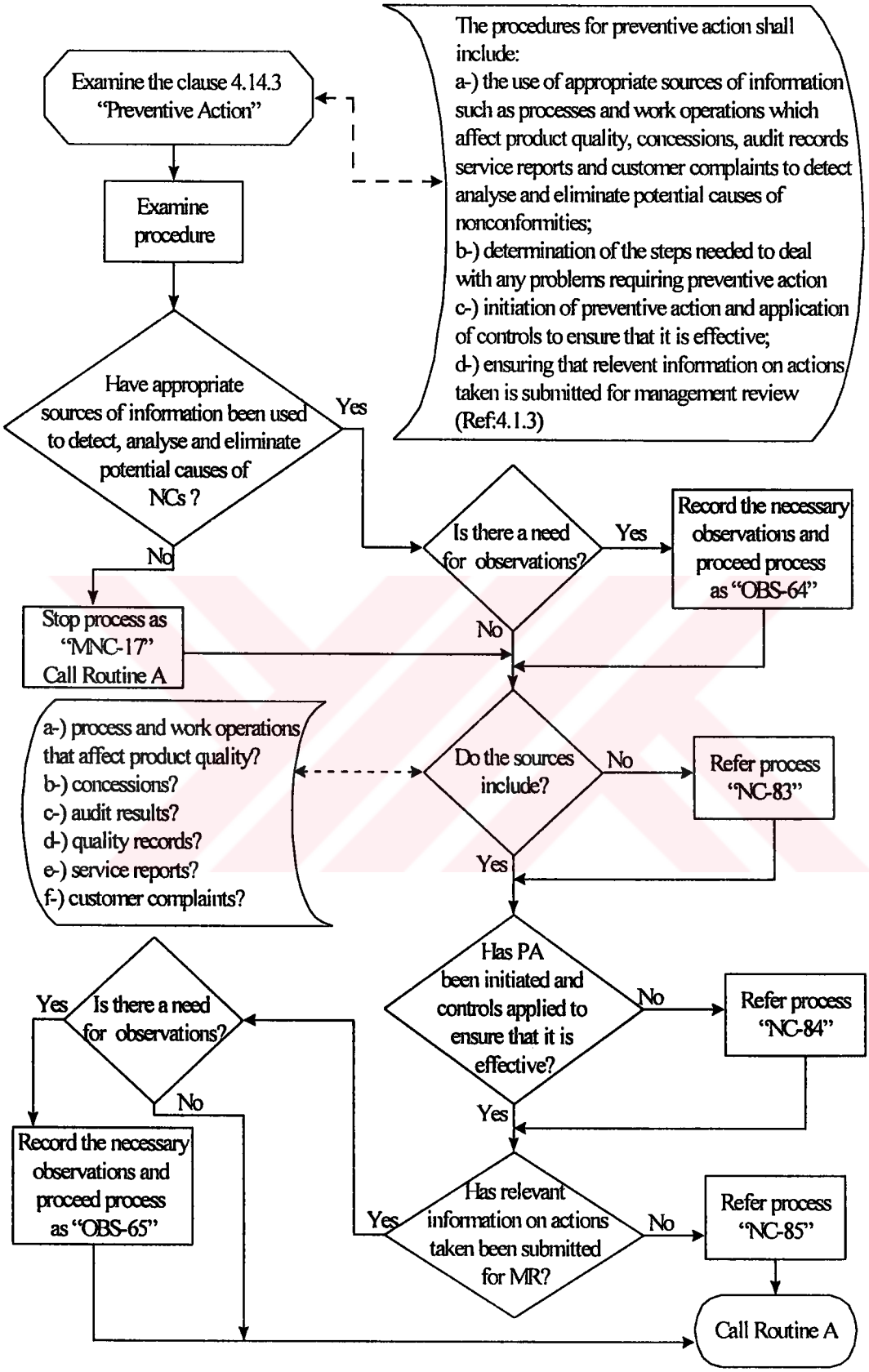

ROUTINE -M1-
Examine the clause 4.13.1 and 4.13.2 - "General", "Review and disposition of nonconforming product
4.13.1
The supplier shall establish and maintain documented procedures to ensure that product that does not conform to specified requirements is prevented from unintended use or installation. This control shall provide for identification, documentation, evaluation, segregation (when practice), disposition of nonconforming product and for notification to the functions concerned.
4.13.2
The responsibility for review and authority for the disposition of nonconforming product shall be defined.
Nonconforming product shall be reviewed in accordance with documented procedures. It may be
a-) reworked to meet the specified requirements,
b-) accepted with or without repair by concession,
c-) regraded for alternative applications or,
d-) rejected or scrapped.
The description of the nonconformity that has been accepted and of repairs shall be recorded to denote the actual condition.
Repaired or reworked product shall be reinspected in accordance with documented procedures.
Examine procedure
Have the responsibilities for review and authority for the disposition of NP been defined?
No
Yes
Stop process as "MNC-15" Call Routine A
Examinethe NP has been reviewed in accordance with documented procedures
Are unsatisfactory results obtained?
No
Yes
Refer process as "NC-74"
Is there a need for observations?
Yes
Record the necessary observations and proceed process as "OBS-60"
No
Refer process as "NC-76"
Refer process as "NC-75"
Are the NP's disposition categories clearly defined?
Yes
No
Have rework process been reinspected?
No
Yes
Have records been maintained?
No
Yes
Refer process as "NC-77"
Call Routine A

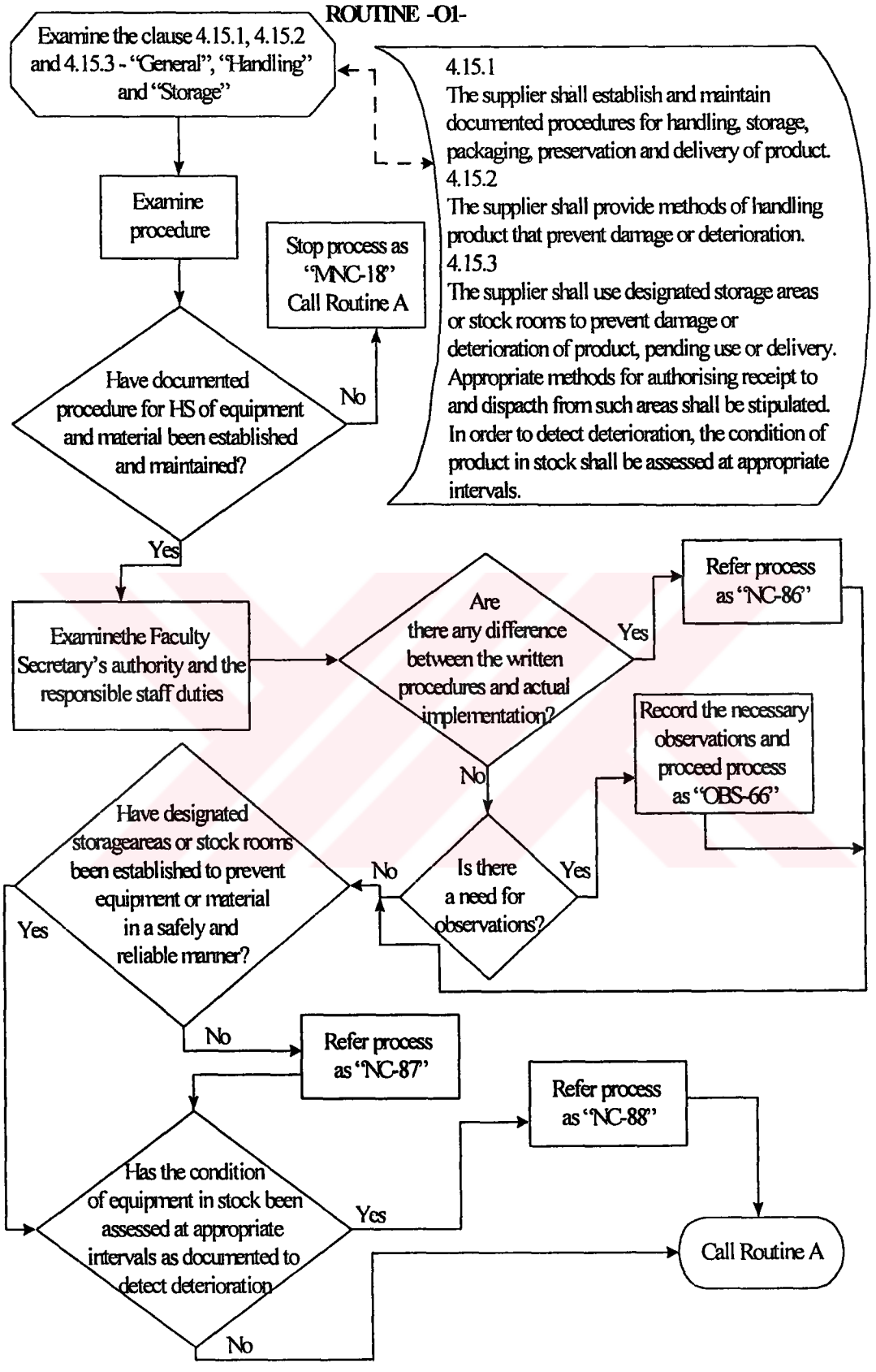

ROUTINE -N1-
Examine the clause 4.14.1 and 4.14.2 - "General", "Corrective Action"
4.14.1
The supplier shall establish and maintain documented procedures for implementing corrective and preventive action.
Any corrective or preventive action taken to eliminate the causes of actual or potential nonconformities shall be to a degree appropriate to the magnitude of problems and commensurate with the risks encountered.
The supplier shall implement and record any changes to the documented procedures resulting from corrective and preventive action.
4.14.2
The procedures for corrective action shall include:
a-) the effective handling of customer complaints and reports of product nonconformities;
b-) investigation of the cause of nonconformities relating to product, process and quality system, recording the results of the investigation (Ref:4.16).
c-) determination of the corrective action needed to eliminate the cause of nonconformities;
d-) application of controls to ensure that corrective action is taken and that is effective.
Examine procedure
Have customer complaints and reported product or process nonconformities been effectively handled?
No
Stop process as "MNC-16" Call Routine A
Yes
Examinethe CAs and PAs that taken to eliminate the causes of actual or potential nonconformities been applied to a degree appropriate with thelevels of the problem or risk encountered
Are unsatisfactory results obtained?
No
Yes
Refer process as "NC-78"
Is there a need for observations?
Yes
Record the necessary observations and proceed process as "OBS-61"
No
Examine how are the reports of NC recorded and who is responsible for the investigation of NCs, discuss with duty person(s)
Have the revisions or amendmends to documented procedures resulting from CA and PA been implemented and recorded?
No
Refer process as "NC-79"
Yes
1

ROUTINE - N1 - (continuing)

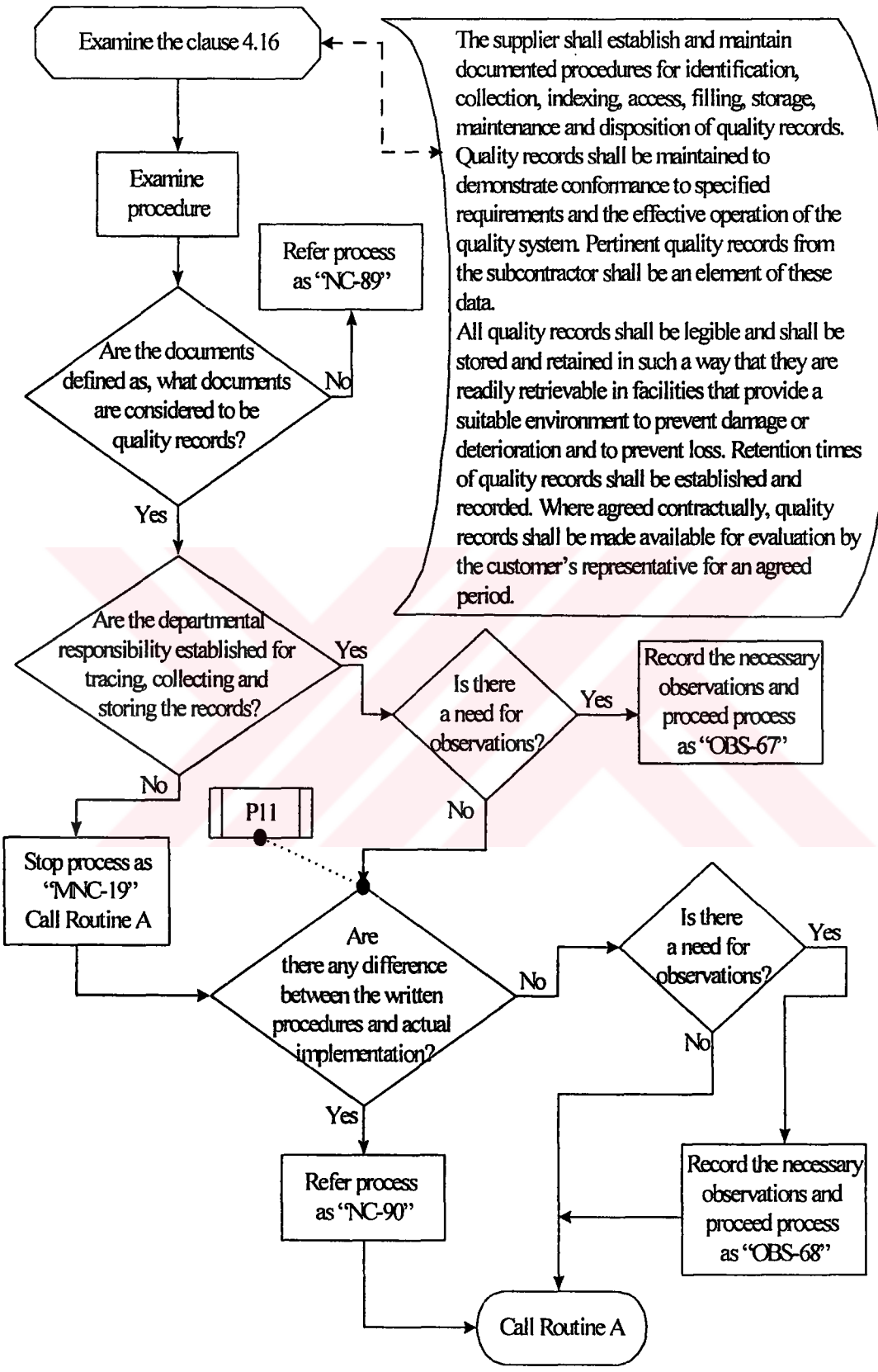


ROUTINE - N2 -

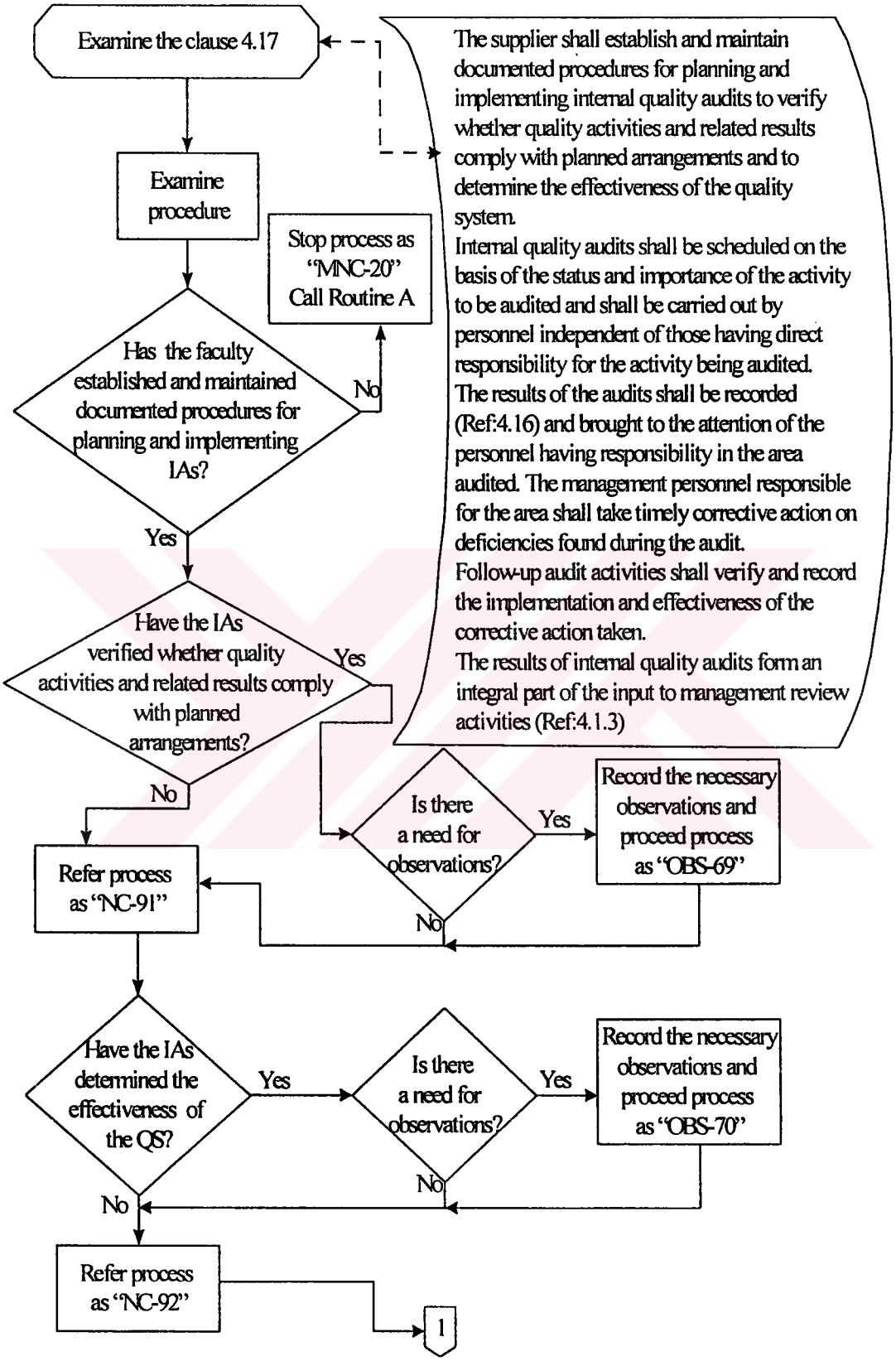

Examine the clause 4.14.3 "Preventive Action"
Examine procedure
The procedures for preventive action shall include:
a-) the use of appropriate sources of information such as processes and work operations which affect product quality, concessions, audit records service reports and customer complaints to detect analyse and eliminate potential causes of nonconformities;
b-) determination of the steps needed to deal with any problems requiring preventive action
c-) initiation of preventive action and application of controls to ensure that it is effective;
d-) ensuring that relevent information on actions taken is submitted for management review (Ref:4.1.3)
Have appropriate sources of information been used to detect, analyse and eliminate potential causes of NCs ?
Yes
No
Is there a need for observations?
Yes
Record the necessary observations and proceed process as "OBS-64"
No
Stop process as "MNC-17" Call Routine A
a-) process and work operations that affect product quality?
b-) concessions?
c-) audit results?
d-) quality records?
e-) service reports?
f-) customer complaints?
Do the sources include?
No
Refer process "NC-83"
Yes
Has PA been initiated and controls applied to ensure that it is effective?
No
Refer process "NC-84"
Yes
Is there a need for observations?
Yes
No
Record the necessary observations and proceed process as "OBS-65"
Has relevant information on actions taken been submitted for MR?
Yes
No
Refer process "NC-85"
Call Routine A


ROUTINE -01-
Examine the clause 4.15.1, 4.15.2 and 4.15.3 - "General", "Handling" and "Storage"
4.15.1
The supplier shall establish and maintain documented procedures for handling, storage, packaging, preservation and delivery of product.
4.15.2
The supplier shall provide methods of handling product that prevent damage or deterioration.
4.15.3
The supplier shall use designated storage areas or stock rooms to prevent damage or deterioration of product, pending use or delivery. Appropriate methods for authorising receipt to and dispacth from such areas shall be stipulated. In order to detect deterioration, the condition of product in stock shall be assessed at appropriate intervals.
Examine procedure
Stop process as "MNC-18" Call Routine A
Have documented procedure for HS of equipment and material been established and maintained?
No
Yes
Examinethe Faculty Secretary's authority and the responsible staff duties
Are there any difference between the written procedures and actual implementation?
Yes
Refer process as "NC-86"
No
Record the necessary observations and proceed process as "OBS-66"
Is there a need for observations?
Yes
No
Have designated storageareas or stock rooms been established to prevent equipment or material in a safely and reliable manner?
Yes
No
Refer process as "NC-87"
Refer process as "NC-88"
Has the condition of equipment in stock been assessed at appropriate intervals as documented to detect deterioration
Yes
No
Call Routine A

