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DESIGN AND IMPLEMENTATION OF QUALITY MANAGEMENT SYSTEM - ISO 9001:2000 FOR CONSTRUCTION COMPANIES

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ÖZET

Son yıllarda, küreselleşme ve Avrupa Birliği'nin genişlemesi iç ve dış piyasalarda başarılı olmak isteyen inşaat firmalarının uyması gereken koşulları büyük bir değişime uğratmıştır. Kuşkusuz, ürün kalitesi daha önce hiç olmadığı kadar beklenir hale gelmiş, düşük kalitenin firmalar üzerindeki mali ve ticari yükü önemli düzeyde artmıştır.

Her alandaki üretimin arttığı 1900'lerin ilk yarısının sonlarında üretimle birlikte önceleri hatalı üretimleri yakalamaya yönelik bir kalite eğilimi varken bu yerini zamanla hataları önlemeye daha sonra da devamlı gelişime bırakmıştır. Artık günümüzde toplam kalite yönetiminden bahsedilmektedir.

Kalitenin takibinde firmaların bir kalite çerçevesi oluşturması ve bu çerçeve dahilinde hareket etmesi gerekmektedir. ISO 9001:2000 Kalite Yönetim Sistemi (KYS) uluslararası bir kalite çerçevesi tesis etmektedir.

İnşaat sektöründeki firmaların ISO 9001:2000 KYS uygulamalarına yönelmesinde pek çok nedenler sıralanabilir. Bunlar arasında:

- Kurumsallaşma gayretleri,
- Maliyet ve süre olarak avantaj yaratma ihtiyacı,
- Üretim etkinliği ve verimliliği,
- Kayıpların azaltılması,
- Çalışanlarda bilinç ve motivasyon artışı,
- Hatalı imalat oranının düşürülmesi,
- İç iletişimin geliştirilmesi,
- Personel değişikliklerinde sürekliliğin korunması ve bilginin kaybolmaması,
- Yeni işe alınmış çalışanların yazılı talimatlar sayesinde işe daha hızlı ve kolay uyum sağlamaları,
- İç performans değerlendirme sistemlerindeki gelişim,

- Kalite sistemi uygulamasındaki kayıtların delil olarak kullanılabilmesi,
- İhale dökümanları dahilinde ISO belgesi aranması,
- Müşteri talebi ve memnuniyeti,
- Gerçekleşen işlerdeki kalite artış ihtiyacı,
- Genişleme stratejilerinin bir parçası olması,
- Rekabetçi ortam gereksinimleri,
- Risk yönetimine katkısı,
- Prestij,
- Uluslararası saygınlık,
- Pazarlama ve reklam amacıyla kullanılabilme gibi başlıklar sayılabilir.

Her sistemde olduğu gibi ISO 9001:2000 KYS kullanımında da kullanıcı firmaların tespit ettiği dezavantajlar mevcuttur. Bunlar arasında:

- Bürokrasi artışı,
- Evrak işlerinde çoğalma,
- Yönetime ayrılması gereken zaman miktarında artış,
- Gereksiz yatırıma zorlanma,
- Mükemmeliyetçilik,
- Operasyonlardaki esnekliğin azalması,
- Personel hoşnutsuzluğu,
- Sorumluluk duygusunun kaybolması gibi başlıklar sayılabilir.

ISO 9001:2000 KYS, firma düzeyinde kalitenin sağlanması, korunması ve devam ettirilip geliştirilmesi yolunda firma işleyiş modeline derinlemesine etkide bulunmaktadır. Firmalar için bir kalite standartından bahsedebilmek için ise bu standartların uluslararası standartizasyon ışığında firma bünyesinde saptanması, dökümante edilmesi ve uygulanması gerekmektedir.

Kalite el kitapları, kalite hedef ve politikaları, prosedürler, talimatlar, formlar, kayıtlar ve daha pekçok dökümanın oluşturulmasında önemli bir bilgi birikimi ve emek ihtiyacı vardır. Daha sonra, oluşturulan dökümanlar çerçevesinde yönetilen

kalite sisteminin en üst düzey yöneticiden en alt çalışana kadar bilinir ve işletilir hale getirilmesi ise ayrı bir çaba istemektedir.

Bu çalışmanın oluşturulmasındaki amaç firmaların kendi işleyişleri ile uyumlu bir ISO 9001:2000 KYS geliştirebilmeleri için analitik tasarım yaklaşımı oluşturmaktır. Bunun yanında, firmalarında KYS veya özellikle ISO 9001:2000 sisteminin yapacağı etkiyi görmek isteyen firma yönetim ve icraa kurulu üyeleri, departman müdürleri, idari personel gibi yönetimsel ve/veya teknik kadroya onları bekleyen süreç için yorumlarla birlikte ışık tutmaya çalışmaktır. Çalışmanın hedef kitlesi daha detaylı olarak:

- Üst düzey yöneticiler: Etkin KYS nasıl olur sorusuna cevap arayıp, sistemin şirketin stratejik hedefleriyle uyumlu ve aynı zamanda ekonomik olduğundan emin olmak isteyen,
- İcraa kurulu üyeleri, yardımcıları, süreç yürütücüleri ve ISO 9000 temsilcileri: KYS kapsam ve tasarım detaylarına karar verirken aynı zamanda sistemin etkin biçimde oluşturulacağından emin olmak isteyen,
- Operasyon ve denetim takımı üyeleri: Etkin ISO 9000 döküman setinin tasarım gerekliliklerini bilmek, sistemin etkin olarak yerleştirilmesini denetlenmesini, dinamik düzeltici ve önleyici faliyetler sürecinin doğru yürütülmesini sağlamak isteyen,
- Şirket dışı ISO yürütücüleri: KYS hakkında yeni şirketlere bilgi aktarılması konusunda bağımsız bir kaynaktan hareket etmek isteyen ve masanın karşı tarafında olmanın nasıl olduğu ile ilgilenen,
- Eğitim kursu düzenleyicileri: Referans ve araştırma kaynağı ihtiyacında olan kişilerdir.

Bu hedef doğrultusunda, ISO danışmanları, kalite güvence sorumluları, ISO temsilcileri ve çeşitli kademedeki şirket çalışanları ile yapılan görüşmeler ve başta ISO 9001:2000 KYS dökümanları olmak üzere konuyla ilgili geniş literatür araştırması sonucunda bir inşaat firmasının bünyesinde ISO 9001:2000 KYS yapılandırılmasına ışık tutulmuştur.

ISO 9001:2000 KYS tasarım kuralları, uygulama kullanımını arttırıp sürekli ilerleme için dinamik gösterim geliştirirken, dökümantasyon ihtiyacını etkin bir şekilde azaltmak üzerine kurulmuştur. Çalışma, bir sürecin başından sonuna irdelenmesi şeklinde tariflenmiştir. Öncelikle standartın gereksinimleri ve ana noktaları yorumlanmış, konuyla ilgili tavsiyeler geliştirilmiştir. Standartın değerlendirilerek uygulamaya sokulması firmadan firmaya işleyişte değişiklik gösterdiğinden örnekleme çalışması tüm teze yayılmış ve bu kabul üzerinden ilerlenmiştir. XYZ firması örneğinde yürürken diğer ölçek ve kapsamdaki firmalara da göndermeler yapılarak süreç araştırılmıştır.

İnşaat sektörünün ISO 9001:2000 KYS kapsamındaki farklılaşmalarına değinilerek bu sektördeki özelliklere sistemin yanıtları gözden geçirilmiştir. Bu çerçevede ulusal ve uluslararası değerlendirmelere yer verilmiştir.

Çalışmada standartın her gereksinimine tam uyum ihtiyacı detaylı olarak tariflenmiştir. Çalışma, her ne kadar, standardın operasyonel gücünü ortaya çıkarmak için teknik düzeyde yazışmış olsa da hiyerarşik yapısı ve açıklayıcı tarzı sebebiyle kavramsal doğası basitlikle canlandırılamamıştır. Bu sebepten konunun netlik kazanmasına ve alternatif yollar adreslenmesine gayret gösterilmiştir.

Bölüm İçerikleri

Çalışma etkin KYS oluşturabilmek için bir tasarım kulları seti ortaya koyma gayretindedir. Ayrıntılı olarak standartın her gereksinimine tam uyum ihtiyacı belirtilmiştir. Tamamlayıcı olarak birkaç farklı sistem tasarımı konfigürasyonu da daha az detaylı olarak değinilmiştir. Çalışmanın ana yapısı, hiyerarşik bir akış içerisinde, öncelikle toplam kalite yönetimi tasarımını irdelemektedir. Daha sonra, ayrı ayrı, kalite el kitabı, standartın süreci ve prosedürler, çalışma talimatları, formlar, kayıtlar ile yardımcı tasarım başlıklara değinmektedir. Sektörel değerlendirmeler ve çıkarımlarla sonlanan tezde anlatılan dökümantasyona ait reel XYZ İnşaat Şirketi'nin yine reel olan örnekleri eklenmiştir.

Bölüm 1'de kalite yönetim sisteminin temeli tanımlanmaktadır. Kalite yönetim sisteminin tüm stratejik hedef ve amaçlarında şeffaf olması zorunludur. Bu düşünceyi iletletmek adına bu bölümde, bütünleşmiş stratejik ve kalite bazlı kalite yönetim sistemi tasarımına yönelik birkaç olası seçenek üzerinde durulmuştur. Takip eden açıklamalarda, doğasında yer alan uluslararası ve ulusal sertifika verme avantajından ötürü ISO 9001:2000 uluslararası standardı üzerinden yürünmüştür. ISO 9001:2000 Kalite yönetim sisteminin esasları detaylandırılmıştır (örneğin, dökümantasyon sisteminin üç taşıyıcısı, KYS operasyonel entegrasyonuna destek veren etkinliğin oluşturulması ve gösterimi, KYS süreç modeli, sürekli gelişim döngüleri ve zorunlu dökümantasyon gereksinimleri).

Bölüm 2'de KYS dökümantasyon tasarımı ve etkin dökümante edilmiş kalite yönetim sisteminin temelini oluşturan dört katmanlı dökümantasyon hiyerarşisi üzerinde durulmuştur. Kalite el kitabının tüm kalite yönetim sisteminin etkinliği üzerindeki anahtar rolü detaylı olarak ortaya konmuştur. Daha sonra daha alt katmanlar (örneğin, süreçler, prosedürler, formlar, kayıtlar ve diğer zorunlu dökümanlar) en uygun dökümantasyon yapısını oluşturacak şekilde tanımlanarak KYS hiyerarşisindeki belirli rolleri anlatılmaya çalışılmıştır.