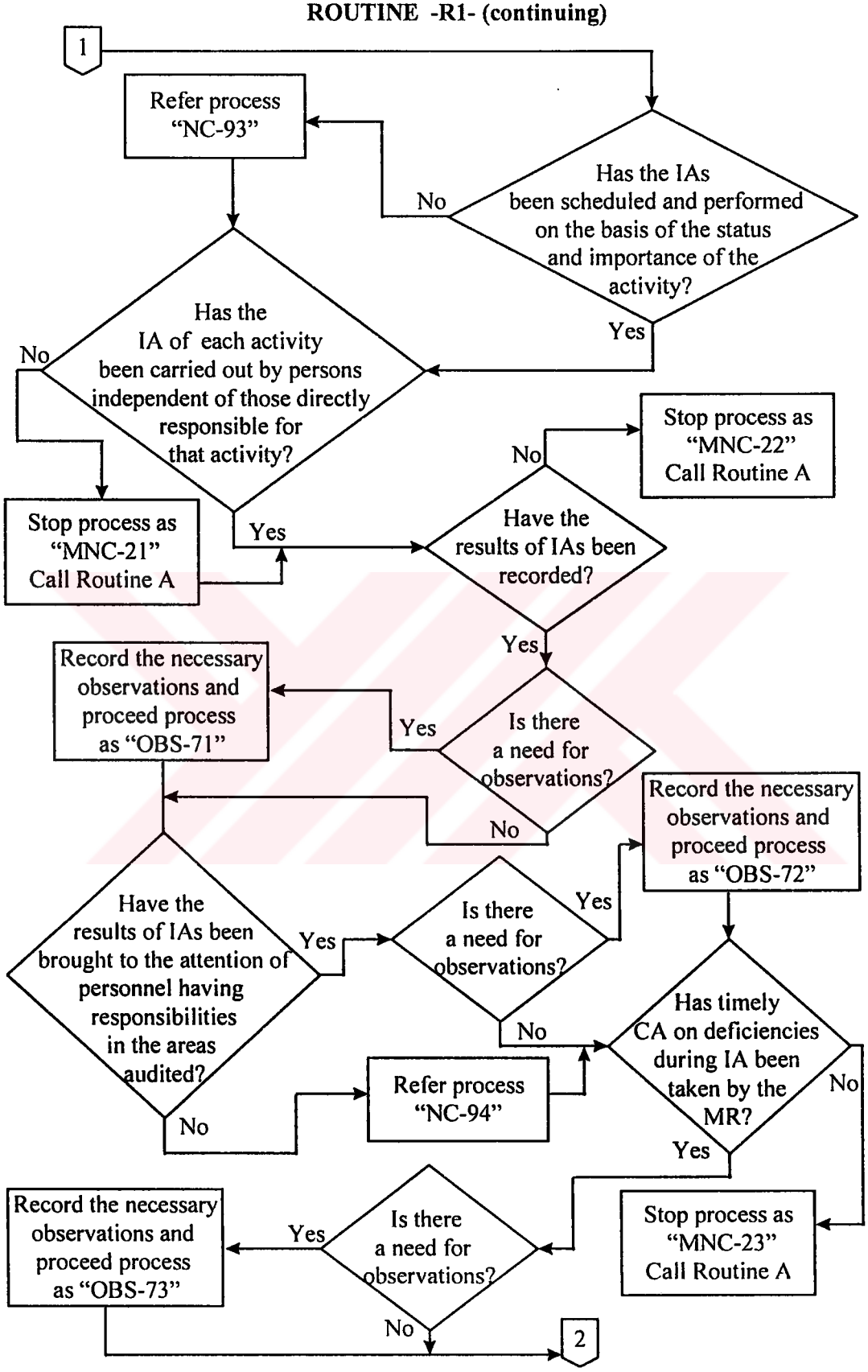
ROUTINE -P1-


Examine the clause 4.16
The supplier shall establish and maintain documented procedures for identification, collection, indexing, access, filling, storage, maintenance and disposition of quality records. Quality records shall be maintained to demonstrate conformance to specified requirements and the effective operation of the quality system. Pertinent quality records from the subcontractor shall be an element of these data.
All quality records shall be legible and shall be stored and retained in such a way that they are readily retrievable in facilities that provide a suitable environment to prevent damage or deterioration and to prevent loss. Retention times of quality records shall be established and recorded. Where agreed contractually, quality records shall be made available for evaluation by the customer's representative for an agreed period.
Examine procedure
Refer process as "NC-89"
Are the documents defined as, what documents are considered to be quality records?
No
Yes
Are the departmental responsibility established for tracing, collecting and storing the records?
Yes
No
Is there a need for observations?
Yes
Record the necessary observations and proceed process as "OBS-67"
No
P11
Stop process as "MNC-19" Call Routine A
Are there any difference between the written procedures and actual implementation?
No
Is there a need for observations?
Yes
No
Yes
Refer process as "NC-90"
Record the necessary observations and proceed process as "OBS-68"
Call Routine A

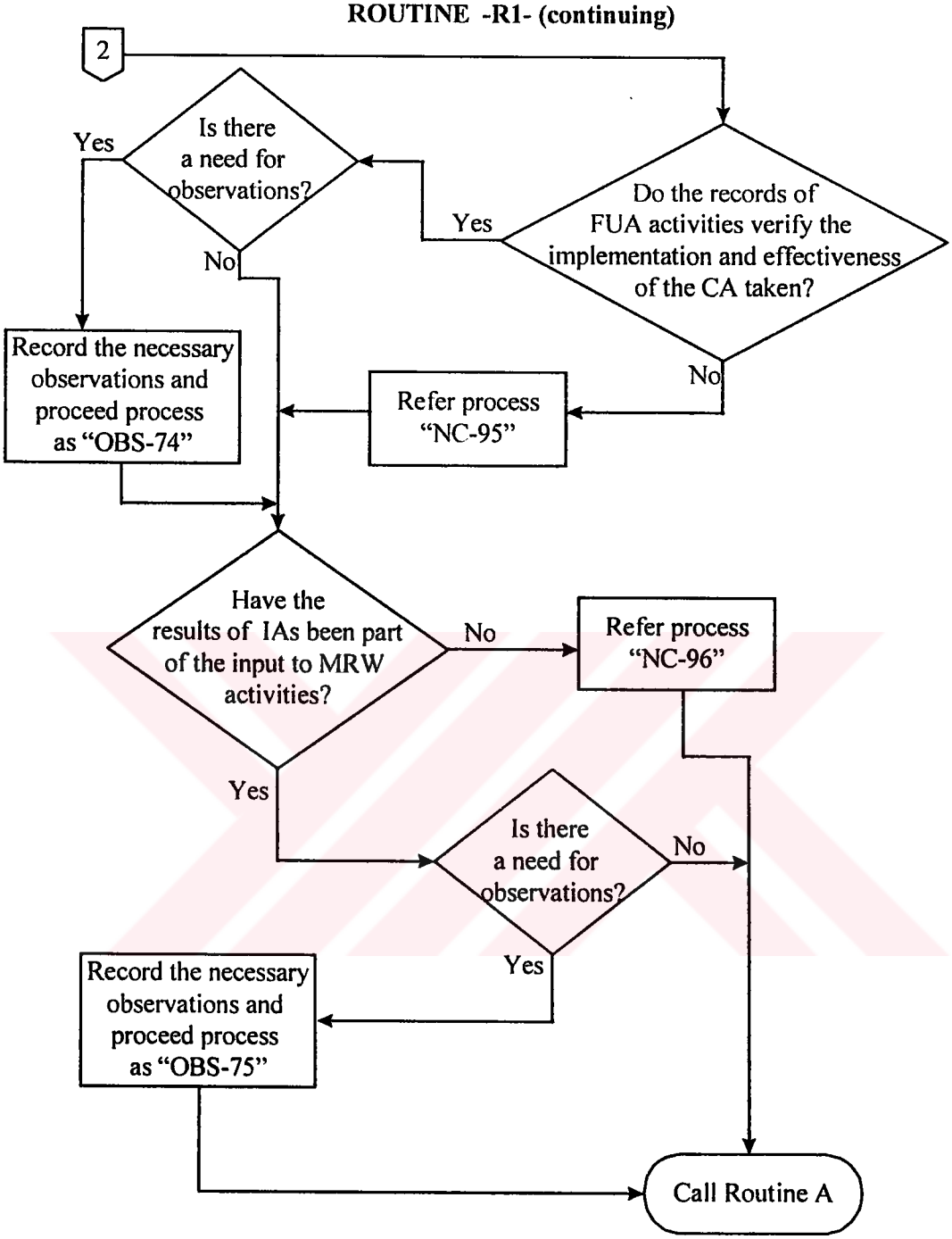
ROUTINE -R1-


Examine the clause 4.17
Examine procedure
Stop process as "MNC-20" Call Routine A
Has the faculty established and maintained documented procedures for planning and implementing IAs?
No
Yes
Have the IAs verified whether quality activities and related results comply with planned arrangements?
Yes
No
Refer process as "NC-91"
Is there a need for observations?
Yes
Record the necessary observations and proceed process as "OBS-69"
No
Have the IAs determined the effectiveness of the QS?
Yes
Is there a need for observations?
Yes
Record the necessary observations and proceed process as "OBS-70"
No
No
Refer process as "NC-92"
1
The supplier shall establish and maintain documented procedures for planning and implementing internal quality audits to verify whether quality activities and related results comply with planned arrangements and to determine the effectiveness of the quality system.
Internal quality audits shall be scheduled on the basis of the status and importance of the activity to be audited and shall be carried out by personnel independent of those having direct responsibility for the activity being audited.
The results of the audits shall be recorded (Ref:4.16) and brought to the attention of the personnel having responsibility in the area audited. The management personnel responsible for the area shall take timely corrective action on deficiencies found during the audit.
Follow-up audit activities shall verify and record the implementation and effectiveness of the corrective action taken.
The results of internal quality audits form an integral part of the input to management review activities (Ref:4.1.3)

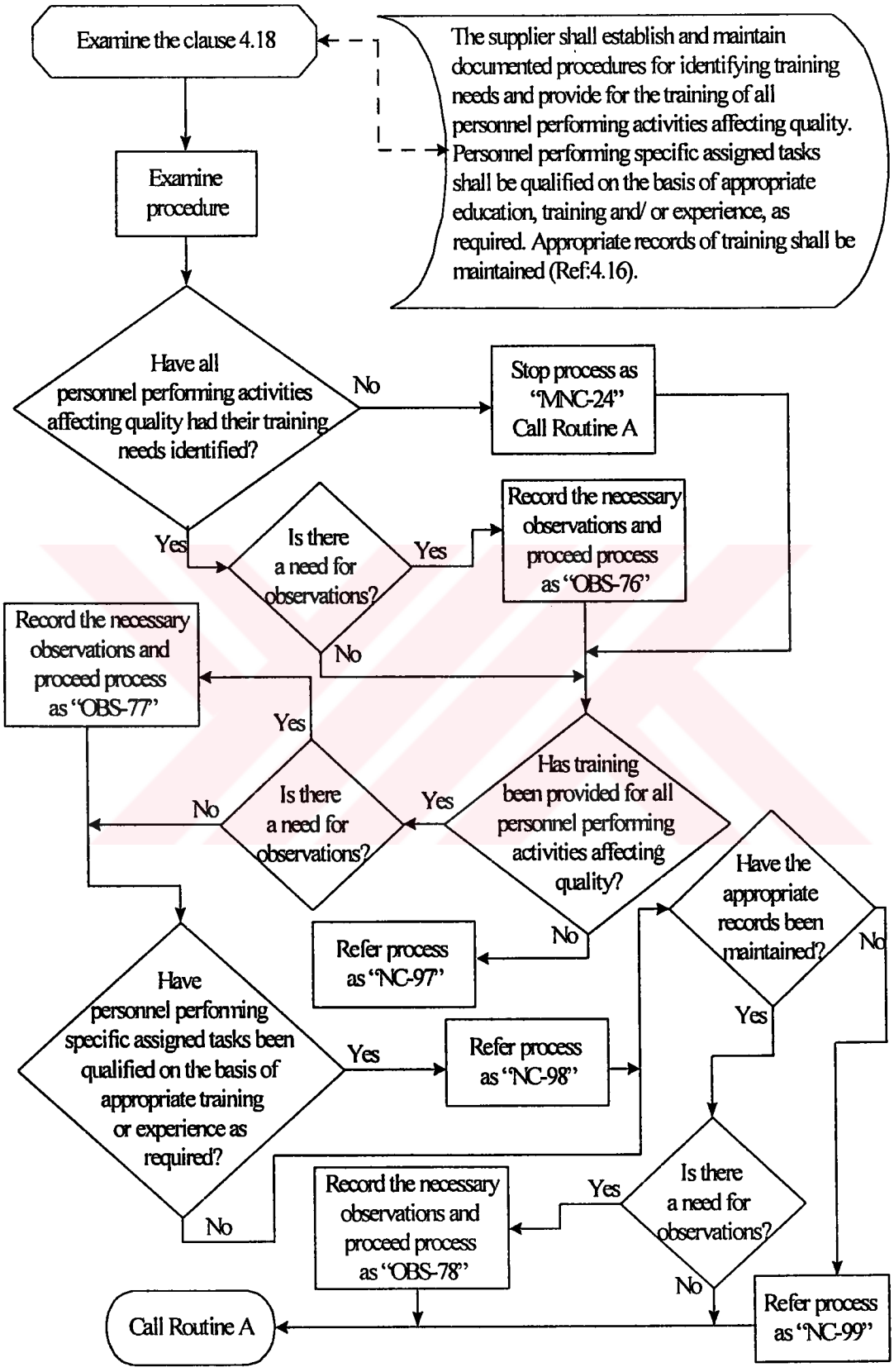
ROUTINE -R1- (continuing)



ROUTINE -R1- (continuing)



ROUTINE -Q1-


Examine the clause 4.18
The supplier shall establish and maintain documented procedures for identifying training needs and provide for the training of all personnel performing activities affecting quality. Personnel performing specific assigned tasks shall be qualified on the basis of appropriate education, training and/ or experience, as required. Appropriate records of training shall be maintained (Ref:4.16).
Examine procedure
Have all personnel performing activities affecting quality had their training needs identified?
No
Stop process as "MNC-24" Call Routine A
Yes
Is there a need for observations?
Yes
Record the necessary observations and proceed process as "OBS-76"
No
Record the necessary observations and proceed process as "OBS-77"
Yes
Is there a need for observations?
No
Has training been provided for all personnel performing activities affecting quality?
Yes
No
Refer process as "NC-97"
Have personnel performing specific assigned tasks been qualified on the basis of appropriate training or experience as required?
Yes
Refer process as "NC-98"
No
Have the appropriate records been maintained?
No
Yes
Is there a need for observations?
Yes
Record the necessary observations and proceed process as "OBS-78"
No
Refer process as "NC-99"
Call Routine A

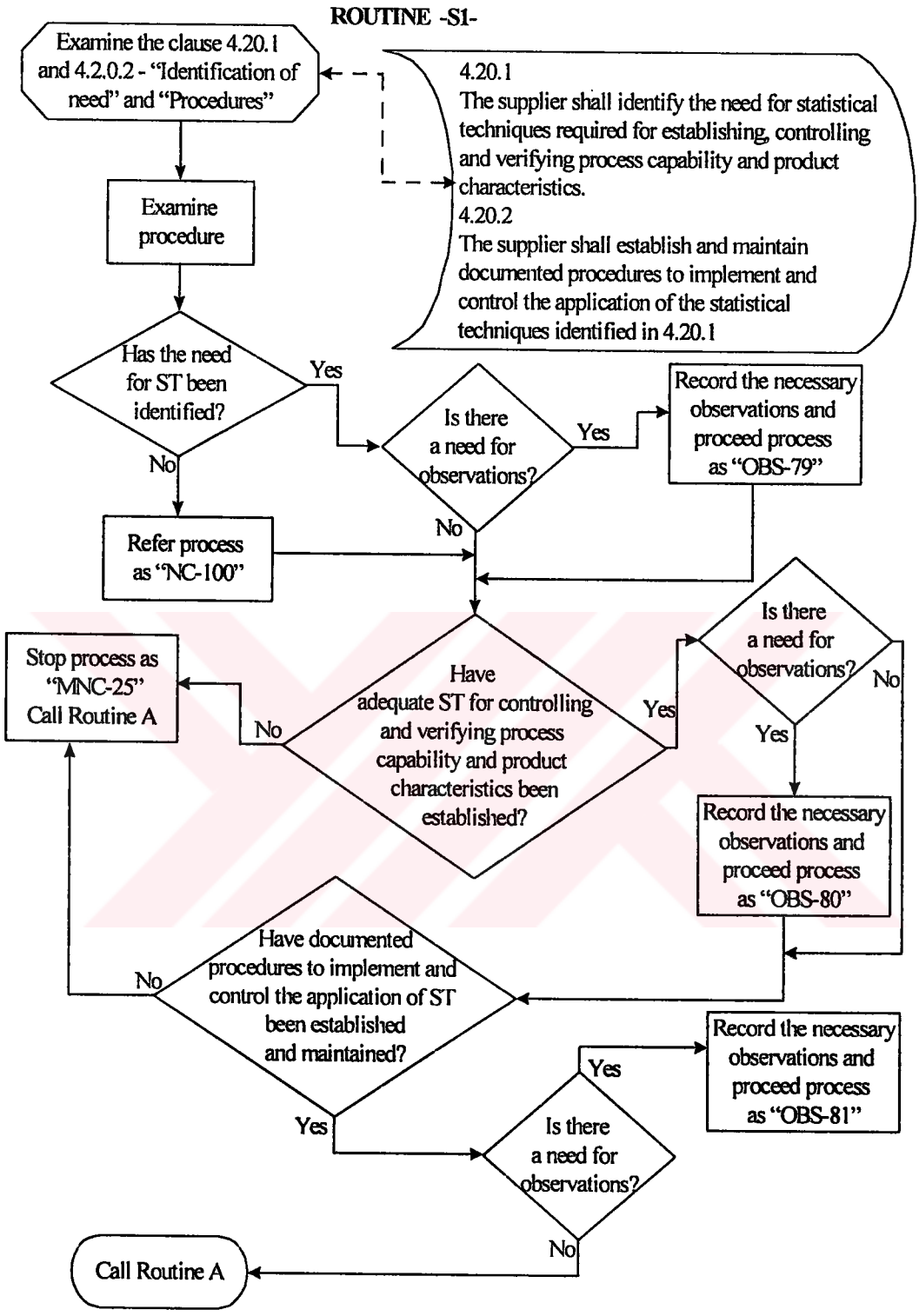


Figure D.1 Algorithm of QMS integration cycle

APPENDIX E. INTEGRATED MANAGEMENT SYSTEM PROCEDURES AND WORK INSTRUCTIONS

E.1. TEAM FORMATION, OPERATION AND DISPERSAL - MANAGEMENT SYSTEM PROCEDURE (MSP 01.1)

E.1.1. PURPOSE

The purpose of this procedure is to define the steps for the formation, operation, and dispersal of teams at İ.T.Ü Maritime Faculty as a key strategy for fostering continuous improvement through employee involvement.

A team is defined as "a group of people who are committed to solve the problems, to perform works who bring a high level of energy to the process, who are able to work well with others, and who are focused on quality."

Teams are encouraged for addressing issues that will foster total quality, continual improvement, environmental awareness and improvement, and multi-disciplinary planning, decision making and internal and external communications.

E.1.2. SCOPE

This procedure applies to all personnel involved in any team (such as functional work teams, task teams, multi-disciplinary teams, and self-directed work teams) at İ.T.Ü Maritime Faculty.

This procedure addresses clause 4.1 in ISO 9002 - 1994, aspects of clause 4.4.1 in ISO 14001-1996 and Section 1 in İ.T.Ü Maritime Faculty 's IMS Manual.