Bölüm 3'de önceki bölümde oluşturulan dökümantasyon yardımıyla KYS kurulumu üzerinde durulmuştur. Bu konuda kullanım kolaylığı oluşturmak amacıyla uygulamadan edinilen püf noktalara değinilmiş, liderlik çalışmasının önemine dikkat çekilmiştir. Dikkatli planlanmış iç denetimin önemli etkisi gibi şirket içi konular aktarılarak sistem sertifikasyon denetimi başlığı altında kalite yönetim sisteminin kurulması tamamlanmıştır.

Bölüm 4'de kurulan sistemin etkinliği konusu araştırılmıştır. Kalite hedefleri tasarımı, formulasyon, uygulama ve analiz konuları irdelenmiştir. Etkinliği arttırmada önemi büyük olan yazım ve yayım teknik ve üslupları detaylandırılmıştır. Etkinliğin teorik faydaları kullanıcı, organizasyonal hedefler ve KYS kapsamında değerlendirilmiştir.

Bölüm 5'de inşaat firmalarının ISO 9001:2000 KYS sistemi üzerine anlayış ve deneyimlerine yer verilmiştir. Sektöre bağlı özellikler vurgulanmaya çalışılarak sistemin kurulmasındaki motivasyonlar, kurulum sonrası faydalar ve sistemin firmalara getirdiği dezavantajlar pratikten alınan bilgilere dayandırılarak aktarılmıştır.

Bölüm 6'da inşaat firmalarında KYS tasarımı ve uygulaması üzerine olan çalışmanın genel değerlendirmesi yapılmıştır. Önerilen tasarım kuralları ışığında oluştulacak, dökümante edilmiş, uygulamaya alınmış ve etkin hale getirilmiş kalite yönetim sisteminin firmanın teknik becerisi, rekabetçi yapısı, kalite taahhütü ve benzersizliği açısından taşıdığı önem ifade edilmiştir.

Eklerde ise bu çalışma kapsamındaki kriterlerle tasarlanmış, uygulamaya sokularak sertifikalandırılmış ve halen işlerliğini güncel olarak sürdüren örnek inşaat firması KYS dökümanlarına yer verilmiştir.

Anahtar Kelimeler: kalite yönetim sistemi, ISO 9001:2000, kalite el kitabı, kalite sertifikası, standardizasyon

SUMMARY

In a world of globalization considering the developing EU issues, the construction companies, whose aim is to achieve success on a national and international platform, have to keep up with the changing requirements of the market. Quality has become one of the major requirements such that the results of poor quality place a great load on the companies in both financially and commercially. So organizations need to act within a quality framework.

This study tries to present an engineering design approach to create a fully compliant and strategically driven ISO 9001:2000 Quality Management System (QMS). The design platform described in the study consists of a set of design tools that can create a fully compliant QMS that addresses a broad audience.

The study supplies a process statement on a hierarchical flow. Since the design and implementation of the standard varies from one organization to another, the case study had become the part of the whole research. While the process had been evaluated on XYZ Construction Company some various scale companies also considered too.

Part Content

A set of design rules is being established for effective QMS creation. In particular, the need for full compliance to each requirement (written as SHALL) of the Standard is addressed in detail. For completeness, several other system design configurations and strategies are also addressed, though in less detail. The overall structure follows a hierarchal flow that first considers the total QMS design issue and then deals separately with the design of the quality manual, standard operating processes and procedures, work instructions, forms, and records, as well as a number of important supplemental design topics.

Part I establishes the basis for QMS design. It is imperative that the QMS be transparent to the overall strategic goals and objectives of the organization. To formalize this concept, this section deals with several possible choices upon which to base an integrated strategic and quality-based QMS design. The ISO 9001:2000 International Standard is chosen for further exposition because of its inherent international and national certification advantage. The fundamentals of ISO 9001:2000 QMS design are then discussed in detail (e.g., the three pillars of documentation, implementation, and demonstration of effectiveness that support QMS operational integrity; the QMS process model; continual/continuous improvement cycles; and mandatory documentation requirements).

Part II deals with QMS documentation design and establishes a four-tier documentation hierarchy as the basis for an effectively documented QMS. The critical role of the quality manual as a key driver to overall QMS effectiveness is discussed in detail. Then, the lower tier documentation (i.e., processes, procedures, forms, records, and other mandatory documents) is addressed in terms of optimum documentation structure and their specific roles in the QMS hierarchy.

Part III deals with QMS implementation that was documented in the previous part. In order to establish practical convenience, the ropes are mentioned and the importance of leadership in underlined. After discussing the impact of carefully planned internal audits the implementation of QMS is completed under the certification audits topic

Part IV deals with the effectiveness of the implemented QMS. The critical area of quality objective design is then discussed in some detail in regard to formulation, implementation, and analysis. Effective writing styles and publication media are addressed to illustrate their impact on QMS effectiveness. Theoretical benefits of the QMS is evaluated by means of readers, organizational objectives and the QMS.

Part V discusses the perception and experiences on ISO 9000 standards in construction companies. The sector specific features are tried to be emphasized. The

motivations to implement QMS, positive and negative outcomes of the system are determined with the help of data taken from practical experiences.

Part VI evaluates the process of design and implementation of QMS for construction companies. It in concluded on the effect that the adherence to the proposed design rules will create a documented, implemented, and systems-effective QMS that is fully compliant with the Standard, and makes a statement about the organization's technical competence, commitment to quality, and enterprise uniqueness.

Several appendixes are also used to present more detail with regard to tool application. They consist of the samples from a construction company's QMS documents, that had been designed, implemented, monitored, certificated within the subjects stated in the thesis and that still sustain their validity.

Key words: quality management system, ISO 9001:2000, quality manual, quality certificate, standardization

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

ASC	**:**	Approved Supplier List
C/I	**:**	Continual Improvement
CAR	**:**	Corrective Action Report
CPD	**:**	Corporate Process Document
CSOP	**:**	Corporate Standard Operating Procedure
DCA	**:**	Document Control Administrator
DQA	**:**	Director of Quality Assurance
DWI	**:**	Divisional Work Instruction
MIS	**:**	Management Information System
MRP	**:**	Material Requirement Plan
NCMR	**:**	Nonconforming Material Report
NCR	**:**	Nonconformance Report
QA	**:**	Quality Assurance
QAT	**:**	Objectives Action Team
QIT	**:**	Quality Improvement Team
QMS	**:**	Quality Management System
QPS	**:**	Quality Policy Statement
RA	**:**	Regulatory Affairs
SCAR	**:**	Supplier Corrective Action Report
SOP	**:**	Standard Operating Procedure
TQM	**:**	Total Quality Management

INTRODUCTION

Quality in a World of Globalization, without question, is needed now as never before. Poor quality, especially in a world of globalization, equates to costs of nonconformance in the area of billions of dollars and, most importantly, oftentimes costs human life.

Quality is the characteristic element of an item that can be evaluated as meeting a standard. If the item meets or exceeds the standard, it is deemed to be of good quality, or high quality. If the item does not meet the standard, it is deemed to be of poor quality. Each installation in construction has several standards of quality: appearance, structural ability, composition, durability, suitability, and quality of workmanship. The acceptability of the installation, and of the project, relies on meeting or exceeding the standards specified.

Quality is an important aspect of the construction project. Time and cost are also important elements of the performance of the construction project, equally as important as quality. A change in the construction cost or budget can have a marked impact on the quality of the project; the duration of the project also can influence the quality of the project.

Acceptable or exceptional quality needs to be achieved on the construction project with each installation, avoiding necessary rework to attain that quality level. Rework of an installation costs more and can also cause delays in the project.

Construction-related firms recognize the need for providing a quality product that will both satisfy the customer and maintain their competitiveness in an ever-changing and demanding market. Quality is considered one of the key transformation elements of project management techniques, deemed necessary for success in the 21st century market place (Kini, 2000). Companies are being persuaded to adopt quality

management systems in order to meet the demands of customers in a globalized market.

The pursuit of quality requires that an organization create a quality framework. The ISO 9001:2000 Quality Management System (QMS) is an internationally established quality framework. This thesis is designed to assist a construction company (an organization) to structure an ISO 9001:2000 QMS on some documentation and implementation concepts.

An effectively designed QMS should do the following:

- Unify the organization's economic needs with its quality requirements;
- Optimize the flow of information to a wide range of users;
- Maintain full compliance with the ISO 9001:2000 International Standard (Standard);
- Provide a dynamic presentation of the organization's drive towards a meaningful ISO 9000 QMS;
- Propose a resolution as to just what a quality manual should contain and thereby provide a basis for a less diverse set of practitioner interpretations.

ISO 9000 is being implemented all over the world as a system of standards related to quality assurance management and control for companies and institutions. These standards were developed by ISO, the International Organization for Standardization, as part of this institution's efforts to promote uniformity and facilitate international exchange between nations. ISO 9000 has gained popularity and is being applied to companies and institutions all over the world due to its generic nature. ISO 9000 certification in the construction industry has been widely accepted in many countries, and the number of certifications for general, heavy and specialty contracting companies is growing considerably. Some investigators (Kubal, 1994) associate ISO 9000 with multiple advantages and with positive changes in internal procedures of construction firms. Yet others (Anitfos, 1996) argue that these standards do not apply

directly to the construction industry and cannot be associated with a substantial improvement in the delivery of a quality construction product.

In a different study (Yates and Anitfos, 1997b), construction companies have generally stated that compliance with ISO 9000 is positive and would increase the industry's competitiveness in local and foreign markets. However, only relatively few construction firms have adapted these standards to their management systems and received ISO 9000 certification.

Quality assurance is important in the engineering and construction industry because of the risk involved in any project. The risk involved in not completing the project on time is high, because many external factors will affect the performance of the project. It is vital that a built-in quality assurance system is developed to avoid any inefficiency that could result in poor quality of products and service being delivered to the customer. Everyone involved in the engineering and construction business has, in different ways, benefited from a common approach to quality work. Systematic quality work reduces the costs of failure in one's own work and in the final product. The standards can make quality work more efficient by creating uniformity. A contractor's in-house quality assurance system is of utmost importance; it prevents problems and their reoccurrence and allows his or her clients to relax.