E.1.3. RELATED PROCEDURES AND OTHER DOCUMENTATION

Other Documents	Description of Document
MSWI 01.1.1	Team Roles & Responsibilities

E.1.4. PROCEDURE

TEAM FORMATION

4.1 An employee at İ.T.Ü Maritime Faculty proposes the formation of a team at any time by contacting his/her Head of Department for approval and formation of the requested team.

The "employee" may be a member of Management, or a lecturer or part time academical staff.

4.2 The Head of Department evaluates the merits and need for the proposed team, consulting with other impacted areas or personnel as necessary.

4.2.1 If the Head of Department decides to form the requested team, go to step 4.4.

4.3 The Head of Department notifies the employee that the team is not needed, explaining the reasons for the rejection of the proposed team.

END OF PROCEDURE.

TEAM MEMBERSHIP

4.4 The Head of Department, possibly with other key management, defines the team's charter (purpose and objectives) and addresses the issue of the Team Leader and other team members.

4.4.1 If the Team Leader is selected by the Head of Department or other key management personnel, then go to step 4.5.

4.4.2 If the Team Leader is to be selected by the team members, then go to step 4.7.

Sometimes, self-nominations from employees can be used to identify potential team members provided this process is pre-approved by the Head of Department or other key management personnel.

4.5 The selected team leader actively participates in the selection of other team members by evaluating the potential team members who were either nominated by their Head of Department, or identified by self-nominations.

4.5.1 If all nominations are accepted, go to step 4.9. Otherwise proceed to step 4.6.

4.6 The Head of Department (Team Sponsor) or assigned Team Leader discusses the reason a nomination has been denied with the person who made the nomination or the self-nominated employee. Proceed to step 4.9.

4.7 The Head of Department (Sponsor), possibly with other key management, selects the team members by evaluating the potential team members who were either nominated by their department heads, or identified by self-nominations.

4.8 The selected team members elect one member to serve as their Team Leader. See Team Roles and Responsibilities, MSWI 01.1.1, for recommended team leader roles and responsibilities.

TEAM TRAINING

4.9 The Head of Department (Team Sponsor) contacts the Management Representative and schedules the team for training as appropriate.

4.10 The Management Representative arranges to provide the appropriate level of training to accomplish the teams defined task.

4.11 The team defines and develops their roles and responsibilities, and elects a team secretary, if not pre-appointed, asking for outside help or guidance if necessary. See Team Roles and Responsibilities, MSWI 01.1.1, for recommended roles and responsibilities.

TEAM OPERATIONS

4.12 The team schedules and conducts meetings as appropriate, following and documenting the results on the team agenda.

Meetings should not be scheduled if any of the following conditions exist:

◊ The problems/ issues can be addressed quickly by phone, memo, etc.

◊ There is insufficient time for the team leader or team members to prepare for the meeting (agenda, tasks done, training needed, etc.).

◊ The people with the necessary information, expertise, and problem solving skills are not available to attend the meeting.

◊ The team will not have the time and/or support it needs to implement the solutions that result from the meeting.

PERFORMANCE MONITORING

4.13 The Head of Department (Sponsor) who formed the team, monitors the team's progress to ensure that it is working effectively and efficiently.

4.13.1 If the team is functioning effectively and efficiently, then go to step 4.19.

PROBLEM RESOLUTION

4.14 The Head of Department (Sponsor) determines the nature and cause of the team's problem (training, resource/ support, or personnel).

4.14.1 If the cause is a training issue, then go to step 4.15.

4.14.2 If the cause is a resource/support issue, then go to step 4.16.

4.14.3 If the cause is a personnel issue, then go to step 4.17.

4.15 The Head of Department (Sponsor) schedules additional or refresher training with the Management Representative to resolve the problem. When training is complete, go to step 4.19.

4.16 The Head of Department (Sponsor) provides the team with the necessary support, resources, and authority to resolve its problem and fulfill its charter. Go to step 4.19.

4.17 Management Representative meets with the team to resolve the personnel issue(s).

4.17.1 If the problem cannot be resolved quickly and is related to one or more specific members of the team, then go to step 4.18. Otherwise go to step 4.19.

4.18 The Head of Department (Sponsor), possibly consulting with Management Representative, removes the ineffective team member(s), appoints a replacement member(s) (if necessary), and ensures that Management Representative is notified and the changes are documented.

TEAM PROPOSALS & CLOSURE

4.19 The team prepares and provides a report of recommendations to the Head of Department (Sponsor) for his/her review and consideration.

4.19.1 If recommendations are acceptable as is (beneficial and within the team's financial guidelines), and no other departments will be affected by the results, then go to step 4.23. Otherwise, go to step 4.20.

4.20 The Head of Department (Sponsor) arranges a meeting of all affected divisions to review, discuss, and decide to what extent the team's recommendations will be implemented, arranging for a verbal presentation by the team if appropriate.

4.20.1 If the recommendations are rejected as is but can be modified and considered again, then go to step 4.21.

4.20.2 If the recommendations are totally rejected, then go to step 4.22.

4.20.3 If the recommendations are accepted for implementation as is, then go to step 4.23.

4.21 The Head of Department (Sponsor) meets with the team to discuss ways in which the recommendations could be modified, and requests that the team re-

evaluate their problem analysis and prepare a set of modified recommendations for future consideration. Go to step 4.12.

4.22 The Head of Department (Sponsor) prepares a written report addressing the reasons for rejection of the team's recommendations, meets with the team to discuss the report and the decision to reject the proposals at this time, disbands the team, and files the team's report and subsequent rejection report for the management review process.

END OF PROCEDURE.

ACTING ON RECOMMENDATIONS

4.23 The Head of Department (Sponsor) recognises the team's efforts and good recommendations, and initiates the appropriate action to ensure that the team's recommendations will be implemented according to the defined plan, possibly involving the team's direct efforts in the implementation.

4.24 Once the teams recommendations have been implemented according to the plan, the Head of Department and team jointly check to ensure that the actual results closely match the planned results.

4.24.1 If the actual results provide the benefits and positive results as planned, then go to step 4.26. Otherwise proceed to step 4.25.

4.25 The Head of Department (Sponsor) takes immediate action to stop the negative results and/or effects, meets with the team to discuss ways in which the recommendations and/or implementation plan could be modified, and requests that the team re-evaluate their problem analysis and prepare a set of modified recommendations for future consideration. Go to step 4.12.

4.26 The Department Manager (Sponsor) prepares to acknowledge the team's efforts and results in an appropriate manner, ensures that all the related management system documentation has been revised and reissued as appropriate, records the team's results as a measure of continual improvement, and files the original report and used for evaluation in the management review process.

E.2. TEAM FORMATION, OPERATION, AND DISPERSAL-MANAGEMENT SYSTEM WORK INSTRUCTION (MSWI 01.1.1)

E.2.1. PURPOSE

The purpose of this work instruction is to provide teams with a guide for establishing those roles and the corresponding responsibilities that have been found to be effective in directing a team's operation.

E.2.2. SCOPE

This guide can be used by all types of teams formed at İ.T.Ü Maritime Faculty. However, it is not required that a team follow each guideline in the work instruction.

E.2.3. RELATED PROCEDURES AND OTHER DOCUMENTATION

Procedure No.	Description of Procedure
MSP 01.1	Team Formation, Operation, and Dispersal

E.2.4. ROLE AND RESPONSIBILITY DESCRIPTION

The roles and responsibilities are:

THE TEAM LEADER

Role: Lead team members in activities to complete the defined goals (solving the problem).

Responsibilities:

1. Prior to or during the first team meeting:

◊ To understand what makes a good team leader

◊ Good listening skills

◊ Good organisation and management skills

◊ Good people skills

◊ Good communication skills

◊ Open-mindedness to new ideas

◊ To select appropriate team members (if appropriate)

◊ To make sure there is a Team Secretary (the Team Leader is not eligible)

◊ To provide supplies (binders, forms, etc.) to team members as needed

◊ To make sure that everyone understands the team's goals, and to get consensus

◊ To be sure that team members and the team secretary understand their roles and responsibilities

2. During regular team meetings:

◊ To plan, open, conduct, and close team meetings in an efficient and effective manner

◊ To provide and follow an agenda for team meetings

◊ To take care of the logistics of the meeting (time, place, material needs, etc.)

◊ To "actively listen" to team members

◊ To summarise team decisions and assignments before the end of team meetings

3. Miscellaneous Responsibilities:

◊ To create an environment in which all team members feel free to contribute

◊ To give feedback on the team's progress and accomplishments to management, and other appropriate people outside the team

◊ To get ideas and technical expertise from non-team members as needed

◊ To assign a substitute Team Leader and Team Secretary when required

◊ To make sure that all team members contribute to the team, and report any member that refuses to "add value" to the team

THE TEAM SECRETARY

Role: To record the activities of the team meetings in a clear and efficient manner.

Responsibilities:

1: During team meetings:

◊ Good listening skills

◊ Good communication skills

◊ To take minutes of all team meetings and any other team activities

◊ To ask for clarification of unclear points while taking notes

◊ To contribute as a Team Member

◊ To distribute the minutes prior to the following meeting

◊ To keep a history of minutes for review and to orient new members

◊ To record "action items" and assigned task responsibilities

◊ To review the previous meeting's minutes at the start of each team meeting, and ask if there are any additions or corrections needed

THE TEAM MEMBERS

Role: To actively participate in team meetings and other team related activities to complete the defined goals.

Responsibilities:

1. During team meetings:

◊ To lend technical expertise to the team

◊ To come prepared and on time to meetings

◊ To "actively listen" to the team leader and other team members

◊ To limit discussion to agenda items

◊ To openly participate and seek creative solutions to problems

◊ To participate in establishing, committing to, and executing the team goal(s)

◊ To meet or exceed the expectations for the team in carrying out assignments

◊ To agree to the rules of consensus

E.3. INTERNAL COMMUNICATIONS - MANAGEMENT SYSTEM PROCEDURE (MSP 01.2)

E.3.1. PURPOSE

The purpose of this procedure is to define the steps that İ.T.Ü Maritime Faculty follows to control the receipt and documentation of, and response to internal communications between various personnel and functions at İ.T.Ü Maritime Faculty.

E.3.2. SCOPE

This procedure applies to all internal communication regarding İ.T.Ü Maritime Faculty's environmental aspects and Integrated Management System, and to all İ.T.Ü Maritime Faculty personnel and internal interested parties involved with and/or affected by such communication.

Such communications include, but are not necessarily limited to, İ.T.Ü Maritime Faculty's:

◊ profile

◊ environmental policy, objectives, and targets

◊ environmental management processes

◊ reports on performance with regard to quality and environmental objectives and targets, as determined during audits and management reviews

◊ employee concerns and questions

◊ project studies

Other internal communication mechanisms are included throughout İ.T.Ü Maritime Faculty's Integrated Management System policies and procedures. This procedure addresses clause 4.4.3 in ISO 14001-1996, and Section 1 in İ.T.Ü Maritime Faculty's IMS Manual.

E.3.3. RELATED PROCEDURES AND OTHER DOCUMENTATION

Other Documents	Description of Document
NONE	

E.3.4. PROCEDURE

4.1 The Management Representative investigates the need for internal communication. The investigation can be initiated by, but is not necessarily limited to, the following:

◊ Generation or alteration of IMS polices, procedures, objectives, and/or targets

◊ Progress toward IMS objectives and/or targets

◊ Demonstration of management commitment to the Integrated Management System

◊ Receipt of an employee concern or question

◊ Completion of the Internal Management System Audit and/or Management Review processes

◊ Ineffectiveness of prior internal communications

◊ Initiation and/or completion of the Corrective Action or Preventive Action processes

◊ Upcoming training and/or educational opportunities

4.1.1 If the Management Representative determines that internal communication is not required, then;

END OF PROCEDURE.

4.2 The Management Representative determines the required recipients and interested parties of the communication and constructs the content, format, and method of the communication accordingly.

Information in the communication should be understandable, adequately explained, verifiable, and presented in a consistent form. Methods to be considered include, but are not necessarily limited to:

◊ Bulletin board postings

◊ Posters

◊ Internal newspapers or newsletters

◊ Meetings

◊ Training and/or informational sessions

◊ Memos/ messages

◊ Electronic mail messages

4.3 The Management Representative issues the communication to the required recipients and interested parties.

4.3.1 If the issued communication does not raise any questions, concerns, or requests for further discussion or communication, then go to step 4.5.

4.4 The Management Representative takes appropriate action to address any questions, concerns, and needs for further discussion to ensure that the primary objectives of the internal communication are met.

4.5 The Management Representative evaluates the long term value of the information communicated, and ensures that all relevant information is incorporated into related employee training and/or orientation programs, or the İ.T.Ü Maritime Faculty's documentation as appropriate.

4.6 The Management Representative ensures that future Internal Management System Audit objectives include assessments of the effectiveness of all internal communications issued since the last Internal Management System Audit.

END OF PROCEDURE.

E.4. MANAGEMENT REVIEW OF INTEGRATED MANAGEMENT SYSTEM MANAGEMENT SYSTEM PROCEDURE (MSP 01.3)

E.4.1. PURPOSE

The purpose of this procedure is to define the steps followed to achieve the following objectives of the management system review process ("management review") at İ.T.Ü Maritime Faculty :

1. To assess the effectiveness of the Integrated Management System (IMS) in satisfying the requirements of the International Standard (ISO 9002-1994, and ISO 14001-1996), complying with relevant environmental legislation and regulations, and achieving the İ.T.Ü Maritime Faculty's quality and environmental policies, objectives, and targets as stated in the IMS Manual.

2. To evaluate compliance to any legal or other environmental requirements.

3. To assess likely future requirements to ensure that the IMS will remain suitable and effective.

4. To review the status of departmental documentation, results from internal audits,

status and results from corrective and preventive actions, data on customers' complaints, service defects, concessions granted, environmental assessments, and any additional quality and environment related information.

E.4.2. SCOPE

This procedure applies to Executive Management, Department Heads, and other key personnel having direct responsibility for the implementation, control, and maintenance of the IMS at İ.T.Ü Maritime Faculty. Specifically, the Department Heads are required to conduct a management review to address the issues stated in the "Purpose", and adhere to the requirements stated in this procedure.

This procedure addresses clause 4.1.3 in ISO 9002-1994 and clause 4.5 in ISO 14001-1996, and Section 1 in İ.T.Ü Maritime Faculty's IMS Manual.

E.4.3. RELATED PROCEDURES AND OTHER DOCUMENTATION

Procedure No.	Description of Procedure
MSP 14.1	Corrective Action Procedure
MSP 14.2	Preventive Action Procedure
Other Documents	**Description of Document**
MSF 01.4.01	Management Review Report

E.4.4. PROCEDURE

4.1 The Management Representative initiates the Management Review process after each internal management system audit, or at a maximum interval of 12 months whatever is most appropriate, by issuing a written request to all Department Heads and checking that they have copies of all relevant audit reports, environmental documentation, and up-to-date reports from quality failure for quality problems in their department.

4.1.1 If the Department Heads have copies of all relevant audit reports, environmental documentation, then go to step 4.3.

The Management Representative is responsible for ensuring that all executive level and department managers understand the management review process and their roles and responsibilities in it.

If a department was not included in the most recent internal management system audit, the management review process is still completed according to these guidelines.

The management review process is an activity separate from the internal audit. Although management review includes the Administrative Executive Committee Meetings which is held weekly basis, Academic Executive Committee Meetings which is held monthly basis, review of audit results, the internal audit cannot be done in lieu of or simultaneously with management review.

4.2 The Management Representative inform regarding with all relevant reports, documentation, and data to the Department Heads as appropriate.

Collecting and maintaining the data necessary for conducting the management review on administrative executive committee reports, academic executive committee reports, corrective action, customer complaints, environmental legislation and regulations, environmental assessments, reported service defects that apply to their department, concessions granted, and other quality results on internal defects is an on-going activity and responsibility - not one that is only done at each management review.

4.3 The Department Heads conduct an objective and thorough review of the IMS in their department(s) by involving lecturers, relevant staff , and other key personnel having direct knowledge of where management system improvements are appropriate or required in light of changing environmental legislation and/or regulation, and responsibility for the implementation, control, and maintenance of the IMS at İ.T.Ü Maritime Faculty.

4.4 Written "reports" using the Management Review Report, MSF 01.4.0.1 that is mentioned in Appendix C, to address the agenda items stated in the "Purpose" and the conclusions reached are submitted by all Department Heads to the Management Representative within 3 weeks after receiving the verbal or written management review request.

4.5 The Management Representative summarises the various individual management review reports and develops a single one year management plan for the faculty.

4.6 The Dean holds an executive level management meeting to review the summarised one year management plan, and integrate the results of the management review process into the faculty's strategic, environmental, and quality plans.

4.6.1 If corrective/ preventive actions are not required as a result of the executive management review meeting, then go to step 4.8.

4.7 Corrective/preventive actions are initiated by the Department Heads according to the Corrective Action Procedure, MSP 14.1, and/or Preventive Action Procedure, MSP 14.2, as appropriate.

4.8 The Management Representative ensures that records of the management reviews (showing how the review was conducted, who was involved, what factors were considered, what conclusions were reached, and what actions were taken) are filed and maintained.

E.5. PREPARATION AND CONTROL OF MANAGEMENT SYSTEM DOCUMENTATION - MANAGEMENT SYSTEM PROCEDURE (MSP 02.1)

E.5.1. PURPOSE

As a means of ensuring that İ.T.Ü Maritime Faculty's training and education services conform to specified requirements, it is essential to establish and maintain a documented management system. The heart of any documented management system is the preparation of related management system procedures (MSPs) and management system work instructions (MSWIs). The purpose of this procedure is to

define the steps followed in the preparation, approval, and distribution of MSPs and MSWIs.

E.5.2. SCOPE

This procedure applies to all departments and personnel initiating or revising MSPs or MSWIs. This procedure addresses clauses 4.2.2 and 4.5 in ISO 9002 -1994, clauses 4.4.4 and 4.4.5 in ISO 14001-1996, and Sections 2 and 5 in İ.T.Ü Maritime Faculty 's IMS Manual.

E.5.3. RELATED PROCEDURES AND OTHER DOCUMENTATION

Procedure No.	Description of Procedure
MSP 05.2	Management System Manual & Procedures Distribution Revision / Amendment and Abolition

Other Documents	Description of Document
MSWI 02.1.1	Instructions for Developing Management System Documents
MSF 02.1.1.1	Master Management System Procedure Distribution List

E.5.4. PROCEDURE

4.1 Any faculty staff may identify and communicate the need for a new or revised Management System Procedure (MSP) or Management System Work Instruction (MSWI) by contacting Management Representative (MR) at any time.

4.2 The MR reviews the need for a new or revised management system document.

4.2.1 If there is no need, then go to step 4.3.

4.2.2 If a new management system document is needed and approved, then go to step 4.4.

4.2.3 If a revision of an existing document is needed and approved, then go to step 4.9.

4.3 MR informs the requester that the management system document is not needed.

END OF PROCEDURE.

4.4 The MR decides if the new management system document is an MSP or an MSWI.

4.4.1 If the document is an MSP, then go to step 4.5.

4.4.2 If the document is an MSWI, then go to step 4.8.

NEW MANAGEMENT SYSTEM PROCEDURE

4.5 The individual or team (assigned by the MR) defines and documents the purpose, scope, related documents, and then flow charts the process in accordance with Instructions for Developing Management System Documents, MSWI 02.1.1.

4.6 The individual or team reviews the flow chart to decide if it provides sufficient detail and clarity for the document users to do the tasks without additional written steps.

4.6.1 If written steps are necessary, then go to step 4.7.

4.6.2 If written steps are not necessary, then go to step 4.10.

4.7 The individual or team prepares a written draft to supplement the flow chart in accordance with Instructions for Developing Management System Documents, MSWI 02.1.1. Go to step 4.10.

NEW MANAGEMENT SYSTEM WORK INSTRUCTION

4.8 The individual or team (assigned by the MR) documents detailed instructions on how to do a particular task/step, looking for possible improvement opportunities in accordance with Instructions for Developing Management System Documents, MSWI 02.1.1. Go to Step 4.10.

4.9 The assigned individual or team makes the necessary revisions/amendments to the management system document.

4.10 The individual or team forwards the draft to the Department Head affected by the management system document for their review and approval.