Today, the reason for the tendency of construction companies to ISO 9001:2000 QMS can be listed as:

- The effort in institutional development,
- The need to create advantage on cost and time of the project realization,
- Productivity and efficiency,
- Reducing the losses,
- Increasing consciousness and motivation within the employees,
- Decreasing the rate of nonconforming construction,
- Improving internal communication,
- Preserving continuity in employee modifications and preventing the loss of important information,

- Easy and rapid adaptation of the latest employees to the work with the documented work instructions,
- Improvements in internal performance appraisal systems,
- Ability to use the QMS records as evidence to conflicts,
- Requirement of ISO certification for some tender documents,
- Customer request and satisfaction,
- Perceiving higher quality of work done,
- Larger improvement strategy,
- Competitive market requirements,
- Better risk management,
- Prestige,
- International respect and recognition,
- Marketing and advert capability.

A successful implementation of ISO 9001:2000 in any type of organization is the result of a fully compliant and strategically driven QMS. The design platform described here consists of a set of design tools that can create a fully compliant QMS whose fabric is an organization's strategic business declaration.

Although this thesis has been considered at a technical level designed to reveal the operational power of the Standard, the conceptual nature of the Standard is not easily envisioned because of its hierarchal nature and descriptive style. The aim is to clarify and to offer alternative ways to address such issues.

The single most difficult aspect in the creation of an effective QMS is the need to create documentation that addresses a broad audience. It is also the most difficult aspect of this design approach, to illustrate how a QMS can be designed to provide the required information for all system users.

Specifically, the thesis has been written for a diverse audience comprising the following:

- Executives who wish to understand what an effective QMS looks like and want to ensure that the system is economically feasible and in concert with the organization's strategic goals;
- Members of steering committees, stewards, process champions, and ISO 9000 management representatives who must decide on the scope and design detail of the QMS configuration and who must ensure that the system is effectively implemented;
- Operational and audit team members who need to understand how to write an effective set of ISO 9000 documents and how to make sure that the system is measured effectively and contains a dynamic corrective and preventive action process.

The case study, which had been spread to whole text, is based on a middle-large scale construction company, XYZ, located in Istanbul who needs to create a QMS from the ground floor. The process is considered as a hierarchical flow and tips, comments and proposals are mentioned during the design and implementation of the system.

AIM OF THE STUDY

The aim of the thesis can be listed mainly as:

- To establish an engineering design approach to create a compliant ISO 9001:2000 QMS. The design rules are constructed to effectively minimize documentation in a way that still increases implementation usage and fosters a dynamic demonstration of continual improvement,
- To provide a reasonable probability of maximized organizational productivity when the ISO 9001:2000 system is implemented,
- To clarify and to offer alternative ways to reveal the operational power of the Standard at a technical level,
- To illustrate how a QMS can be designed to provide the required information for all system users,

- To clarify the effect of QMS, especially ISO 9001:2000 QMS, to the organizations for the members of board of directors, steering committee, department managers, administrative and technical personnel by enlightening the whole process with comments and proposals,
- To establish the usefulness of ISO 9001:2000 QMS to the organizations those have already created a QMS but would like to bring their efforts to a new level of effectiveness.
- To determine whether ISO 9000 is an applicable tool for construction companies.
- To identify the barriers for acceptance to ISO 9000 certification.
- To provide a theoretical background on the issue of quality in construction, on the application of ISO 9000 in the construction industry and on the current status and application of ISO 9000 as part of the management systems of construction firms.

RESEARCH METHODOLOGY

In order to obtain the aim of the study the following research methodology had been established:

- An extensive literature search on quality management and ISO 9001:2000.
- Organized interviews with ISO registrars, consultant organization specialists, trainers, ISO management representatives, members of the board of directors and steering committee, regional coordinators, QA&QC managers, employees at various organizational levels.
- Interpretation of the requirements stated in the Standard and its associated guidelines.

These methods are followed to gain an overall knowledge about the quality management and ISO 9001:2000. Also, especially by the help of the interviews, a contribution to the clarification of the broad range of perspectives is established.

The ISO 9001:2000 international standard of quality management systems – requirements booklet constitutes a main frame where the inner part is more depended on the interpretations of the requirements and comments on the Standard.

Hence the whole study is a process approach; the case study that was carried out within the body of the thesis was not examined at a specific part of the text but whole parts. Also data collected from the literature review is evaluated to point out the positive and negative outcomes of the construction companies for QMS.

PART 1: QUALITY MANAGEMENT SYSTEM (QMS) DESIGN FUNDAMENTALS

It is imperative that the QMS be transparent to the overall strategic goals and objectives of the organization. To formalize this concept, this part deals with several possible choices upon which to base an integrated strategic and quality-based QMS design. The ISO 9001:2000 International Standard is chosen for further exposition because of its inherent international and national certification advantage. The fundamentals of ISO 9001:2000 QMS design are then discussed in detail.

1.1 QMS FOUNDATIONS

The framework for a systematic, engineering approach for the creation of effective QMS is relevant to standards and requires knowledge of process-oriented structures. For this purpose it is possible to mention the concept of core competencies. Once the organization's core competencies have been defined, it is necessary to select a QMS baseline that can result in an effective QMS.