4.10.1 If the document requires changes, then go to step 4.11.

4.10.2 If the document is approved, then go to step 4.12.

4.11 The responsible Department Head highlights the required changes directly on the draft and sends it back to the individual or team. Go to step 4.9.

4.12 The Department Head marks the draft as approved and send it to the individual or team for collection and forwarding to Management Representative.

4.13 The MR reviews the draft management system document to ensure that it meets the original intent.

4.13.1 If the draft is approved, go to step 4.14.

4.13.2 If the draft is not approved, go to step 4.11.

4.14 The MR prepares the final version of the document, placing a dashed vertical line in the right-hand margin to denote any current revisions to the document and the final version of the document, placing a bold vertical line in the right-hand margin to denote any current amendments to the document and then adds the procedure to the Master Management System Procedure Distribution List, MSF 02.1.1.1.

4.15 The MR arranges for both "awareness" and "user" training on new documents, distributes the documents to all affected personnel, and stores the master copy of the document in master documentation file for a minimum of the time the document remains active plus one year.

4.16 Upon receiving the distributed documents, department heads place the documents at their points of use, removing and destroying the prior version (if one exists).

END OF PROCEDURE.

E.6. INSTRUCTIONS FOR DEVELOPING QUALITY SYSTEM DOCUMENTS - MANAGEMENT SYSTEM WORK INSTRUCTION (MSWI 02.1.1)

E.6.1. PURPOSE

A clear statement addressing the procedure's intent, focus, and (possibly) importance.

E.6.2. SCOPE

A description of the functional areas, personnel, and other organizational aspects covered and affected by the procedure. The scope also states the specific ISO 9002 and/or ISO 14001 clauses addressed by the procedure, and possibly the section of the Integrated Management System Manual (IMSM) from which the procedure is referenced.

E.6.3. RELATED PROCEDURES AND OTHER DOCUMENTS

A listing of titles and identification numbers of other documents (procedures, work instructions, and/or forms) referenced by the procedure.

Each activity or task (rectangle) should address the following issues:

WHO: Who should do the task? Who is responsible?

WHAT: What needs to be done? What is the task that needs to be accomplished?

WHERE: Where should this task be done? (Include if this is important)

WHEN: When should this task occur? What is the sequence, frequency, etc.?

HOW: How should one do this task? This does not mean a "low level" detailed explanation, but rather reference the work instructions, forms, etc. required to perform a specific step.

RECORDS: State the records generated that show the required step/task has been accomplished.

Always examine the flow chart to identify opportunities for improvement. (eg. look to eliminate or simplify any steps that do not add value, that cause scrap, rework, or other waste, or that may impact the environment.)

Use the following guidelines when documenting procedure steps in the written form:

The written draft should explain each task or activity (rectangle) in the flow chart by using a directive statement specifying who does what, when, where, and how the outcome is verified, or how the task should be done according to a referenced work instruction. (Be as brief as possible, using simple language. One to two short sentences per step is ideal.) Each decision (diamond) should be written as an "If - Then" statement under the appropriate directive statement.

MANAGEMENT SYSTEM WORK INSTRUCTIONS (MSWIs)

Document the step-by-step instructions and information necessary to do a particular task, looking for improvement opportunities. (eg. greater ease, simplicity, clarity, safety, etc.)

Include lists of documents, equipment, tools, materials, etc. necessary to properly perform the task.

Write instructions to be as brief as possible, using simple language. One to two short sentences per step is ideal. Assign each step in the instruction a "step number" for easy reference.

Work instructions consist of part-specific written instructions, flow charts, drawings and/or sketches, specification sheets, checklists, photographs, etc. Such documents are not considered as management system documents, although they are part of the management system. (See MSP 09.1)

MANAGEMENT SYSTEM DOCUMENT NUMBERING

Management system documents are numbered according to the following scheme:

Example 1: MSP 10.1 is the number for the first procedure referenced in the IMS manual section 10, addressing the policy for ISO 9002 clause 4.10.

Example 2: MSWI 18.1.2 is the number for the second work instruction referenced from MSP 18.1 which addresses the procedural steps for ISO 9002 clause 4.18.

Example 3: MSF 13.1.0.1 is the number for the first form referenced directly from MSP 13.1 which is the procedure for clause 4.13. Note the zero indicates that there is no work instruction for this form.

E.7. QUALITY PLANNING - MANAGEMENT SYSTEM PROCEDURE (MSP 02.2)

E.7.1. PURPOSE

The purpose of this procedure is to define the steps that İ.T.Ü Maritime Faculty follows for the quality planning of new or modified services at the faculty's facilities. This procedure is used to ensure that appropriate control plans and product-related work instructions are developed and available, addressing all quality assurance inspection and testing activities with appropriate specifications and acceptance criteria.

E.7.2. SCOPE

This procedure applies to Training Programs which is in compliance with STCW 95 Convention and IMO Model Courses, Quality & Environmental Assurance, Purchasing, Safety, and other personnel involved in quality planning process at İ.T.Ü Maritime Faculty.

This procedure addresses clause 4.2.3 of ISO 9002 - 1994, aspects of clauses 4.3.4 and 4.4.6 of ISO 14001 - 1996, and Section 2 in İ.T.Ü Maritime Faculty's IMS Manual.

E.7.3. RELATED PROCEDURES AND OTHER DOCUMENTATION

Procedure No.	Description of Procedure
MSP 01.1	Team Formation, Operation and Dispersal
MSP 02.1	Preparation and Control of Management System Documentation
MSP 02.3	Environmental Planning
MSP 03.1	Contract Review
MSP 06.2	Purchase Order Generation and Issue
MSP 09.1	Issue and Control of Process Monitoring and Operating Instructions
MSP 18.1	Training Assessment & Delivery

E.7.4. PROCEDURE

4.1 When the need for a new quality plan is identified, the Management Representative establishes a cross-functional Team according to the Team Formation, Operation, & Dispersal Procedure, MSP 01.1.

The team consists of the Management Representative, the appropriate Department Head, other members that may include lecturers, research assistants.

When appropriate in the quality planning process, the Management Representative initiates the Environmental Planning Procedure, MSP 02.3, to ensure that any and all environmental aspects of the quality plan and/or project are identified and that the Environmental Management Program is amended where relevant.

4.2 The team determines whether the "new" plan is entirely new to the faculty's facilities, or if it is a variation of an existing facility.

Management Representative reviews all customer requirements specified in the customer contract according to the Contract Review Procedure, MSP 03.1.

4.3 The Management Representative produces a Quality Assurance Plan using the preliminary list of special process characteristics as a reference, and develops and maintains a project schedule chart to manage the progress of the quality planning process.

4.4 The Management Representative conducts a review of the Assurance Plan and project schedule chart for correctness and consistency.

4.4.1 If the plan and chart are acceptable, then go to step 4.6.

4.5 The Management Representative notes any comments or concerns, and forwards the plan and chart back to the team for revision. Go to step 4.3.

4.6 The Team reviews the need for establishing a prototype plan.

4.6.1 If there is no need to specify a prototype, then go to step 4.10.

4.7 The team assists in the development of the prototype plan and gives necessary input to ensure the special process characteristics are included in this plan.

İ.T.Ü Maritime Faculty uses the prototype plan to specify the necessary process parameters and dimensional measurements (including initial and boundary conditions) and tests that will be performed during the establishment of project.

4.8 The prototype that was established is reviewed by the team to ensure that it follows the prototype plan.

4.8.1 If the prototype is acceptable, then go to step 4.10.

4.9 The team ensures that the necessary revisions are made to ensure consistency and compliance between the prototype plan and the conforming process.

4.10 The team finalises the special process characteristics from the specifications (including relevant conventions and rules) and documents the pertinent information on the plan.

4.11 The test method shall necessary to properly verify the special characteristics are identified by the team, documented on the plan, and verified for availability.

4.12 The team assesses feasibility of the proposed process for defining the needs as specified in the contract.

4.12.1 If the process is feasible, then go to step 4.14.

4.13 The team notifies Management Representative and Dean that the project process is not feasible at this time, and all related documentation is maintained by Management Representative for a minimum of two years.

END OF PROCEDURE.

4.14 The team ensures that the appropriate controls or procedure changes are in place to establish new/modified project according to the Preparation and Control of Management System Documentation, MSP 02.1.

This applies to any management system procedures or management system work instructions as appropriate.

4.15 The team assists with the Evaluation Analysis using the special process characteristics to resolve and anticipate any potential process problems.

4.16 If it deems necessary the team develops the pre control plans based on the special process characteristics to control nonconformances during the project trial run.

The plan includes the following additional process controls:

◊ Frequent process inspections

◊ Final check-points

◊ Process audits

4.17 The team develops and documents new, tentative work instructions as needed following the Issue and Control of Process Monitoring and Operating Instructions, MSP 09.1. Go to step 4.19.

4.18 The team modifies existing work instructions and appropriate control plans to accommodate the variations, and thereby generates new tentative work instructions following the Issue and Control of Process Monitoring and Operating Instructions, MSP 09.1.

The work instructions may be structured as a formal control plan, specification sheet, job routing or a combination of these or other formats. In total, the work instructions address the required processing steps, reference-appropriate management system documents (MSPs, MSWIs, and MSFs), define the critical quality characteristics requiring verification, list verification methods, frequency, and specific acceptance criteria, and provide instructions necessary to ensure process conformance to specified requirements.

4.19 The team identifies and defines the necessary quality control inspection and testing activities develops new quality control tests in cases where existing tests are not appropriate, and documents appropriate specifications and acceptance criteria for process control and the final project using the Issue and Control of Process Monitoring and Operating Instructions, MSP 09.1.

4.20 The team determines the equipment, tools like computer, stationary etc. needs for the new project.

4.20.1 If the equipment, tools are currently used for existing projects, go to step 4.22.

4.21 The team determines appropriate quality control receiving inspection and testing activities and related specifications, for subcontractors to the Faculty Secretary for documentation according to the Purchase Order Generation and Issue Procedure, MSP 06.2.

4.22 The work instructions identified with an expiration date are issued to appropriate project and verification personnel and training is provided and documented (as appropriate) by Management Representative and/or the team according to the Training Assessment and Delivery Procedure, MSP 18.1.

4.23 In accordance with the schedule for project and the tentative work instructions, and verification personnel conduct a project trial run and document pertinent

information related to project and quality performance results (changes, notes, problems, special conditions, and so forth) directly on the tentative work instructions.

4.24 At the final stage of the project study, the team reviews the control plan and tentative work instructions, and evaluates all the feedback information obtained by verification personnel.

The feedback information includes an evaluation of the project.

4.24.1 If quality improvements are not necessary, go to step 4.26.

4.25 If it deems necessary the work instructions and other related documentation are modified by the team and other qualified personnel.

4.26 The team reviews and develops the plan from the results of the process trial run.

The plan is the final phase after the pre control plan and is a "living document", reflecting any changes of controls made after evaluating process output

4.27 The team ensures the work instructions will be finalised and any new work instruction will be reviewed, approved, issued and controlled according to Issue and Control of Process Monitoring and Operating Instructions, MSP 09.1.

4.28 The team submits the project and appropriate documentation to the customer for final review and approval.

4.28.1 If the plan and supporting documentation are acceptable, then go to step 4.30.

4.29 The team makes whatever changes are necessary to the project plan and other documents to satisfy the customer's requirements.

4.30 All documentation related to the project is filed and maintained by the Dean for two years.

END OF PROCEDURE.

E.8. ENVIRONMENTAL PLANNING - MANAGEMENT SYSTEM PROCEDURE (MSP 02.3)

E.8.1. PURPOSE

The purpose of this procedure is to define the steps that İ.T.Ü Maritime Faculty follows in the process of environmental planning. This procedure is used to ensure that the environmental aspects and related significant environmental impacts of İ.T.Ü Maritime Faculty's activities, products, and services are identified, and that these impacts are considered in setting İ.T.Ü Maritime Faculty's environmental objectives, targets, and management programs. This procedure also addresses the steps followed to identify and have access to legal and other requirements (Environmental Law 2872) that are applicable to İ.T.Ü Maritime Faculty's environmental aspects. When new laws, regulations and rules will come into force or any amendment into the existing law, Government shall inform the Faculty about the requirements of laws, regulations and rules.

E.8.2. SCOPE

This procedure applies to Quality & Environmental Assurance, Purchasing, Safety, and other personnel involved in the environmental planning process at İ.T.Ü Maritime Faculty in accordance with the Environmental Law 2872.

This procedure addresses clauses 4.3, 4.4.3, and 4.5.1 of ISO 14001:1996 and Section 2 in İ.T.Ü Maritime Faculty's IMS Manual.

E.8.3. RELATED PROCEDURES AND OTHER DOCUMENTATION

Procedure No.	Description of Procedure
MSP 01.1	Team Formation, Operation, and Dispersal
MSP 02.1	Preparation and Control of Management System Documentation
MSP 01.2	Internal Communications

MSP 18.1	Training Assessment and Delivery
MSP 14.1	Corrective Action
MSF 02.3.0.1	Environmental Management Program
MSWI 02.3.1	Guidelines for Identifying and Assessing Environmental Aspects and Impacts

E.8.4. PROCEDURE

4.1 When the need for a new or revised environmental plan is identified, the Management Representative establishes a team according to the Team Formation, Operation, & Dispersal Procedure, MSP 01.1.

The team consists of the Management Representative, the appropriate Department Head, other members that may include, lecturers and employees.

4.2 It is the responsibility of Management Representative to communicate with Local Authority (Tuzla Municipality), suppliers and contractors in liaison with the requirements of environmental management system procedures and work instructions for ensuring and maintaining smooth environmental operation and process. In addition to that the team reviews and revises the rules and regulations as necessary, to identify and have access to all applicable legal and other environmental requirements.

Other requirements to which the faculty may subscribe include, but are not limited to, industry codes of practice, non-regulatory guidelines, and voluntary environmental codes of conduct.

4.3 The team reviews and revises the Environmental Aspects List, MSF 02.3.0.2, the inputs and outputs associated with the current and relevant past activities and applicable legal and regulatory requirements, following the Guidelines for Identifying and Assessing Environmental Aspects and Impacts, MSWI 02.3.1, as necessary.

4.4 The team identifies and reviews the potential environmental impacts related to the identified environmental aspects, following the Guidelines for Identifying and Assessing Environmental Aspects and Impacts, MSWI 02.3.1, as necessary.

4.5 The team evaluates the relative significance of the environmental impacts, following the Guidelines for Identifying and Assessing Environmental Aspects and Impacts, MSWI 02.3.1, as necessary.

4.6 The team establishes, revises, and documents appropriate environmental objectives for each relevant function and level within the organisation on the Environmental Management Program, MSF 02.3.0.4, which are consistent with the environmental policy and commensurable with the significance of the environmental impacts.

Additional considerations in the establishment of environmental objectives include, but are not limited to, results of management and environmental reviews of the Integrated Management System, legal and other requirements, technological options, financial, operational, and views of interested parties.

4.7 The team establishes, reviews, and documents appropriate, specific, measurable, and time-constrained environmental targets on the Environmental Management Program, MSF 02.3.0.4.

4.8 The team establishes and documents a program for achieving the documented objectives and targets on MSF 02.3.0.4, including the designation of responsibilities at each relevant function and level of the organisation and the means and time frame by which they are to be completed.

4.9 The Management Representative ensures that the environmental objectives, targets, and management programs are communicated to all appropriate personnel within the organisation, initiating the Internal Communications Procedure, MSP 01.2, and/or the Training Assessment and Delivery Procedure, MSP 18.1, as appropriate.

4.10 The team considers processes for external communication of its significant environmental aspects, recording their decisions and initiating the external communications as necessary.

4.11 The Management Representative periodically tracks the progress towards the documented environmental objectives and targets, obtaining the needed input from the responsible personnel, and taking action to foster progress towards the target, as necessary.

4.12 The Management Representative evaluates compliance with relevant environmental legislation and regulations at a minimum of one-month intervals, documenting the results of the evaluation and initiating the Corrective Action Procedure, MSP 14.1, as necessary.

4.13 The Management Representative reviews the entirety of the Environmental Management Program at least once a year to ensure that the information is up-to-date.

4.13.1 If the information is not up-to-date, go to step 4.1.

4.14 The Management Representative ensures that all documentation related to the Environmental Planning Process is submitted for the next Management Review and is filed and maintained for a minimum of five years.

E.9. GUIDELINES FOR IDENTIFYING ENVIRONMENTAL ASPECTS AND IMPACTS - MANAGEMENT SYSTEM WORK INSTRUCTION (MSWI 02.3.1)

E.9.1. ENVIRONMENTAL ASPECTS

An environmental aspect is defined as an element of faculty's activities and services which can interact with the environment, signifying the potential of a positive or negative environmental impact.

The identification of environmental aspects includes consideration of normal and abnormal process conditions, as well as potential emergency conditions.

E.9.2. ENVIRONMENTAL IMPACTS

An environmental impact is defined as the change which can take place in the environment as the result of an environmental aspect.

E.9.3. IDENTIFICATION AND ASSESSMENT OF ENVIRONMENTAL ASPECTS AND IMPACTS

Review the operations and other activities of the faculty. Limit the review to those issues that can be expected to be controlled and/or influenced.

Categorise the operations into major functional categories. Each functional category should be large enough for meaningful review, yet small enough to be accurately understood.

For each functional category, identify as many environmental aspects, as defined above, as possible.

For each environmental aspect, identify the related actual and potential, positive and negative, environmental impacts, as defined above.

Evaluate the significance of the environmental aspects, ranking and rating them, if possible.

Tuzla Municipality carries out Garbage Reception Facilities. Relevant care shall be taken by the faculty person who is incharge during the handling process by Tuzla Municipality.

- Chimney emmisions shall be controlled annually by Tuzla Municipality.

- Environmental Internal Performance Criteria shall be controlled by Faculty Secretary on a monthly basis for the purpose of evaluating the cleaning contractors.

Consideration of the significance of environmental impacts should include, but is not limited to, the following criteria:

- scale of the impact

- severity of the impact
- probability of occurrence
- duration of impact
- potential regulatory and legal exposure
- difficulty of changing the impact
- cost of changing the impact
- effect of change on other activities and processes
- concerns of interested parties

In accordance with the above criteria's İ.T.Ü Maritime Faculty's criteria of significancy regarding with the environmental significant impacts are listed below :

1-) If the garbage is not collected in a proper way it shall directly effect the environmental pollution of site.

2-) Recycling or regeneration of paper and glass based garbages shall ensure conservation of natural resources and in addition to that it shall also ensure the improvement of the added values for Governmental Economy.

3-) Cleanliness of the environment directly effects the image of the Faculty, for that reason the necessary attention should be given for the presentation of Faculty

4-) Controlling the amount of chemicals shall reduce the water pollution in swimming pool.

5-) Burners maintenance and control, utilising filters for chimneys shall reduce the air pollution in the site.

6-) Sea water quality shall be traced for preventing the accidental spillage from the sewage system into the sea.

7-) Seafarers has to take necessary precautions for maintenance operations and the bunkering operations in the totally closed lifeboat and service boat in order to prevent oil spillage into the sea. As well as that carrying out planning maintenance system shall allow to reduce the exhaust emissions for preventing the air pollution.

8-) MARPOL and ISM Courses shall improve the students informative background for shipboard operations.

9-) Minimising energy consumption shall ensure economic process operations.

10-) If the outside noise level is below 60 dbs, it has no significant impact on the environment.

11-) Electromagnetic wave emissions in GMDSS laboratory has no significant impact on the environment until the radio waves cause alteration in external devices. Faculty has not received any complaint till now.

Priorities environmental objectives and targets in accordance with the significance assigned to the environmental impacts. The environmental aspects and the impacts of information shall be kept up to date and will be amended in accordance with the new developments and new or modified activities and services.

E.10. CONTRACT REVIEW - MANAGEMENT SYSTEM PROCEDURE (MSP 03.1)

E.10.1. PURPOSE

The purpose of this procedure is to define the steps followed to ensure that all quotations/tenders submitted or contracts/orders received at İ.T.Ü Maritime Faculty are thoroughly reviewed to assure:

1. Adequate definition, detail, and documentation of the faculty's requirements;

2. İ.T.Ü Maritime Faculty is able to meet all contract requirements; and

3. Any differences between the contract requirements and the original quotation/tender are resolved.

E.10.2. SCOPE

This procedure applies to all personnel involved with the review and submittal of quotations/tenders, and the review and acceptance of contracts/orders received by İ.T.Ü Maritime Faculty.

This procedure addresses Clause 4.3 in ISO 9002 -1994 and Section 3 in İ.T.Ü Maritime Faculty's IMS Manual.

E.10.3. RELATED PROCEDURES AND OTHER DOCUMENTATION

Description of Document

Customer Quote Form (CQF), Provision Contract, Clothing Contract

E.10.4. PROCEDURE

□□1□Faculty Secretary receives and handles an inquiry from the Department Heads / Vice Dean regarding the faculty's needs.

4.1.1 If the inquiry is not received by verbal communication, go to step 4.5.

This procedure does not apply if the "inquiry" is a request for equipment/ material or service information only.

VERBAL COMMUNICATION RECEIVED FROM SUPPLIER

4.2 The Faculty Secretary documents the faculty's needs on the appropriate form and reads back the documented information to obtain confirmation, possible clarification, before ending the conversation.

4.2.1 After receiving quotations, if it appears that the faculty has the capability to meet the documented requirements, go to step 4.5.

4.3 The Faculty Secretary informs the supplier that İ.T.Ü Maritime Faculty cannot meet their current requirements, and documents the results of this communication.

4.3.1 If the supplier wishes to change the requirements that inhibit the faculty from meeting the request, then go to step 4.5.

4.3.2 If the supplier does not wish to change the requirements that inhibit the faculty from meeting the request, but there appears to be an opportunity for expanding the faculty's capabilities, then go to step 4.4; otherwise,

END OF PROCEDURE.

4.4 The Faculty Secretary forwards the documented request to the Dean for further evaluation and communication to other departments.

END OF PROCEDURE.

4.5 The Faculty Secretary evaluates the "documented inquiry" to determine the appropriate manner to process it.

4.5.1 If the conditions is a request for a verbal quotation on standard equipment/ material and/or services, go to step 4.6.

4.5.2 If the conditions is a request for a written quotation or a verbal quotation on a non-standard product, go to step 4.7, otherwise proceed to step 4.10.

VERBAL QUOTES ON STANDARD EQUIPMENT/ PRODUCTS/ SERVICES (ADMINISTRATIVE CONTRACTS)

4.6 The Faculty Secretary references the standardised information and provides form the supplier a quotation or cost estimate (as appropriate), sends a written confirmation to the customer to the supplier (if requested), documents the verbally quoted cost on the CQF, and files for one year.

END OF PROCEDURE.

WRITTEN QUOTATION or a VERBAL QUOTATION ON A NONSTANDARD EQUIPMENT/ PRODUCTS/ SERVICES (ADMINISTRATIVE CONTRACTS)

4.7 The Faculty Secretary reviews the documented specifications on the written quotation to ensure it is sufficient for providing. Faculty Secretary also reviews any other information that İ.T.Ü Maritime Faculty has regarding similar services provided form suppliers in the past, consulting other departments as necessary to determine if the supplier is capable of meeting the faculty's requirements.

4.7.1 If the supplier is unable to meet the faculty's requirements, or if the requirements are not adequate to provide an accurate quote, go to step 4.9.

4.8 The Faculty Secretary submits a written quotation/proposal to the supplier and places the documentation in the supplier's file for one year.

END OF PROCEDURE.

4.9 The Faculty Secretary contacts the supplier to inform them that İ.T.Ü Maritime Faculty cannot provide on the current requirements, and documents the results of this contact.

4.9.1 If the faculty wishes to change any requirements that inhibit the supplier from providing the quotation, return to step 4.7.

4.9.2 If the faculty does not wish to change the requirements, but there appears to be an opportunity for expanding the faculty's capabilities, then go to step 4.4; otherwise,

END OF PROCEDURE

PROJECT OR ACADEMICAL BASED CONTRACTS

4.10 The Dean reviews the documented specifications on the documented order to ensure that there is complete definition and documentation of Customer requirements, the Academical Staff Promotion requirements and Administrative Personnel Promotion requirements, and that agreement exists between the activities (if any) and the current contract requirements.

4.10.1 If the customer's requirements are not complete or are not in agreement with any tender, go to step 4.12.

4.11 The Dean determines if İ.T.Ü Maritime Faculty has the capability, including capacity, to meet the customer's requirements by consulting with other departments as necessary.

4.11.1 If İ.T.Ü Maritime Faculty has the capability to meet all the customer's requirements, go to step 4.13.

4.12 The Dean contacts the customer to discuss the requirements that are not complete, not in agreement with any tender, or those which the faculty is unable to meet, and documents the results of the contact.

4.12.1 If the customer wishes to change any requirements, return to step 4.10.

4.12.2 If the customer does not wish to change the requirements, go to step 4.15.

4.13 The Dean informs the customer that the project is accepted and stores all the documentation in the file for one year.

4.14 Until the requirements are met, the designated project coordinator or Dean continues to verify consulting with other departments as necessary, and advising the customer for the implementation of project process or the changes occurred during the process of project.

END OF PROCEDURE.

CANCELLATION OF CUSTOMER PROEDUCT OR SERVICE ORDER

4.15 The Dean informs the customer (in written form if necessary) that İ.T.Ü Maritime Faculty cannot accept the contract.

4.16 The Dean documents cancellation of the order and files and maintains all applicable documentation in the file for two years.

END OF PROCEDURE.

E.11. CONTROL OF EXTERNAL DOCUMENTS AND DATA MANAGEMENT SYSTEM PROCEDURE (MSP 05.1)

E.11.1. PURPOSE

The purpose of this procedure is to define the steps İ.T.Ü Maritime Faculty follows in controlling documentation and data (of external origin) revision, approval, and issue.

This procedure is used to ensure that external documents and data are properly identified and controlled, that they are available at the appropriate locations, that the use of outdated or obsolete data or standards is prevented, and that any obsolete documents retained for legal and/or knowledge preservation purposes are suitably identified.

E.11.2. SCOPE

This procedure applies to all personnel assigned to handle, use, or issue environmental documentation and/or documents and data of external origin that are used to maintain product quality.

Controls of revisions to management system (i.e., procedures, work instructions, records) are governed by the following procedures:

a.) Management System Manual Procedures Distribution Revision Amendment and Abolution Procedure, MSP 05.2

b.) Preparation and Control of Management System Documentation Procedure, MSP 02.1

c.) Issue and Control of Process Monitoring and Operating Instructions, MSP 09.1

This procedure addresses clause 4.5 in ISO 9002-1994, clause 4.4.5 in ISO 14001-1996, and Section 5 in İ.T.Ü Maritime Faculty's IMS Manual.

E.11.3. RELATED PROCEDURES AND OTHER DOCUMENTATION

Procedure No.	Description of Procedure
MSP 02.1	Preparation and Control of Management System Documentation
MSP 05.2	Management System Manual Procedures Distribution Revision Amendment Abolution
MSP 09.1	Issue and Control of Process Monitoring and Operating Instructions

E.11.4. PROCEDURE

All documents and data covered by this procedure shall be controlled by Management Representative for the storage or use of the document/data.

4.1 The appropriate Department Head (or designee) obtains the new/revised document or data of external origin (standards, environmental documentation, and other externally generated documents and data used to provide services which meet defined requirements).

4.1.1 If the document of external origin is new, then go to step 4.3.

4.2 The Department Head (or designee) ensures the document is issued to all current holders or storage locations and stamped with a revision number to prevent unauthorised copies of the "controlled" document. The Head of Department also ensures that the appropriate document register is updated and any obsolete documents are removed from all points of issue/use.

Obsolete documents retained for legal and/or knowledge preservation purposes are stamped "Obsolete - Do Not Use" and segregated to prevent further use.

END OF PROCEDURE

4.3 The Department Head ensures that the document is stamped with a revision number to prevent unauthorised copies, and is available and controlled at all

appropriate locations. The Department Head also establishes and maintains a document register to ensure the most current version of the document is available for use.

END OF PROCEDURE

E.12. MANAGEMENT SYSTEM DOCUMENTATION DISTRIBUTION REVISION, AMENDMEND, ABOLUTION - MANAGEMENT SYSTEM PROCEDURE (MSP 05.2)

E.12.1. PURPOSE

The purpose of this procedure is to define the steps that İ.T.Ü Maritime Faculty follows to issue Integrated Management System (IMS) documentation, or revise/ amend and distribute revisions to existing controlled copies of the IMS manuals.

E.12.2. SCOPE

This procedure applies to all personnel that hold, revise, amend, issue, and control IMS manuals at İ.T.Ü Maritime Faculty.

This procedure addresses clause 4.5.2 of the ISO 9002-1994, clause 4.4.5 in ISO 14001-1996, and Section 5 in İ.T.Ü Maritime Faculty's IMS manual.

E.12.3. RELATED PROCEDURES AND OTHER DOCUMENTS

Procedure No.	Description of Procedure
MSP 02.1	Preparation & Control of Quality System Documentation
MSP 09.1	Issue and Control of Process Monitoring & Operating Instructions
MSWI 02.1.1	Instructions for Developing Quality System Documents

MSF 05.2.1 Revision/ Amendment/ Abolution Requirement & Reply Record

E.12.4. PROCEDURE

4.1 Any faculty staff may request that a IMS manual be issued to them (or others) or request revisions to the IMS documentation by submitting the request to the Management Representative for his review and possible approval.

4.2 The Management Representative reviews the request for possible approval.

4.2.1 If the request is for a revision / amendment and the request receives approval, then go to step 4.7.

4.2.2 If the request is for a new issue of the IMS documents and it receives approval, then go to step 4.4.

4.3 The Management Representative sends the request back to the originator and notifies him/her why the request was not approved.

END OF PROCEDURE.

4.4 Management Representative issues the new IMS documents to the appropriate individual(s) (on the request) and determines if the documents to be issued is "Controlled" or "Uncontrolled".

4.4.1 If the individual receiving the IMS manual controls or influences İ.T.Ü Maritime Faculty's management system, then go to step 4.6.

4.5 Management Representative indicating "Uncontrolled" copy of the IMS documents, types the name of the person receiving the manual on the cover, and does not assign any copy number on the front page. Go to step 4.10.

"Uncontrolled" copies of IMS documents are issued by request on the authority of the Management Representative and are not maintained as part of the document control system at İ.T.Ü Maritime Faculty.

4.6 Management Representative notes the "Controlled" manual on the cover, types the name of the person receiving the copy on the cover, notes the copy number to allow for easy detection of any unauthorized copies of this "Controlled" document, and issues the revised/ amended IMS manual to the appropriate individual. Proceed to step 4.10.

4.7 The Management Representative initiates the revision/ amendment on the IMS documents, identifies the revision/amendment in the revised documents, and removes the prior revision indicators to the affected section(s) of the IMS documents.

Revisions are identified by a dashed vertical line in the right hand margin of the revised IMS documents, amendments are identified by a bold vertical line in the right hand margin of the revised IMS documents and a summary of the changes are noted on the "Revisions/Amendment" page found at the beginning of the Manual.

4.8 Management Representative issues the revised/amended IMS document sections and Revision page to the appropriate individual(s) (on the distribution list).

4.9 Upon receiving the revised/amended sections, the authorised holder of the IMS documents places the revised/amended section into the IMS documents, and removes and disposes of the outdated sections to prevent inadvertent use.

4.10 Management Representative documents the distribution of the IMS manuals and retains one master copy of all outdated IMS document sections for a period of 1 year.

The distribution record contains the following information for controlled copies of the IMS manual:

- Issue date of original copy
- Issued to (department name or title/name of person)
- Copy number
- Date removed (when appropriate)

E.13. SUBCONTRACTOR SUPPLIER SELECTION AND ASSESSMENT MANAGEMENT SYSTEM PROCEDURE (MSP 06.1)

E.13.1. PURPOSE

The purpose of this procedure is to define İ.T.Ü Maritime Faculty's approach to subcontractor evaluation, selection, assessment, and development in order to ensure that materials and services are purchased from subcontractors on the basis of their ability to meet requirements on quality, delivery, cost and environment, as well as management system and other quality and environmental assurance requirements.

E.13.2. SCOPE

This procedure applies to all subcontractors who supply materials and/or services which affect İ.T.Ü Maritime Faculty's process quality or management system, and the personnel who interact with them.

This procedure addresses clause 4.6 of ISO 9002-1994 and Section 6 in İ.T.Ü Maritime Faculty's IMS manual.

E.13.3. RELATED PROCEDURES AND OTHER DOCUMENTS

Procedure No.	Description of Procedure
MSP 06.2	Purchase Order Generation and Issue
MSP 10.1	Receiving Inspection and Testing
	Acquisition Process Records in accordance with the Supply Law numbered 2886 and 1050.

E.13.4. PROCEDURE

All supplies like Fuel Oil, Provision, Faculty Staff Transportation, Stationary etc. are carried out in accordance with the Supply Regulations of İTÜ on behalf of the Government Supply Regulations (Reg. 2886 and 1050), Trade Law and Budget Law.

If this procedure is being used for Supplier Selection, go to step 4.1.

If this procedure is being used for Supplier Assessment, go to Step 4.13.

4.1 When the faculty wishes to purchase products or services that will affect the environment and/or İ.T.Ü Maritime Faculty's quality and customer satisfaction checks the Approved Subcontractor List (ASL) and sends the purchase requisition to supplier in accordance with the supply regulations.

4.1.1 If the subcontractor is currently on the ASL, then go to step 4.12.

This procedure applies to subcontractors / suppliers that provide products or services that can affect quality, customer satisfaction, and the environment.

4.2 The Department Head also issues a request to Faculty Secretary to add a new subcontractor to the ASL at the time the requisition is submitted.

4.3 When Faculty Secretary receives a request to add a new subcontractor/ supplier then he reviews the request and determines if the requested subcontractor can be substituted by another subcontractor already on the ASL.

4.3.1 If an approved subcontractor cannot be substituted, then go to step 4.5.

4.4 The Faculty Secretary advises the requester that another approved subcontractor/ supplier can be substituted. Go to step 4.12.

4.5 The Faculty Secretary consulting with Management Representative decides if the material/service to be purchased will have an effect on the environment or the quality of the process provided to customers.

4.5.1 If the material/service will not have an adverse effect on the environment and İ.T.Ü Maritime Faculty's process quality and customer satisfaction then;

END OF PROCEDURE.

4.6 The Faculty Secretary sends the items which will be supplied to the requested subcontractor.

The items which will be supplied from the requested subcontractor includes specifications of the items, quality restrictions, quantity of item, delivery date conditions.

In an emergency case, due to faculty requirements, an order may need to be placed with a subcontractor prior to the receipt of the completed subcontractor evaluation. Subsequent orders, however, will not be placed until the completed quotations is returned to Purchasing.

4.7 The Faculty Secretary places the order with the subcontractor/ supplier according to the Purchase Order Generation and Issue Procedure, MSP 06.2. Proceed to step 4.8 after the receipt of the completed quotations.

4.8 The Faculty Secretary evaluates the completed quotations upon receipt and determines whether or not the subcontractor meets İ.T.Ü Maritime Faculty's delivery, quality, environmental, cost, and management system requirements.

4.8.1 If the subcontractor does not meet İ.T.Ü Maritime Faculty's requirements and doesn't supply critical components, then go to step 4.9.

4.8.2 If the subcontractor supplies critical components or the assessment of the completed Subcontractor Evaluation Packet is in question, then go to step 4.10.

4.8.3 If the results of the evaluation are favourable, go to Step 4.11.

4.9 The Faculty Secretary documents the reasons on the reverse side of the subcontractor quotation record, places the subcontractor on the unapproved remark, and maintains the record for a period of one year.

END OF PROCEDURE.

4.10 The Faculty Secretary may schedule and perform an on-site management system audit of the subcontractor.

4.10.1 If the subcontractor does not a pass the audit and development of their management system is not feasible, then;

4.11 Faculty Secretary puts the subcontractor's name on ASL.

END OF PROCEDURE.

4.12 Faculty Secretary places the order with the subcontractor/ supplier according to Purchase Order Generation and Issue Procedure, MSP 06.2.

END OF PROCEDURE.

SUPPLIER ASSESSMENT

4.13 The Faculty Secretary determines when a subcontractor should be assessed based on the impact of the subcontractor on the environment and quality of the final product, and assigns to perform the assessment if appropriate.

4.14 The Faculty Secretary determines the number of purchase orders used to assess the subcontractor and receives the information (from the subcontractor's most recent purchase orders) by using earliest evaluations and backgrounds.

4.15 The Faculty Secretary assesses the product of subcontractors according to results of the Receiving Inspection and Testing Procedure, MSP 10.1, documents the findings on the receiving inspection and testing record and forwards the results to Dean for approval.

4.16 A Purchasing associate tallies the subcontractor performance and assigns an overall subcontractor rating, and forwards the form to the Faculty Secretary.

4.17 The Faculty Secretary reviews and evaluates the subcontractor assessment.

4.17.1 If the results of the subcontractor evaluation show that the subcontractor's performance is acceptable to İ.T.Ü Maritime Faculty, then go to step 4.19.

4.18 Faculty Secretary informs the subcontractor that their performance is unacceptable, requests that corrective action be completed within a specified period of time, and places the subcontractor on a probationary status until corrective action is completed or removes the subcontractor from the ASL, as appropriate.

4.19 The Faculty Secretary works with key subcontractors to develop their management system and requests the assistance of the Management Representative, as appropriate.

The development focuses on major subcontractors who supply critical components/services for İ.T.Ü Maritime Faculty's process.

4.20 If the demand occurs from the subcontractor, Faculty Secretary schedules and performs surveillance audits of the subcontractor's management system as determined during subcontractor development.

4.21 The Faculty Secretary communicates the results to the subcontractor.

4.22 The Faculty Secretary documents the decisions made and actions taken on the "comments" maintains these records for a period of one year.

END OF PROCEDURE.

E.14. PURCHASE ORDER GENERATION AND ISSUE - MANAGEMENT SYSTEM PROCEDURE (MSP 06.2)

E.14.1. PURPOSE

The purpose of this procedure is to define İ.T.Ü Maritime Faculty's approach for the generation and issue of purchase orders that are carried out by protocols (contracts) which significantly related with MSP 03.1 Contract Review Procedure, Invitation to Bid and Direct Purchasing in accordance with İTÜ Supply Regulations in accordance with the Governmental Supply Regulations numbered 2886 and 1050 .

E.14.2. SCOPE

This procedure applies to all personnel involved in the purchase of products/services at define İTÜ Maritime Faculty.

This procedure addresses clause 4.6 in ISO 9002 -1994 and Section 6 in define İTÜ Maritime Faculty's IMS manual.

E.14.3. RELATED PROCEDURES AND OTHER DOCUMENTS

Procedure No.	Description of Procedure
MSP 06.1	Subcontractor Selection and Assessment

E.14.4. PROCEDURE

4.1 After receiving a request to initiate a purchase order (PO), the Faculty Secretary determines if the subcontractor for the order is on the Approved Subcontractor List (ASL).

4.1.1 If the subcontractor is on the ASL, then go to step 4.3.

4.2 The Faculty Secretary informs the individual who requested the order and forwards the request to his staff who evaluates the request according to the Subcontractor Assessment and Selection Procedure, MSP 06.1.

END OF PROCEDURE.

4.3 The Faculty Secretary determines whether the order is contract based, bid based or direct purchase.

4.3.1 If the PO is invitation to bid type, then go to step 4.5.

4.4 The Faculty Secretary types the PO form.

4.5 The Faculty Secretary reviews the PO for correctness and authorization.

PO's exceeding 4,000,000,000 TL then it requires invitation to bid for requesting the purchase in accordance with the supply regulations. (If PO's exceeding 60,000,000,000 TL then a permission is requested from the Finance Administration.)

4.5.1 If the PO is correct and authorised, then go to step 4.7.

4.6 The Faculty Secretary contacts the person requesting the PO (if appropriate) and resolves any problems or concerns about the order.

4.7 The PO is filed by the Faculty Secretary.

4.8 The Faculty Secretary prints the PO and determines if the order needs to be expedited.

4.8.1 If the order is not urgent, then go to step 4.10.

4.9 The Faculty Secretary faxes a copy of the PO to the subcontractor and verifies its receipt.

4.10 The Faculty Secretary mails/faxes the PO to the subcontractor, forwards the appropriate copies to Receiving, maintains a copy to place into the master file, and waits for confirmation from the subcontractor.