1.1.1 The Relevance of Standards

Management standards are relevant in a world of accelerated technology and rampant globalization. Standards are most useful when applied in a stable and predictable environment. Operating under the conditions of crisis and chaos makes it a must to use management techniques designed to handle large fluctuations. In the end, however, a standard is still necessary that defines the baseline so that measurements of the progress, or lack of progress, are meaningful.

To establish meaningful standards requires that there are universal organizational fundamentals. Such fundamentals must be constant, although the paradigms may shift. However, no matter what the paradigm shift involves, those who lose one cent per item will never make up the loss in volume. Those who do not know what their

customer really needs will still lose to someone else who does. Those who do not cost-reduce their expenses continuously will eventually lose their market dominance. Those who do not periodically offer more performance for the same price will lose their competitive edge. And those who do not nurture their suppliers could lose a month's shipments waiting for a product from a vendor who went bankrupt because the vendor priced the product at a loss to win your contract.

Thus, the development and application of standards to enhance organizational development remains relevant in spite of the overwhelming, constantly changing twenty-first century explosion in technology and globalization. In fact, international and national standards are now in use in over 160 countries to form the foundation for effective quality management systems. The number of Annual Quality Awards now lists at least 119 programs worldwide (Johnson, 2001).

The framework for a systematic, engineering approach for the creation of effective QMSs requires knowledge of process-oriented structures. For this purpose, the following section discusses the concept of core competencies.

1.1.2 Core Competencies

The QMS requirements are superimposed upon the overall operational structure of the organization. The organization is not designed to follow a standard. Standards are used to enhance the effectiveness of the operating system. The operating system is designed to meet the needs of customers as dictated by the organization's market imperatives. The QMS is most effective when it is transparent to the overall strategic goals and objectives of the organization.

The strategic goals and objectives of the organization are embedded within the organization's processes or core competencies (i.e., the overall operational structure of the organization is in the form of core competencies) (Stewart, 2002). Each core competency is characterized by a process that must link seamlessly into the next core

competency to produce an effective overall QMS. The model of a typical QMS is illustrated in Figure 1.1.

As indicated in Figure 1.1, the essential feature of the QMS is the conversion of customer requirements, as defined in a mutually agreed-to specification, into a project or service that satisfies the customer's applications. The critical supplemental feature of the QMS is the ability of the organization to measure and correct both its internal nonconformities that result from its realization activities and its external nonconformities that result from customer usage. The feedback loop entitled "internal nonconformance management" represents the internal nonconformities, and the feedback loop entitled "customer nonconformance management" represents the external nonconformities.

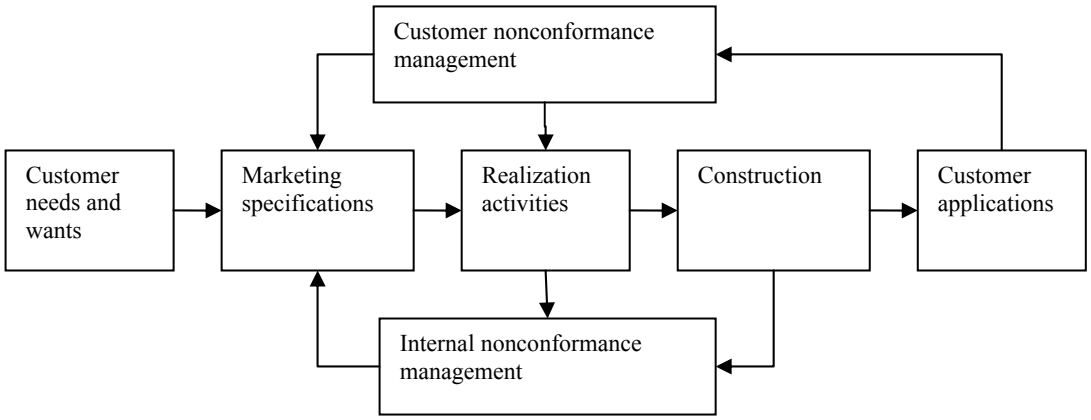

Figure 1.1 Functional model of a typical QMS

Both a core competency and a process transform inputs into usable outputs and are thus equivalent functional terms. However, the term process is more commonly used operationally and is more readily understood when the term *sub-process* is used.

In the development of an effective QMS, it is critical that all of the organization's core competencies (processes) are defined so that the overall management process is without gaps. The interrelationships of the core processes form a spider web, and voids in the web are places where productivity and profits usually fall through.

Figure 1.2 is an example of a typical set of enterprise core competencies that require a process document. In Figure 1.2, there are eight core competencies defined. Core competency number 4 (operations) contains not only an additional core competency—quality assurance and regulatory affairs (QA&RA)—but also contains a number of sub-processes (e.g., construction). As a result, the operations process charting would consist of an overall process that links up with the sub-processes. In this manner, all of the core competencies can be captured to form a complete QMS process.

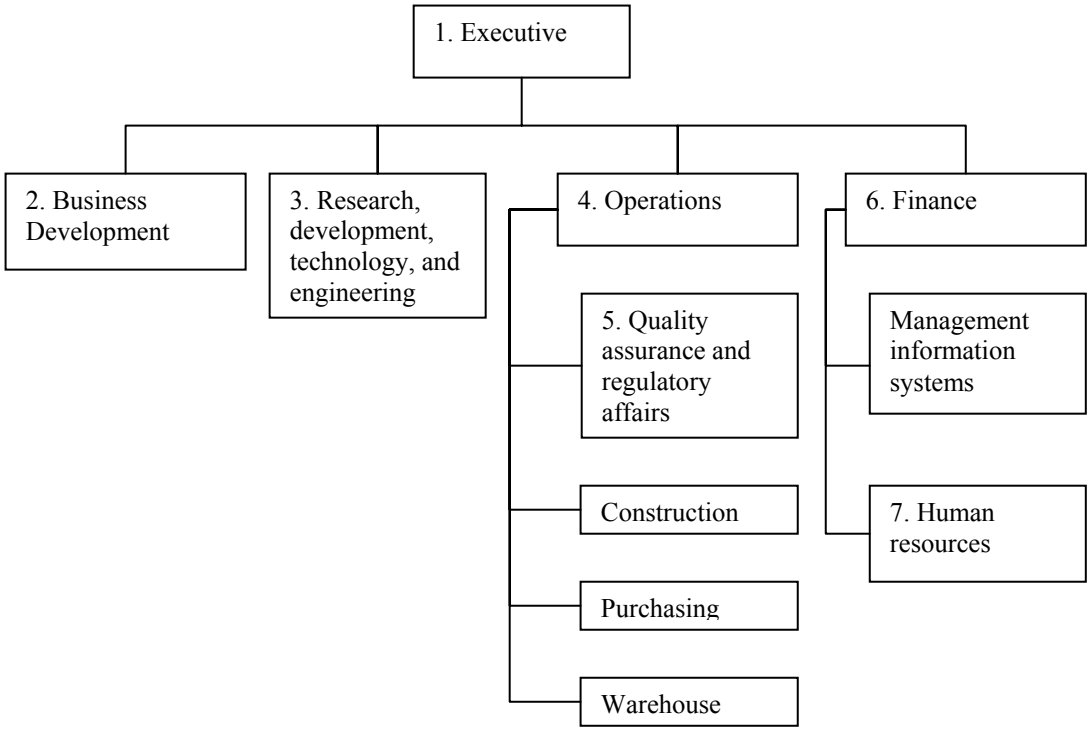

Figure 1.2 Typical core competencies (processes and sub-processes).

The exact choice of core competencies—the resultant processes and sub-processes—is somewhat subjective and is a function of the economic impact of the function on the total organizational effectiveness. For example, the management information systems (MIS) block under finance could just as well be placed under construction, as it represents any number of computer systems that are used to analyze and control the enterprise's productivity and profitability.

Once the organization's core competencies have been defined, it is necessary to select a strategy by which the now documented processes can be activated to form an effective QMS. In this strategy, an effective QMS hierarchal structure consists of the following:

- Documentation that accurately describes the organization's core competencies and provides the necessary policies, processes, procedures, forms, and records to support the organization's QMS;
- Implementation based on the operational use of the documents on a daily basis;
- Demonstration of effectiveness based on the monitoring, measuring, and analyzing of operational data and the corresponding corrective and preventive action programs.

The activities of documentation, implementation, and demonstration of effectiveness form the three pillars upon which rest the quality management system's operational integrity (see Figure 1.3).

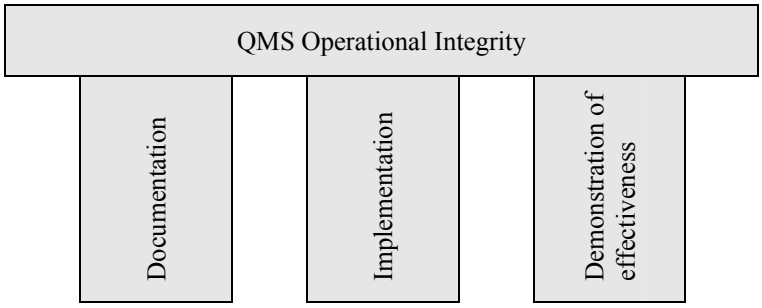

Figure 1.3 The three pillars of a QMS.

In parallel with QMS structure, employees develop knowledge of the organization's goals and objectives and the organization develops a common management language that results in a quantitative management style where decisions are based primarily on analyzed data. Developing a systematic approach to the application of this quantitative QMS strategy is therefore essential.

1.1.3 Selection of a QMS Baseline

A number of quality management baselines exist that can result in an effective QMS. They consist primarily of custom designed total quality management (TQM) programs, and programs built upon a nationally or internationally recognized standard. Figure 1.4 illustrates three specific types of systems for evaluation: a typical TQM example, a system based on ISO 9001:2000, and a system based on national standard.