Special documents (prints, bills of material, other specs, etc.) are included with the PO as appropriate.

4.10.1 If subcontractor acknowledges the order then go to step 4.13.

4.11 The Faculty Secretary makes contact with the subcontractor to determine if the order was received and if there are any questions or problems.

4.11.1 If the order was received, then go to step 4.13.

4.12 The Faculty Secretary faxes the order to the subcontractor, calls to confirm receipt, and addresses any questions/discrepancies as needed, contacting engineering or other personnel who made the request if necessary.

END OF PROCEDURE.

4.13 Assessment category (A: Routine suppliers, B : Suppliers used in emergency or X: Governmental imposed suppliers)

Established suppliers have been categorised and approved by the Faculty Secretary and appear on the current Approved Suppliers List.

All suppliers other than those utilised in an emergency will be approved by Dean. Where a supplier/ sub-contractor not on the approved list has to be used in an emergency, the degree of monitoring of their service will be increased to ensure the faculty's requirements are met.

The down grading of a supplier as a result of poor performance may be carried out by Dean at any time either as a result of his own experience or as result of feed back.

Annual Management Review meetings will address the poor performance of suppliers and sub-contractors to relevant departments and appropriate action will be taken to ensure the maintenance of faculty's standards.

In order to ensure monitoring for the suppliers, unsatisfactory performance will be reported to Dean.

END OF PROCEDURE.

E.15. VERIFICATION AND CONTROL OF CUSTOMER SUPPLIED PRODUCT - MANAGEMENT SYSTEM PROCEDURE (MSP 07.1)

E.15.1. PURPOSE

The purpose of this procedure is to define the steps that İ.T.Ü Maritime Faculty follows to receive, verify, and control customer-supplied equipment/ material, and to ensure that equipment/ material that is lost, damaged, or otherwise unsuitable for use is recorded and reported to the customer.

E.15.2. SCOPE

This procedure applies to all İ.T.Ü Maritime Faculty employees that are involved with receiving and handling materials for the courses which is organised in Maritime Safety Training Center. The course organiser and facilitating staff involved in the course must ensure this procedure is operated.

This procedure addresses clause 4.7 in ISO 9002 - 1994 and Section 7 in İ.T.Ü Maritime Faculty's IMS Manual.

E.15.3. RELATED PROCEDURES AND OTHER DOCUMENTATION

Procedure No.	Description of Procedure
MSP 13.1	Nonconforming Process Review and Disposition

E.15.4. PROCEDURE

4.1 The course organiser will confirm that the customer supplied product conforms to the requirements of the course. When customer-supplied material arrives at İ.T.Ü Maritime Faculty, the assigned Receiving Personnel performs the verification of the material.

This verification activity includes the following checks:

Obvious nonconformances such as damage, defects, improper identification, or nonconformance to specified requirements in accordance with general practice or specific work instructions where appropriate;

1. Agreement between the packing slip and received material;

2. Outgoing inspection records (by the customer/ regulations) or other records such as PO or other verification data, etc., when stated as requirements in the contract.

4.1.1 If no nonconformances are found, proceed to step 4.5.

4.2 The Receiving Personnel initiates the Nonconforming Process Review and Disposition Procedure, MSP 13.1, contacts Faculty Secretary, and proceeds with disposition accordingly.

4.2.1 If immediate return is possible and recommended to Faculty Secretary, go to step 4.4.

4.3 The Receiving Personnel labels the nonconforming material and sends the material to the appropriate holding area and carried out following the Nonconforming Process Review and Disposition Procedure, MSP 13.1. Go to step 4.21.

4.4 The Receiving Personnel loads the nonconforming material back on the delivery truck for return to the customer, makes a notation on the Packing Slip, documenting the condition of the nonconforming material which was returned, and forwards the Packing Slip to Supplier. Go to step 4.21.

4.5 The Receiving Personnel records that customer supplied material does not confirm the specifications.

4.6 The Receiving Personnel determines if the customer-supplied material requires inspection.

4.6.1 If special inspection is required, go to step 4.8.

4.7 The Receiving Personnel signs and dates the Packing Slip and sends the material with the packing slip to the Faculty Secretary. Go to step 4.14.

4.8 The Receiving Personnel sends the material and packing slip to the Inspection Team which shall be established in accordance with Team Formation, Operation and Dispersal Procedure MSP 01.1.

4.9 The Inspection Team determines if processing or use of the material must be initiated before inspection can be completed.

4.9.1 If processing of the material is not urgent, go to step 4.11.

4.10 The Inspection Team records the necessary information about the released material and sends the information to the Faculty Secretary, labels the material to be released.

The Inspection Team continues to inspect the material that has not been released as defined in step 4.11.

4.11 The Inspection Team inspects the material according to the appropriate instructions.

4.11.1 If there are no nonconformances found, then go to step 4.13.

4.12 The Inspection Team initiates the Nonconforming Process Review and

Disposition Procedure, MSP 13.1, consulting Faculty Secretary Go to step 4.21.

4.13 The Inspection Team signs and dates the packing slip, then sends the material for use or storage.

4.14 Upon receiving customer-supplied material, the Faculty Secretary records the necessary information about the received material (part number, documentation provided by the customer, etc.), enters material information into the inventory system.

4.15 The Faculty Secretary determines if the material is needed immediately for processing.

4.15.1 If the material is needed immediately for processing, then go to step 4.17.

4.16 The Faculty Secretary sends the material to the appropriate storage area and updates the status of the material in the inventory system.

END OF PROCEDURE.

4.17 The Faculty Secretary sends the material to the appropriate area for processing or use, and updates the status of the material in the inventory system when appropriate.

4.18 The Operators ensure that customer-supplied material meets required specifications throughout processing or use.

4.18.1 If customer-supplied product is lost, damaged, or otherwise unsuitable for use during processing, go to step 4.20.

4.19 The Operator performs the necessary operations and updates the status of the material in the inventory system as necessary.

END OF PROCEDURE.

4.20 The Operator initiates the Nonconforming Process Review and Disposition Procedure, MSP 13.1.

4.21 The Faculty Secretary obtains and documents the necessary information about the nonconforming customer-supplied material.

END OF PROCEDURE.

E.16. PRODUCT IDENTIFICATION AND TRACEABILITY MANAGEMENT SYSTEM PROCEDURE (MSP 08.1)

E.16.1. PURPOSE

The purpose of this procedure is to define the steps that İ.T.Ü Maritime Faculty follows to identify courses throughout all stages of theoretical and practical training courses and to ensure that course traceability is established and maintained where applicable.

E.16.2. SCOPE

This procedure applies to all courses which are defined in IMO Model Courses and STCW 95 used in processing, as well as the courses which are established for the maritime industrial needs.

This procedure addresses clause 4.8 in ISO 9002-1994 and Section 8 in İ.T.Ü Maritime Faculty's IMS Manual.

E.16.3. RELATED PROCEDURES AND OTHER DOCUMENTATION

Procedure No.	Description of Procedure
MSP 13.1	Nonconforming Process Review and Disposition

E.16.4. PROCEDURE

4.1 Vice Dean who is responsible for Training & Education checks to ensure that all course programs and schedules are clearly identified in Training Curriculum in accordance with the STCW 95 Convention and Faculty Training Rules.

4.1.1 If the course implementation methodology is properly defined, then go to step 4.3.

4.2 The relevant Department Head initiates the Nonconforming Process Review and Disposition Procedure, MSP 13.1.

END OF PROCEDURE.

4.3 The Department Head is responsible for establishing and maintaining the general aspects of the course and the course schedule consulting with the lecturers in faculty.

4.3.1 If part or all of the course schedules and concepts is to be used immediately in processing, then go to step 4.5.

4.4 Vice Dean consulting with the Department Heads and lecturers updates or upgrades the schedules or concepts or methodology of the courses for the purpose of continual improvement taking into account of technological developments and benchmarking utilisations as an annual base.

4.5 Courses shall be carried out in accordance with the course programs and schedules.

4.6 Course evaluation and examinations shall be carried out by lecturers in accordance with the İTÜ and Faculty Training Rules.

4.6.1 If the course is newly generated or modified before the beginning of semester then go to step 4.8.

4.7 Lecturers shall report the results of examination to the Student Administration Division.

4.8 Upon receiving the draft course program the relevant Department Head checks to ensure that the course is properly identified according to the Guidelines for Course Identification, MSWI 08.1.1.

4.8.1 If the course schedule and concepts are properly identified, then go to step 4.10.

4.9 The relevant Department Head initiates the Nonconforming Process Review and Disposition Procedure, MSP 13.1.

END OF PROCEDURE.

4.10 The Department Head performs the final processing and identifying course programs as required by the defined needs.

4.10.1 If the programmed course is ready to be thought , go to step 4.13.

4.11 The Department Head checks to ensure that the programmed course is properly identified by means of a model number, or other pertinent data as required by the examination standard or stated lay outs.

4.11.1 If planned course is properly identified, then go to step 4.13.

4.12 The Department Head initiates the Nonconforming Process Review and Disposition Procedure, MSP 13.1.

END OF PROCEDURE.

4.13 The Vice Dean who is responsible for Training & Education enters the course information into the course programs and maintains it during the life cycle implementation.

END OF PROCEDURE.

E.17. ISSUE AND CONTROL OF PROCESS MONITORING AND OPERATING INSTRUCTIONS - MANAGEMENT SYSTEM PROCEDURE (MSP 09.1)

E.17.1. PURPOSE

The purpose of this procedure is to define the steps İTÜ Maritime Faculty follows in the issue and control of instructions for process monitoring and operation. This procedure is used to ensure that process monitoring instructions are properly identified, issued, and controlled, for the proper operation of the process are present.

E.17.2. SCOPE

This procedure applies to all personnel who issue and control process monitoring and operating instructions for quality and environmental aspects of İTÜ Maritime Faculty's Integrated Management System.

This procedure addresses clause 4.9 in ISO 9002-1994, clause 4.4.6 and aspects of clause 4.4.2 and 4.5.1 in ISO 14001-1996, and Section 9 in İ.T.Ü Maritime Faculty's IMS Manual.

E.17.3. RELATED PROCEDURES AND OTHER DOCUMENTATION

Procedure No.	Description of Procedure
MSP 18.1	Training Assessment & Delivery

E.17.4. PROCEDURE

4.1 When a course implemented or generated by each department, Department Head obtains and reviews of the current/preliminary process monitoring and operating instructions for the new or existing course specifications.

4.2 Each Department Head contacting with relevant lecturer identifies what tasks are necessary for the lecturer in processing of the course, determines what is not common knowledge, and includes that information in the process monitoring and implementing instructions as appropriate.

4.3 Each Department Head reviews the instructions to check that the designated special characteristics are properly specified in terms of monitoring frequency, criteria for monitoring, etc., to ensure course quality.

4.4 Each Department Head determines the amount and level of information and instructions required for the proper processing of the course, including significant environmental impacts of the activities and potential consequences of departure from specified operating procedures.

4.4.1 If all the necessary instructions and/or information are defined and documented for the lecturers to perform the job, then go to step 4.11.

4.5 Lecturer drafts the appropriate process monitoring and course instructions to address the need.

Process monitoring and instructions at İTÜ Maritime Faculty often include or reference the following information:

- Course name and number keyed to process training
- Current evaluation/date
- Required tools, gages, and other equipment
- Designated special characteristics
- Inspection and test instructions
- Corrective action instructions
- Revision date and approvals
- Visual aids
- Tool change intervals and set-up instructions
- Relevant safety requirements
- Relevant environmental standards, policies, objectives, and targets

4.6 Department Head submits a "draft" set of training programmes and instructions for processing the course to Vice Dean for review and approval who is responsible form training and education.

4.7 If the programme and instructions are approved, then go to step 4.10.

4.8 The Vice Dean who is responsible form training and education highlights any changes or concerns and forwards the program to the relevant Department Head for revision.

4.9 Department Head with the relevant lecturer receives the work instruction(s) and makes the necessary corrections. Go to step 4.6.

4.10 Vice Dean who is responsible form training and education reviews and signs off on the new or revised process monitoring instruction(s).

4.11 Department Head forwards a copy of the approved process monitoring and operating instructions to the appropriate lecturers affected by the instruction(s).

4.12 The appropriate lecturer(s) issues all process monitoring and operating instructions with the course and/or materials, and ensures the students have the necessary training and education.

4.13 The Department Head (or designee) ensures that the documents are available and controlled at all appropriate locations, the most current versions of the documents are available for use, and all obsolete versions are prevented from further use.

4.14 Obsolete documents to be retained for legal and or knowledge preservation are stamped "Obsolete - Do Not Use For Process" and segregated to prevent further use.

E.18. EMERGENCY PREPAREDNESS AND RESPONSE - MANAGEMENT SYSTEM PROCEDURE (MSP 09.2)

E.18.1. PURPOSE

The purpose of this procedure is to define the steps İTÜ Maritime Faculty follows for preparing for, preventing, and responding to accidents and emergency situations, particularly where there may be a significant impact on the environment.

This procedure is used to ensure that potential accidents and emergency situations are identified and prevented and that emergencies and serious environmental impacts are mitigated.

E.18.2. SCOPE

This procedure applies to all personnel performing activities which may adversely affect the environment and those personnel who may be affected by any accident or emergency situation at İ.T.Ü Maritime Faculty.

Such situations include, but are not limited to, the following:

- Fires
- Chemical spills
- Internal accidents
- Earthquakes

This procedure addresses clause 4.4.7 in ISO 14001-1996, and Section 9 in İ.T.Ü Maritime Faculty's IMS Manual.

E.18.3. RELATED PROCEDURES AND OTHER DOCUMENTATION

Procedure No.	Description of Procedure
MSP 01.1	Team Formation, Operation, and Dispersal
MSP 01.2	Internal Communications
MSP 02.3	Environmental Planning
MSP 17.1	Internal Management System Audits
MSP 18.1	Training Assessment & Delivery

E.18.4. PROCEDURE

Proceed to Step 4.1 to address the procedure steps for Emergency Preparedness. Proceed to Step 4.6 to address the steps for emergency Response.

EMERGENCY PREPAREDNESS

4.1 The Management Representative identifies potential emergencies and environmental impacts which may occur at İTÜ Maritime Faculty.

The results of the Environmental Planning Procedure, MSP 02.3, and the Internal Management System Audits Procedure, MSP 17.1, are used as inputs.

4.2 The Management Representative takes appropriate actions to prevent the occurrence of the identified potential emergencies and environmental impacts and to minimise any environmental impacts that may be associated with them.

Preventive activities may include, but are not limited to, the following:

- Formation of appropriate teams, such as control teams and emergency medical personnel according to the Team Formation, Operation, and Dispersal Procedure, MSP 01.1.
- Construction of appropriate emergency response and evacuation procedures and plans and hazards analyses.
- Posting of appropriate personal protective equipment, emergency equipment, emergency signs, and instructions.
- Training of İTÜ Maritime Faculty personnel in emergency preparedness, response, mitigation, and evacuation according to the Training Assessment and Delivery Procedure, MSP 18.1.

4.3 The Management Representative tests the adequacy of all emergency preparedness and response procedures, plans, etc., through the use of emergency drills at a minimum of six month intervals.

4.3.1 If the test shows the procedure to be adequate then,

4.4 The Management Representative revises the emergency preparedness and response procedures, plans, etc.

4.5 The Management Representative ensures that any changes to emergency preparedness and response procedures, plans, etc., are communicated to the appropriate personnel according to the Internal Communications Procedure, MSP 01.2, and/or the Training Assessment and Delivery Procedure, MSP 18.1.

END OF PROCEDURE.

EMERGENCY RESPONSE

4.6 Any employee may identify and communicate the need for emergency response by contacting the Management Representative at any time.

4.7 The Management Representative reviews the need for emergency response.

4.7.1 If emergency response is required, go to step 4.9.

4.8 The Management Representative notifies the requester that emergency response is not needed at this time.

END OF PROCEDURE.

4.9 The Management Representative invokes the Emergency Response Plan, or deploying the appropriate emergency response teams and/or contacting the appropriate emergency responders.

4.10 The Management Representative invokes the Internal Communications Procedure, and/ or the external communications as appropriate.

4.11 The Management Representative reviews the emergency preparedness and response procedures after the occurrence and mitigation of the accident or emergency situation.

4.11.1 If the review shows the procedure not to be adequate, then go to step 4.4, otherwise,

E.19. RECEIVING INSPECTION AND TESTING - MANAGEMENT SYSTEM PROCEDURE (MSP 10.1)

E.19.1. PURPOSE

The purpose of this procedure is to define the steps İ.T.Ü Maritime Faculty follows to inspect and verify conformance of incoming product to the specified requirements. In particular, this procedure ensures that:

1) Incoming material is not used or processed until it has been inspected or otherwise verified as conforming to specified requirements.

2) Material that is released for urgent use is done so under positive recall procedures.

E.19.2. SCOPE

This procedure applies to all materials/ equipment related to the management system and supplied to İ.T.Ü Maritime Faculty by outside subcontractors and to all İ.T.Ü Maritime Faculty employees who are involved with receiving materials into inventory or service.

This procedure addresses clause 4.10 in ISO 9002-1994 and Section 10 in İ.T.Ü Maritime Faculty's IMS Manual.

E.19.3. RELATED PROCEDURES AND OTHER DOCUMENTATION

Procedure No.	Description of Procedure
MSP 13.1	Nonconforming Process Review and Disposition
MSP 08.1	Product Identification and Traceability

E.19.4. PROCEDURE

4.1 When material arrives at İ.T.Ü Maritime Faculty, the assigned Receiving Personnel checks the material for the following attributes:

- obvious nonconformances, such as damage, defects, improper identification, or nonconformance to specified requirements in accordance with general practice or product-specific work instructions where appropriate;
- agreement between the Packing Slip and Purchase Order; and
- Other records such as PO or other verification data,

İ.T.Ü Maritime Faculty uses various methods to verify conformance of incoming product such as:

- Receiving inspection and/or testing (e.g., sampling based on performance)
- 2nd or 3rd party assessments or audits of subcontractor locations
- Part evaluation by accredited contractors or test laboratory
- Subcontractor warrants or certifications
- Others

4.1.2 If no nonconformances are found, proceed to step 4.5.

4.2 Receiving initiates the Nonconforming Process Review and Disposition Procedure, MSP 13.1, contacts Faculty Secretary immediately, informs him of the situation

4.2.1 If immediate return is not possible or recommended by Faculty Secretary, then go to step 4.4.

4.3 The Receiving Personnel loads the nonconforming material back on the delivery truck for return to the supplier, makes a notation on the Packing Slip showing the nonconforming material that was returned and its condition.

END OF PROCEDURE.

4.4 The Receiving Personnel labels the nonconforming material and immediately segregates the material until return is determined and carried out following the Nonconforming Process Review and Disposition Procedure, MSP 13.1.

4.5 The Receiving Personnel checks, to determine if the incoming material requires special inspection by the inspection team.

4.5.1 If special inspection is required, then go to step 4.7.

4.6 The Receiving Personnel signs and dates the Packing Slip and sends the material and Packing Slip to the Faculty Secretary. Go to step 4.13.

4.7 The Receiving Personnel sends the material and Packing Slip to Inspection.

4.8 The Inspection team receives the material and determines if the material is needed for urgent service.

4.8.1 If processing and use of the material is not urgent, then go to step 4.10.

4.9 Inspection releases the necessary quantity of material to processing by recording the necessary information about the released material/ equipment, forwarding the information to the Faculty Secretary to allow for immediate recall and replacement in the event that the material/equipment is later found to be defective.

Inspection must be completed for any material/ equipment that is not released as urgent.

4.10 The Inspection team verifies the material/ equipment according to the appropriate work instructions.

4.10.1 If there are no nonconformances found, then go to step 4.12.

4.11 The Inspection team records the results of the inspection on the Packing Slip and/or other inspection records and initiates the Nonconforming Process Review and Disposition Procedure, MSP 13.1.

END OF PROCEDURE.

4.12 The Inspection team signs and dates the Packing Slip and then sends the material with the Packing Slip to the Faculty Secretary.

4.13 Upon receiving material, the Faculty Secretary records the necessary information about the received material (part number, purchasing documentation, etc.), enters the material information into the inventory system.

4.14 The Faculty Secretary labels the material with a İTÜ Maritime Faculty part number and description on a label affixed to the material and/or container as appropriate.

The label should contain the appropriate information as specified in the Product Identification and Traceability Procedure, MSP 08.1.

4.15 The Faculty Secretary determines if the material is needed for processing.

4.15.1 If the material is not needed immediately for processing, then go to step 4.17.

4.16 The Faculty Secretary sends the material to the appropriate processing area and updates the status of the material in the inventory system.

END OF PROCEDURE.

4.17 The Faculty Secretary sends the material to the appropriate storage area and updates the status of the material in the inventory system.

END OF PROCEDURE.

İTÜ Maritime Faculty's In-Process Inspection and Testing and Final Inspection and Testing for the course assessments and evaluations shall be carried out in accordance with the Inspection and Test Status Procedure MSP 12.1.

E.20. INSPECTION AND TEST STATUS - MANAGEMENT SYSTEM PROCEDURE (MSP 12.1)

E.20.1. PURPOSE

The purpose of this procedure define the steps in İ.T.Ü Maritime Faculty to ensure that the inspection and test status of each stage of the process provided by the faculty

are as identified and comply with the Quality and Environmental Management System.

1) Describes the method to be used to identify progress of clients attending training programs.

2) Assessment, evaluation and examinations shall carried out by the İ.T.Ü Maritime Faculty's quality and environmental aspects.

E.20.2. SCOPE

This procedure applies to all courses related to the management system in İ.T.Ü Maritime Faculty and all academical staff are involved with the requirements of this procedure.

This procedure addresses clause 4.12 in ISO 9002-1994 and Section 12 in İ.T.Ü Maritime Faculty's IMS Manual.

E.20.3. RELATED PROCEDURES AND OTHER DOCUMENTATION

Procedure No.	Description of Procedure
MSP 13.1	Nonconforming Process Review and Disposition
MSP 08.1	Product Identification and Traceability
MSP 14.1	Corrective Action
MSP 14.2	Preventive Action
MSP 09.1	Issue and Control of Process Monitoring and Operating Instructions
MSP 02.2	Quality Planning
MSP 16.1	Management System Record Maintenance

E.20.4. PROCEDURE

4.1 All academical staff are responsible for ensuring that the aspects of the faculty's Quality and Environmental Management System are adequate to meet the faculty's policy.

4.2 The Vice Dean who is responsible from training and education is responsible for ensuring that the courses and the assessment of each course is constantly monitored and remains effective in accordance with the faculty's Quality and Environmental Management System.

4.3 The inspections and test shall be carried out for the process of all courses in accordance with International Maritime Organisation (IMO) approved UNDP funded, IMO, Faculty and State Organisation implemented Marine Safety Training Center administrative training/ education policies, rules accepted IMO Model Courses with the authorisation of IMO and the national Faculty Training Rules.

E.21. NONCONFORMING PROCESS REVIEW AND DISPOSITION MANAGEMENT SYSTEM PROCEDURE (MSP 13.1)

E.21.1. PURPOSE

The purpose of this procedure is to define the steps that İTÜ Maritime Faculty follows to document, segregate, evaluate, and dispose/ close out action of process that is suspect or does not conform to specified requirements.

E.21.2. SCOPE

This procedure applies to any personnel involved in or responsible for identification, documentation, segregation (when practical), evaluation and disposition of nonconforming process that are provided to customers and for the notification of the functions concerned.

This procedure addresses clause 4.13 in ISO 9002-1994, aspects of clause 4.5.2 in ISO 14001-1996, and Section 13 in İ.T.Ü Maritime Faculty's IMS Manual.

E.21.3. RELATED PROCEDURES AND OTHER DOCUMENTATION

Procedure No.	Description of Procedure
MSP 13.2	Failure Code Reporting and Feedback
MSF 13-14.1.0.1	Record of Nonconformity and Corrective Action Form

E.21.4. PROCEDURE

4.1 When nonconforming (or suspect) process is discovered, the staff who identified, reports (verbally or written statement) the situation his/her Department Head.

This staff is referred to as the nonconformity raised initiator (NCRI).

The failure code is used as input to the Quality Failure Analysis and Coding Technique (Q-FAC) as a means to analyse defect data and drive a prioritised plan through corrective action.

4.2 The NCRI initiator notifies the relevant Department Head(s) who have been taken the responsibility and authority to perform nonconforming process review and disposition / close out action.

4.2.1 If the review and appropriate disposition/ close out action of the nonconforming process will occur immediately upon its discovery, proceed to step 4.4.

The Department Heads have the knowledge to perform nonconforming process review and disposition/ close out action. These authorised staff (referred to as the review personnel) are responsible for obtaining the information, other knowledgeable personnel, etc., necessary for determining the appropriate review and disposition.

4.3 The review personnel (or assigned personnel) identifies the nonconforming process writes the Record of Nonconformity and Corrective Action Form MSF 13-14.1.0.1 and sends a copy of the form to relevant Department Head. Proceed to step 4.4 when the department responsible is ready to continue review.

The Record of Nonconformity and Corrective Action Form MSF 13-14.1.0.1 stays with the department responsible for review until its disposition/ closed out action is determined.

4.4 The review personnel examines the nature of the nonconformance and determines disposition by addressing the following questions in the order listed:

a) Does the nonconformance affect process performance?

b) Can the process be "reworked" to meet the specified requirements?

c) Can the process be "used as is" with concession?

d) Can the process be "modified" with concession?

e) In the case of rejection process, can the process be regraded for alternative applications?

4.4.1 If the disposition/ close out action decision involves the process being "used as is" or "modified" with concession, then go to step 4.5.

4.4.2 If the disposition/ close out action decision involves visible rework on the exterior of the process, then go to step 4.6.

4.4.3 If neither of the above apply, go to step 4.7.

4.5 The review personnel obtains concession from the parties responsible for specifying the process requirements, analyses and mitigates potential environmental impacts, and documents the actual condition of the process to be put into use. Go to step 4.7.

4.6 The review personnel obtains approval from the Management Representative before performing any rework.

4.7 The review personnel completes the root cause and the result of investigation of the Record of Nonconformity and Corrective Action Form MSF 13-14.1.0.1, and notifies any functions that may be affected by the nonconforming process and/or decisions on its disposition/ close out process.

4.8 If necessary the review personnel compares the intended disposition or close out action with regard to both material/ equipment and process specifications - to the currently approved implementation or plan .

4.8.1 If there are no differences between the intended disposition/ close out action and the approved quality plan, then go to step 4.10.

4.9 The review personnel obtains authorisation from the Management Representative prior to proceeding with disposition/ close out action and ensures that satisfactory continual improvement.

This requirement applies to services from subcontractors as well as in-house process requirements.

4.10 The review personnel sends one copy of the Record of Nonconformity and Corrective Action Form MSF 13-14.1.0.1 to Management Representative, and ensures that the other copy of the Record of Nonconformity and Corrective Action Form MSF 13-14.1.0.1 remains with the appropriate department until completion of the action to be taken, for initiation of the disposition/ close out action to be taken.

4.11 The appropriate disposition/close out action is carried out by designated personnel in the relevant department.

4.11.1 If the disposition/close out action does not involve repair or rework, then go to step 4.13.

4.12 The Faculty Secretary who has been given the authority and responsibility for inspection re-inspects the reworked or repaired equipment in accordance with the instructions.

4.12.1 If the equipment/ material does not pass re-inspection, go to step 4.2.

4.13 The inspection personnel initials Record of Nonconformity and Corrective Action Form MSF 13-14.1.0.1, and ensures that the equipment/ material is returned to the activity in which the nonconformance was discovered.

4.14 After "disposition" and "close out action to be taken" are completed, the Management Representative closes out the non conformity, stores Record of Nonconformity and Corrective Action Form MSF 13-14.1.0.1 for one year.

4.15 Management Representative reviews the completed Record of Nonconformity and Corrective Action Form MSF 13-14.1.0.1 on a monthly basis for correctness and completeness of all information and enters the non conformity information into the Q-FAC database according to Failure Code Reporting and Feedback, MSP 13.2.

END OF PROCEDURE.

E.22. QUALITY FAILURE CODE REPORTING AND FEEDBACK MANAGEMENT SYSTEM PROCEDURE (MSP 13.2)

E.22.1. PURPOSE

The purpose of this procedure is to define the steps that İ.T.Ü Maritime Faculty follows to quantify and analyse management system nonconformances and to establish a prioritised plan.

E.22.2. SCOPE

This procedure applies to personnel involved in analysing nonconformance data with Q-FACT, communicating the results, or managing related Management System Improvement Teams and/or corrective action activities. This procedure addresses clause 4.13 in ISO 9002-1994, aspects of clause 4.5.2 in ISO 14001-1996, and Section 13 in İ.T.Ü Maritime Faculty's IMS Manual.

E.22.3. RELATED PROCEDURES AND OTHER DOCUMENTS

Procedure No.	Description of Procedure
MSP 01.4	Management Review of the Integrated Management System
MSP 13.1	Nonconforming Process Review & Disposition

MSP 14.1	Corrective Action
MSP 14.2	Preventive Action
MSF 13-14.1.0.1	Record of Nonconformity and Corrective Action Form

E.22.4. PROCEDURE

4.1 Copy of Record of Nonconformity and Corrective Action Form MSF 13-14.1.0.1 (which describe nonconformances and initiate the review and disposition/ close out action of nonconforming process), are distributed to review personnel by Management Representative. (see Nonconforming Product Review & Disposition Procedure, MSP 13.1).

4.2 Management Representative enters the failure code from the nonconformity information into the database on a monthly basis or as required.

4.2.1 If the failure code is complete and appears to be correct, then go to step 4.5.

4.3 Management Representative notifies the department responsible for correcting and preventing the nonconformance and requests a clarification or correction to ensure that the failure code is correct.

4.4 The responsible department investigates the future consideration and situation to clarify or correct any concerns or problems with the currently reported failure code. Return to step 4.2.

4.5 Copies of closed out nonconformities (which describe the action that was taken to correct the nonconformance) are distributed to Management Representative by the department responsible for the action.

4.6 Management Representative adds this information to the appropriate nonconformity record in the database on a monthly basis or as required.

4.7 At the conclusion of three month, Management Representative generates review from the Quality Failure Database and analyses the data to help management system improvement efforts.

A standard Pareto Analysis Report will be generated according to Quality Failure Database. This report is first reviewed by the Management Representative for information on how to focus management system improvement efforts, and is then distributed to all Department Heads. These reports will serve as useful information for the Management Review process (reference Management Review of the Integrated Management System Procedure, MSP 01.4) and the Corrective and Preventive Action processes (reference MSP 14.1 and MSP 14.2).

Open Status Records Reports will be generated according to Quality Failure Database. These reports are reviewed by Management Representative to assess and take action on any appropriate (eg., urgent, outstanding, etc.) "open status records".

4.8 Pareto Analysis Reports, Open Status Records Reports, and Nonconformities raised are maintained by Management Representative for a minimum period of one year.

END OF PROCEDURE.

E.23. CORRECTIVE ACTION - MANAGEMENT SYSTEM PROCEDURE (MSP 14.1)

E.23.1. PURPOSE

The purpose of this procedure is to define the steps followed to initiate, execute, and document corrective action taken in response to nonconformances. Specifically, the Corrective Action Procedure includes the following issues as specified in clause 4.14.2 in ISO 9002-1994 and clause 4.5.2 in ISO 14001-1996:

a) the effective handling of customer complaints and reports of process and/or environmental nonconformities;

b) investigation of the cause of nonconformities relating to process and management system and recording the results of the investigation;

c) determination of the corrective action needed to eliminate the root cause of nonconformities;

d) application of controls to ensure that corrective action is taken and that it is effective;

e) taking action to mitigate any impacts caused and for initiating and completing corrective action.

Corrective action is concerned with revising the integrated management system (policies, procedures, instructions, etc.,) to eliminate the root cause of the problem. It is not about putting faulty process right.

E.23.2. SCOPE

This procedure applies to all departments at İ.T.Ü Maritime Faculty where nonconformance to quality or environmental system requirements or customer requirements occurs and corrective action is required and undertaken. This procedure addresses clauses 4.14 in ISO 9002 - 1994 and 4.5.2 in ISO 14001-1996, and Section 14 in İ.T.Ü Maritime Faculty's IMS Manual.

E.23.3. RELATED PROCEDURES AND OTHER DOCUMENTATION

Procedure No.	Description of Procedure
MSP 02.1	Preparation & Control of Management System Documentation
MSP 09.1	Preparation & Control of Process Monitoring and Operating Instructions
MSP 05.1	Control of External Documents and Data

MSP 13.2	Failure Code Reporting and Feedback Procedure
MSF 13-14.1.0.1	Record of Nonconformity and Corrective Action Form

E.23.4. PROCEDURE

4.1 The Management Representative initiates the request for corrective action (CA) and describing the nonconformity on a Record of Nonconformity and Corrective Action Form MSF 13-14.1.0.1

4.1.1 If the corrective action is not in response to a serious nonconformity, then go to step 4.3.

The need for corrective actions is typically identified or triggered by the following situations:

- To eliminate the cause of poor quality process or services identified by the receipt of a customer complaint.
- To resolve nonconformities found during internal, external (customer), or third party audits or management system problems uncovered during the "Management Review" process.
- To address environmental problems and their impacts resulting from a failure of the integrated management system.
- To eliminate the cause of a poor quality process or service, identified by quality failure analysis using (reference Failure Code Reporting and Feedback Procedure, MSP 13.2).

4.2 If necessary the Management Representative specifies the root cause and the result of investigation on the Record of Nonconformity and Corrective Action Form MSF 13-14.1.0.1 that a statement of "proposed corrective action" must be submitted by the responsible Department Head for review by Management Representative prior to initiating the CA activities.

4.3 The Management Representative sends the Record of Nonconformity and Corrective Action Form MSF 13-14.1.0.1 to the responsible Department Head for his/her review and response, and files a copy of the form until the original Record of Nonconformity and Corrective Action Form MSF 13-14.1.0.1 is returned to Management Representative and subsequently filed.

4.4 The Department Head responsible for performing the requested corrective action reviews the Record of Nonconformity and Corrective Action Form MSF 13-14.1.0.1 for understanding and acceptance.

4.4.1 If the details of the nonconformity are understood, correct, and accepted, then go to step 4.8.

4.5 The Department Head documents any questions, concerns, and/or disagreements on the Record of Nonconformity and Corrective Action Form MSF 13-14.1.0.1, and sends it back to the Management Representative.

4.6 The Management Representative communicates with the Department Head to resolve the issues of concern, and comes to a mutual agreement on the status of the CA, documenting any changes on the CA as appropriate.

4.6.1 If it is agreed that the CA (as resolved) is still valid, then go to step 4.8.

4.7 The Management Representative closes out the CA and documents the reasons for its cancellation.

END OF PROCEDURE.

4.8 The responsible Department Head signs the Record of Nonconformity and Corrective Action Form MSF 13-14.1.0.1 as accepted, and initiates appropriate actions to investigate the extent of the problem, the impact of the problem, and determine the root cause(s).

4.8.1 If the problem is not an internal or external nonconformance to a process specification or requirement then go to step 4.10.

External nonconformances may involve process being returned from the customer's, industrial facilities (projects), distribution areas, or dealers.

4.9 The responsible Department Head uses disciplined problem solving methods to perform an appropriate root cause analysis on the process, reviewing the results, and responding in a manner prescribed for situations involving external nonconformances.

4.10 The responsible Department Head determines a course of corrective action and a corresponding implementation plan, and then documents the corrective action and verification of corrective action and "implementation date" on the Record of Nonconformity and Corrective Action Form MSF 13-14.1.0.1.

4.10.1 If the CA does not have a requirement for approval of the proposed corrective action, then go to step 4.15.

4.11 The responsible Department Head maintains a copy of the Record of Nonconformity and Corrective Action Form MSF 13-14.1.0.1, and sends the original to the Management Representative for review and approval of the corrective action.

4.12 The Management Representative reviews the corrective action plan submit.

4.12.1 If the corrective action and implementation date are acceptable, then go to step 4.14.

4.13 The Management Representative sends the Record of Nonconformity and Corrective Action Form MSF 13-14.1.0.1 back to the Department Head for revisions, with the reasons for rejection of the proposed corrective action plan clearly noted. Go to step 4.10.

4.14 The Management Representative signs the Record of Nonconformity and Corrective Action Form MSF 13-14.1.0.1 as "approved", and notifies the Department Head to proceed with the corrective action plan.

END OF PROCEDURE.

4.15 The responsible Department Head initiates and performs the corrective actions according to the plan.

4.16 The Management Representative reviews all "open" corrective action requests at a minimum of 2-week intervals, requesting the status of the corrective actions from the responsible Department Head as appropriate.

4.16.1 If the corrective action appears as if it will be completed on time, then go to step 4.18.

4.17 The Management Representative takes appropriate action to foster the successful completion of the CA by upgrading or downgrading the non conformity.

4.18 When the Department Head feels that the corrective actions specified on the Record of Nonconformity and Corrective Action Form MSF 13-14.1.0.1 are complete and effective, he/she then notifies the Management Representative.

4.19 Management Representative verifies the corrective actions for completeness and effectiveness.

4.19.1 If the "completed" corrective actions are effective, then go to step 4.21.

4.20 The Management Representative issues a revised CA to the responsible Department Head with the requirement of a "proposed corrective action " statement. Go to step 4.3.

4.21 The responsible Department Head initiates appropriate action to implement and record changes in the management system procedures, work instructions, forms, etc., resulting from the corrective action in accordance to the Preparation and Control of Management System Documentation, MSP 02.1, Control of External Documents and Data, MSP 05.1, and/or Preparation and Control of Process Monitoring and Operating Instructions, MSP 09.1.

4.22 The Management Representative completes the authorisation section of the Record of Nonconformity and Corrective Action Form MSF 13-14.1.0.1 and closes out the CA after all affected management procedures, work instructions, etc., are revised and reissued, and ensures that a copy of the completed Record of

Nonconformity and Corrective Action Form MSF 13-14.1.0.1 is filed and maintained by Department Head for a period of four years.

END OF PROCEDURE.

E.24. PREVENTIVE ACTION - MANAGEMENT SYSTEM PROCEDURE (MSP 14.2)

E.24.1. PURPOSE

The purpose of this procedure is to define the steps followed to initiate, execute, and document preventive action taken in response to management system weaknesses (potential causes of nonconformities). Specifically, the Preventive Action Procedure includes the following issues as specified in clause 4.14.3 in ISO 9002 - 1994 and clause 4.5.2 in ISO 14001-1996.

a) the use of appropriate sources of information such as processes and work operations which affect process quality, concessions, audit results, quality and environmental records, and customer complaints to detect, analyze and eliminate potential causes of nonconformities;

b) determination of the steps needed to deal with any problems requiring preventive action;

c) initiation of preventive action and application of controls to ensure that it is effective;

d) confirmation that relevant-information on actions taken is submitted for management review;

e) taking action to mitigate potential environmental impacts and for initiating and completing preventive action.

E.24.2. SCOPE

This procedure applies to all departments at İ.T.Ü Maritime Faculty where weaknesses to quality or environmental system requirements or customer requirements are identified and preventive action is required and undertaken.

This procedure addresses clause 4.14 in ISO 9002-1994 and clause 4.5.2 in ISO 14001-1996, and Section 14 in İ.T.Ü Maritime Faculty's IMS Manual.

E.24.3. RELATED PROCEDURES AND OTHER DOCUMENTATION

Procedure No.	Description of Procedure
MSP 02.1	Preparation & Control of Management System Documentation
MSP 05.1	Control of External Documents and Data
MSP 09.1	Preparation & Control of Process Monitoring and Operating Instructions
MSF 14.2.0.1	Preventive Action Request (PAR) Form

E.24.4. PROCEDURE

4.1 Any staff may initiate a request for preventive action by notifying the Management Representative for a review of the request.

4.1.1 If the request is approved, go to step 4.3.

The need for preventive action is typically triggered by the following situations:

To resolve weaknesses found and capitalise on "opportunities for improvement" identified during internal audits or management reviews.

- To use information such as quality records, concessions, customer feedback, process capability studies, and management review reports to identify, analyse, and eliminate causes of potential nonconformities.

- To address environmental concerns and their potential impacts resulting from a weakness of the integrated management system.

4.2 The Management Representative informs the staff that the preventive action is not needed at this time.

END OF PROCEDURE.

4.3 The Management Representative initiates the request for Preventive Action (PA) by assigning a PA reference number and describing the weakness (potential nonconformance) on the Preventive Action Request (PAR) Form, MSF 14.2.0.1.

4.4 The Management Representative sends the PAR Form to the responsible Department Head for his/her review and response, and files a copy of the PAR Form under the PA reference number for retention until the original PAR Form is returned to Management Representative and subsequently filed.

4.5 The Department Head responsible for performing the requested preventive action reviews the PAR Form for understanding and acceptance.

4.5.1 If the details of the potential nonconformity are understood, correct, and accepted, go to step 4.9.

4.6 The Department Head documents any questions, concerns, and/or disagreements on the PAR Form, and sends it back to the Management Representative.

4.7 The Management Representative communicates with the department manager to resolve the issues of concern, and comes to a mutual agreement on the status of the PAR, documenting any changes on the PAR, as appropriate.

4.7.1 If it is agreed that the PAR (as resolved) is still valid, go to step 4.9.

4.8 The Management Representative closes out the PAR and documents the reasons for its cancellation.

END OF PROCEDURE.

4.9 The department manager signs and dates the PAR Form as accepted, and initiates appropriate actions to investigate the extent of the potential problem.

4.10 The Department Head determines a course of preventive action and a corresponding implementation plan, then documents the "proposed preventive action" and "implementation date" on the PAR.

4.11 The Department Head initiates and performs the preventive actions according to the plan.

4.12 The Management Representative reviews all "open" preventive action requests at a minimum of 4-week intervals, requesting the status of the preventive actions from the responsible Department Head as appropriate.

4.12.1 If the preventive action appears as if it will be completed on time, go to step 4.14.

4.13 The Management Representative takes appropriate action to foster the successful completion of the PAR.

4.14 When the Department Head feels that the preventive actions specified on the PAR are complete and effective, he/she then notifies the Management Representative.

4.15 Management Representative verifies the preventive actions for completeness and effectiveness.

4.15.1 If the "completed" preventive actions are effective, go to step 4.17.

4.16 The Management Representative issues a revised PAR to the Department Head and meets with the department manager as appropriate. Go to step 4.5.

4.17 The Department Head initiates appropriate action to implement and record changes in the management system procedures, work instructions, forms, etc., resulting from the preventive action in accordance to the Preparation & Control of Management System Documentation, MSP 02.1; Control of External Documents and Data, MSP 05.1; and/or Preparation & Control of Process Monitoring and Operating

Instructions, MSP 09.1.

4.18 The Management Representative completes the verification section of the PAR Form and closes out the PA after all affected management procedures, work instructions, etc., are revised and reissued, and ensures that a copy of the completed PAR Form is filed and maintained by Department Head for a period of four years.

4.19 The Management Representative ensures that relevant information on the preventive actions taken is submitted for the next management review.

END OF PROCEDURE.

E.25. HANDLING, STORAGE, PACKAGING, PRESERVATION AND DELIVERY - MANAGEMENT SYSTEM PROCEDURE (MSP 15.1)

E.25.1. PURPOSE

The purpose of this procedure is to define the steps that İ.T.Ü Maritime Faculty follows in order to handle, store, package, preserve, and deliver products. The objective of this procedure is to ensure that materials and products used do not deteriorate or become otherwise damaged.

E.25.2. SCOPE

This procedure applies to all personnel that handle incoming equipment/ material.

This procedure addresses clause 4.15 in ISO 9002-1994 and Section 15 in İ.T.Ü Maritime Faculty's IMS Manual.

E.25.3. RELATED PROCEDURES AND OTHER DOCUMENTATION

Procedure No.	Description of Procedur
MSP 10.1	Inspection and Testing
MSP 06.1	Subcontractor Selection and Assessment

MSP 13.1	Nonconforming Process Review and Disposition
MSP 14.2	Preventive Action

E.25.4. PROCEDURE

4.1 Receiving and handling of equipment/ material shall be carried out in accordance with the Inspection and Testing Procedure MSP 10.1.

4.2 The Faculty Secretary receives and handles all incoming equipment/ material any additional safety regulations in order to ensure staff safety, and to preserve process quality.

4.3 After receipt, designated receiving personnel stores all equipment/ material that is not immediately needed for process in their appropriate storage areas to preserve equipment/ material quality.

4.4 Storage personnel releases equipment/ material to process when requested by Department Heads.

4.5 All in-process equipment/ material is handled by the appropriate staff for ensuring any additional safety regulations in order to ensure staff safety, and to preserve process quality.

İTÜ Maritime Faculty is not concerned with Packaging, Preservation and Delivery, therefore this requirement of the standard is not applicable and is not addressed in the Integrated Management System.

E.26. MANAGEMENT SYSTEM RECORD MAINTENANCE MANAGEMENT SYSTEM PROCEDURE (MSP 16.1)

E.26.1. PURPOSE

The purpose of this procedure is to define the steps that İ.T.Ü Maritime Faculty follows to ensure that all management system records are properly identified, collected, indexed, filed, and stored to allow for ready access and retrieval

Management system records demonstrate İ.T.Ü Maritime Faculty's conformance to its integrated management system, customer, regulatory, and other requirements. Management system records are retained to provide evidence of conformance and to assist in corrective action for management system problems that reveal themselves over time. Archiving system shall be carried out in accordance with the Higher Education Archiving Rules.

E.26.2. SCOPE

This procedure applies to all management system records and all faculty personnel that use, handle, or maintain management system records.

This procedure addresses clause 4.16 in ISO 9002 - 1994, clause 4.5.3 in ISO 14001-1996, and Section 16 in İ.T.Ü Maritime Faculty's IMS Manual.

E.26.3. RELATED PROCEDURES AND OTHER DOCUMENTATION

Procedure No.	Description of Procedure
MSP 01.3	Management Review of the Integrated Management System
MSF 16.1.0.1	Department Management System Records List

E.26.4. PROCEDURE

All İ.T.Ü Maritime Faculty's required management system records and the person(s) responsible for their control are clearly identified in the appropriate procedures and work instructions which comprise the integrated management system.

4.1 When a management system record is needed or generated, the appropriate person (specified in the procedure or work instruction) completes the record.

4.2 The appropriate person conducts a review of the management system record or forwards the record to another designated staff for review, as specified in the procedure or work instruction.

This review ensures that:

- The record is complete and legible.
- All signatures and initials are filled in where necessary.
- The information contained in the record makes sense.
- The information contained in the record is correct and has not been improperly altered.
- Any errors that have been made in the record have been properly corrected, initialed, and dated.
- The environmental records shall include even infringements with legal requirements and their corrective actions.

4.2.1 If the record is acceptable, then go to step 4.5.

4.2.2 If the record is not acceptable but was internally generated, then go to step 4.4.

4.3 The reviewer either sends the record to the Management Representative that created the record for correction, or contacts the Management Representative that created the record for verbal verification of the discrepancy. Go to step 4.5.

4.4 The record is corrected by the reviewer (in consultation with the person who generated the record).

4.5 The reviewer initials and dates the record as complete and forwards it to the Management Representative for record control (or designee) for proper storage.

Records may be accumulated and stored according to the Department Management System Records List, MSF 16.1.0.1, provided the delay in storing does not inhibit information flow or access.

When records are in electronic form, they may be stored as soon as they are reviewed.

4.6 The person responsible for record control places the records in storage according to the Department Management System Records List, MSF 16.1.0.1, ensuring that the contents and the earliest removal date are clearly identified.

Containers for storing management system records may be folders, file cabinets, boxes, computer directories, etc., provided they allow the record to be properly identified and stored so as to minimise deterioration, damage, or loss.

4.7 When a record is needed from storage, the person checking out the record fills in the appropriate sections of the Department Management System Record Checkout Sheet, MSF 16.1.0.2.

When agreed contractually, İ.T.Ü Maritime Faculty makes management system records available to the customer for an agreed period.

4. 8 When the record is returned, the person returning the record enters the date returned and her/his initials in the "Date Returned" block of MSF 16.1.0.2.

4.9 Once a year, the person responsible for record control (or designee) purges all records in storage that are past their retention period and disposes of them according to the Department Management System Records List, MSF 16.1.0.1.

The retention for management system records are specified in the appropriate management system procedures or work instructions.

4.10 In accordance with the Management Review of the Integrated Management System Procedure, MSP 01.4, the Department Head reviews the content of appropriate management system records to assess the need for possible management system corrective or preventive action.

END OF PROCEDURE.

E.27. INTERNAL MANAGEMENT SYSTEM AUDITS - MANAGEMENT SYSTEM PROCEDURE (MSP 17.1)

E.27.1. PURPOSE

The purpose of this procedure is to define the steps that İTÜ Maritime Faculty follows in preparing, performing, documenting, and following up on internal management system audits. İTÜ Maritime Faculty conducts internal management system audits for the following purposes:

1) To verify whether quality and environmental activities and related results comply with planned arrangements, including the requirements of the ISO 9002-1994 and ISO14001-1996 Standards and relevant environmental legislation and regulations.

2) To determine the overall effectiveness of the management system.

3) To provide information on the results of the audit to management for review.

E.27.2. SCOPE

This procedure applies to all faculty personnel who are responsible for planning, development, use, and maintenance of the integrated management system (IMS) at İTÜ Maritime Faculty.

This procedure addresses clause 4.17 in ISO 9002-1994, clause 4.5.4 in ISO 14001-1996, and Section 17 in İ.T.Ü Maritime Faculty's IMS Manual.

E.27.3. RELATED PROCEDURES AND OTHER DOCUMENTATION

Procedure No.	Description of Procedure
MSP 14.1	Corrective Action
MSP 14.2	Preventive Action
MSP 01.3	Management Review of the Integrated Management System

E.27.4. PROCEDURE

This procedure is typically initiated about four to six weeks prior to the execution of an internal management system audit as called for by İTÜ Maritime Faculty's audit schedule.

4.1 All activities in the management system are audited on a regular basis and at a minimum of once per year. Activities are audited more frequently if there are significant changes taking place (eg., high turnover of personnel, changes in relevant environmental regulation or legislation, modified procedures and work instructions, etc.) or if there is a history of problems in that area.

AUDIT PLANNING, COORDINATION, AND PREPARATION

4.2 The Management Representative defines the specific objectives for the upcoming internal management system audit based on the status, maturity, and importance of specific elements in İTÜ Maritime Faculty's management system.

Early audit objectives focus on determining the extent of conformance to established policies, procedures, and practices, as well as determining the extent that established policies, procedures, and practices conform to regulations and standards. (eg., Are we doing what we say we do, and does what we do conform to the requirements of the Standards and the faculty's defined quality and environmental policies?) Whenever there are corrective or preventive actions made to the management system since the last management system audit, follow-up objectives focus on assuring the effective implementation of these changes. When the management system is well established, the later audit objectives focus on seeking ways to improve the effectiveness of the system.

4.3 The internal audit team develops an audit program based upon the defined audit objectives in a format consistent with the Sample Audit Program and sends the proposed program to the Management Representative for review and approval.

4.4 The Management Representative reviews the proposed audit program to ensure that it is consistent with and effective for the defined audit objectives, and marks any suggested revisions directly on the proposed audit program as deemed appropriate.

4.4.1 If the proposed audit program has suggested revisions noted on it, go to Step 4.3.

4.5 The Management Representative sends a copy of the approved audit program and objectives to all Department Heads and other personnel who will be involved in the audit at least two weeks prior to the audit date.

4.6 At least three weeks prior to the audit date, the internal audit team reviews the appropriate management system documentation, records of completed corrective and preventive actions, and past audit findings for the activities to be audited, and then develops a set of checklists for each auditor covering the management system elements and activities to be audited

4.7 The internal audit team sends the checklists to the Management Representative for review, requesting feedback on any questions or concerns regarding the checklists.

4.8 The Management Representative and each audit team member study the checklists to ensure that they understand and agree with each audit item.

4.8.1 If the team member(s) understands and accepts the checklist items, then go to Step 4.10.

4.9 The audit team member(s) contacts the lead auditor to resolve any questions or concerns with the audit checklists and makes revisions as necessary.

INTERNAL MANAGEMENT SYSTEM AUDIT INVESTIGATION

4.10 The internal audit team members informs the Department Heads being audited at the time indicated on the audit program, and briefly review the objectives, scope, and methods for the audit with him/her.

4.11 The lead auditor facilitates the audit investigation based upon the checklists, and ensures that all findings are clearly documented on the checklists, referencing people interviewed, and documents, materials, records, and other items reviewed as appropriate.

The checklists only serve as a guide to the auditors, and other areas may be investigated as deemed necessary by the auditors or as requested by the auditee.

The audit team members act as aids to the lead auditor and investigate items as instructed to do so. The Head of the activity being audited acts as the Department guide and spokesperson, answering questions, observing, and encouraging staff to volunteer information as requested.

4.12 When a nonconformance is identified, the auditor presents the nature of the nonconformity and the evidence to the management spokesperson for verification, addresses any questions or concerns that the management spokesperson may have, and gives advice when requested regarding any problems which are uncovered.

4.12.1 If the nonconformance is confirmed, then go to Step 4.14.

4.13 The lead auditor seeks to resolve issues or concerns to confirm or modify the nonconformance.

4.14 After the facts of the nonconformity are verified (or modified), the auditor either drafts a nonconformance statement in his/her notes and/or checklists when time permits, or documents the necessary information for writing one later (within 7 days of completing the audit).

The nonconformance statement includes the nature of the nonconformity, the factual evidence obtained, and the nature of the requirement that is not being complied with (eg., the appropriate ISO 9000 and/or ISO 14001 Standard clause number, the appropriate management system document section/page/paragraph, what the management spokesperson says is the approved practice, contract requirements, statutory and/or environmental regulations, national standards, and any other relevant requirements).

REPORTING AND FOLLOW-UP

4.15 Within one week of completing the internal audit program, the lead auditor prepares a brief internal audit report and submits it to the Management Representative for review and approval.

The audit report includes the names and titles of the audit team members, a summary of general observations (eg., general degree of compliance and any significant problems encountered), and all statements of nonconformities, weaknesses, and/or opportunities for improvement.

4.16 The Management Representative reviews and approves the internal audit report, and then distributes copies of the entire report to the Department Heads of the audited areas.

Any additional comments or observations that the Management Representative may have attached to the report, but in no case can the auditor's observations be deleted or modified by the Management Representative.

4.17 The Management Representative initiates the Corrective Action Procedure, MSP 14.1 for any nonconformities listed in the Internal Audit Report, and the Preventive Action Procedure, MSP 14.2 for any weaknesses and "opportunities for improvement" identified and documented.

4.18 The Management Representative updates and maintains the long-range audit schedule based upon the documented results of the audit and the planned corrective and preventive actions.

4.19 The QEAM files and maintains the following records for a period of five (5) years:

- Long-range audit schedule
- Internal audit program
- Completed checklists- signed and dated by each auditor
- Audit report

Management reviews are typically held after each internal management system audit and are carried out in accordance with the Management Review of the Integrated Management System Procedure, MSP 01.3.

E.28. TRAINING ASSESSMENT AND DELIVERY - MANAGEMENT SYSTEM PROCEDURE (MSP 18.1)

E.28.1. PURPOSE

The purpose of this procedure is to define the steps that İ.T.Ü Maritime Faculty follows to identify the training needs and provide training for all personnel performing activities affecting quality and/or potentially impacting the environment.

E.28.2. SCOPE

This procedure covers all personnel performing activities affecting the quality of İ.T.Ü Maritime Faculty's process and services and/or potentially impacting the environment. The procedure addresses the assessment of training needs, the process of issuing different types of training to qualify people to perform tasks on the basis of education, training, and/or experience, the mechanisms for delivering training and follow-up, and the means to document training results.

This procedure ensures that all staff are aware of:

1. The importance of, and their individual roles and responsibilities for, conformance to the environmental policy and relevant requirements of the management system, including the Emergency Preparedness and Response Procedure, MSP 09.2.

2. The actual and potential effects on the environment of all staff activities and of departure from specified requirements, and the potential environmental benefits of improved individual performance.

This procedure addresses clause 4.18 in ISO 9002 - 1994, clause 4.4.2 in ISO 14001-1996, and Section 18 of İ.T.Ü Maritime Faculty's IMS Manual.

E.28.3. RELATED PROCEDURES AND OTHER DOCUMENTATION

Procedure No.	Description of Procedure
MSP 09.2	Emergency Preparedness and Response

MSF 18.1.0.1	Training Request Form
MSF 18.1.0.2	In House Training Record

E.28.4. PROCEDURE

4.1 The Department Head reviews the need for training.

The need for training is identified and triggered by situations such as the following:

I. introduction of new technology;

II. changes in relevant environmental legislation or regulation;

III. hiring of service;

IV. significant change in procedure;

V. job reassignment/cross training;

VI. observation of performance problems;

VII. request by staff;

VIII. performance review;

IX. corrective/preventive action processes;

X. management review process.

4.2 The Department Head determines, through discussion with the staff, the amount and type of training needed by comparing the staff's current skill level to the skill level required by the situation/task.

4.2.1 If formal training (eg. training which requires more than simple on-the-job instruction) is required, then go to step 4.4.

4.3 The Department Head assigns staff with the required knowledge and skills to provide instruction and guidance.

4.4 The Department Head and staff jointly determine if the staff has the background and skills necessary to successfully complete the training.

4.4.1 If the staff has the necessary skills, then go to step 4.6.

4.5 The Department Head identifies alternate means of training. Go to step 4.2

4.6 The Department Head or staff completes Section A of the Training Request Form, MSF 18.1.0.1.

4.6.1 If off-the-job training (in-house seminars, training classes, etc.) is needed, then go to step 4.8.

4.7 The Department Head assigns staff with the appropriate skills/knowledge to perform the training and signs Section B of the Training Request Form, MSF 18.1.0.1 indicating approval and issuance of the training. Go to step 4.13.

4.8 The Department Head determines if he/she has the authority to approve off-the-job training.

4.8.1 If the Department Head has the authority, then go to step 4.12.

4.9 The Department Head signs his/her approval on Section B of the Training Request Form, MSF 18.1.0.1 and forwards the form to the Management Representative for approval.

4.10 The Management Representative reviews the request for off-the-job training.

4.10.1 If the request for training is approved, then go to step 4.12.

4.11 The Management Representative or Department Head identifies an alternate form of training. Go to step 4.2.

4.12 The Management Representative or the Department Head completes Section B of the Training Request Form, MSF 18.1.0.1 and makes arrangements for appropriate training.

4.13 When the training is complete, the provider of the training or Department Head completes Section C of the Training Request Form, MSF 18.1.0.1 and attaches appropriate records of training.

The Department Head completes Section C where it is not feasible for the provider of the training (outside seminars, classes, etc.)

4.13.1 If training cost reimbursement is not needed for the off-site training, then go to step 4.17.

4.14 The staff provides receipts for his/her expenses (tuition, books, etc.) to the Department Head.

4.15 The Department Head forwards the receipts to accounting with a copy of the approved training request form.

4.16 Accounting reviews the receipts, issues a check/ cash to staff for the amount on the receipt, and forwards a copy of the check to Management Representative as evidence of payment.

4.17 The Department Head assigns staff with knowledge/skills to provide follow-up training and support to the newly-trained staff.

Follow-up training and support may include observing newly-trained staffs performance, and follow-up discussions on subject, etc.

4.17.1 If training provided information and skills not new to the faculty, then go to step 4.19.

4.18 The Department Head and the staff jointly determine what type of follow-up and support is needed.

4.19 The staff is responsible for follow-up training and support determines effectiveness of training and completes Section D of the Training Request Form, MSF 18.1.0.1.

4.19.1 If the training was sufficient and effective, then go to step 4.21.

4.20 The Department Head takes appropriate action to resolve the issue of insufficient or ineffective training (additional training, additional supervision, etc.).

4.21 The Department Head maintains all Training Request Forms, MSF 18.1.0.1.

END OF PROCEDURE.

CURRICULUM VITAE

He was born in Ankara in 1969. He was graduated TED Ankara College in 1987 and was graduated Maritime Faculty of İstanbul Technical University as a Marine Engineer in 1991. He was graduated master of science program at Institute for Nuclear Energy of İstanbul Technical University in 1995. He is still working as a research assistant in Maritime Faculty of İstanbul Technical University.