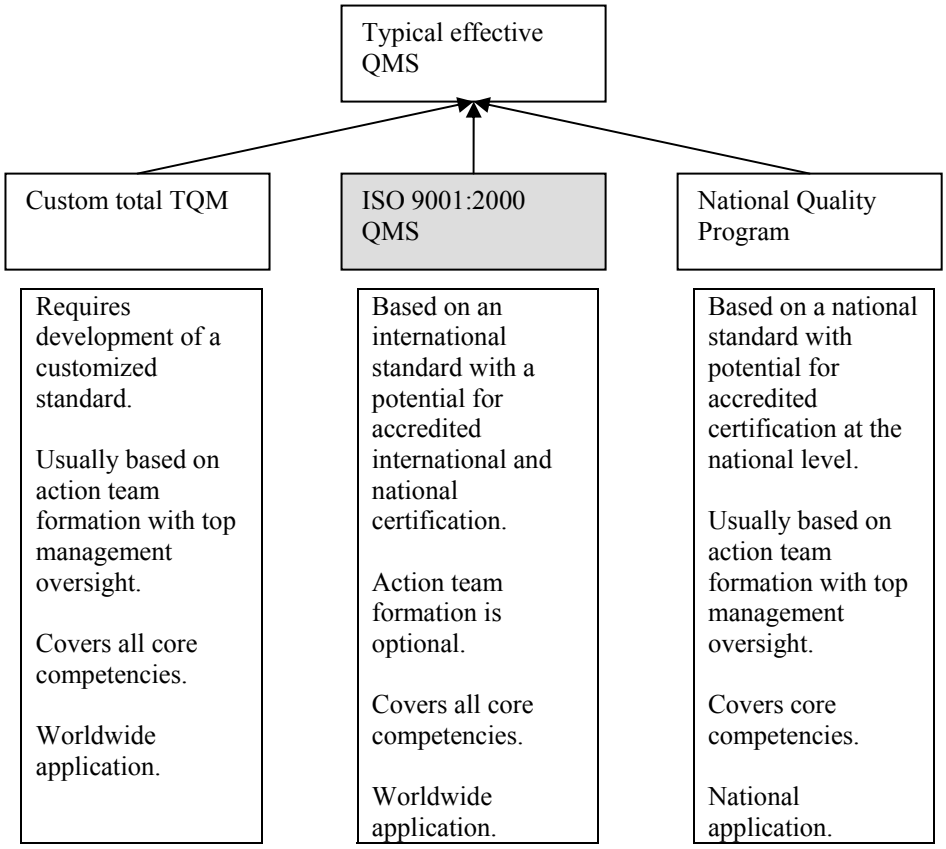

Figure 1.4 Potential effective QMS baselines.

All three systems can be designed to encompass all of the organization's core competencies. In addition, all three can employ action teams to measure cost of quality and to provide top management with a corrective and preventive action

protocol. The key difference between the three lies in the ability of the ISO 9001:2000 approach to attain certification, either nationally, internationally, or both.

Although there is a nationally recognized certification, of the three concepts, only the ISO 9001:2000 QMS provides for both accredited international and national recognition.

1.2 THE ISO 9001:2000 QMS

The process used to create an effective QMS based on the ISO 9001:2000 International Standard extends directly to the creation of any QMS based on a standard.

By a standard, it is meant that a document published by either a national or international organization that has achieved a relatively high level of industry recognition and credibility in its specific area of expertise. However, no matter how complex the set of standards, the underlying process to create an effective QMS is the same.

Here it is focused on the optimization process on the international standard, ISO 9001:2000 Quality Management System: Requirements (ISO Standards Compendium, 9th Edition) especially for a construction company. Throughout the text, the term Standard (capitalized) is used to denote the ISO 9001:2000 International Standard.

Effective QMS Processes

The process to produce an effective QMS requires the following:

- The analysis of the Standard's requirements—these are stated in terms of SHALLS;
- The introduction of an interpretive scheme based on the author's experience and technical background;

- The top management decision on the total effort to be expended to produce the QMS (i.e., the degree of responsiveness);
- The integration of business strategy with strategic quality management goals;
- The clear presentation of the strategic organizational policies documented in a quality manual (manual);
- The aggressive implementation of the designed QMS;
- The demonstration that the QMS is effective through the analysis of data that tracks QMS performance against quality objectives.

As a result, the goal is to present a set of QMS design rules that can produce a fully responsive QMS that is both in compliance with the Standard and an effective strategic declaration of the organization's business objectives.

The Standard—through its inherent continuous/continual improvement paradigm, stress on customer satisfaction, heightened awareness of a lowered cost of quality, transparent business/quality objectives, and explicit calls for process/procedural analysis—offers the supplier a unique opportunity to improve its competitive advantage.

Specifically, the Standard has integrated the following eight quality management principles into its requirements[1]:

1. Customer focus;
2. Leadership;
3. Involvement of people;
4. Process approach;
5. System approach to management;
6. Continual improvement;
7. Factual approach to decision making;
8. Mutually beneficial supplier relationships.

[1] ISO 9000 Quality Management Principles at http://www.iso.ch/iso/en/iso9000-14000/iso9000/qmp.html.

As a result, only a fully responsive QMS will include the totality of the eight principles and offer the organization the maximum return against these principles. However, this potential for enhanced marketability, productivity, and profitability is dependent upon:

- the supplier's desire to fully comply with the Standard,
- write the documented system in a user-friendly manner for a very wide range of readers,
- make a total management commitment to this effort,
- and establish a QMS that can be maintained in a cost effective manner.

The goal is to improve organizational effectiveness, not just get certified. Most importantly, a unified, strategic, business-and-quality policy signals to all employees that the main purpose of the ISO 9000 certification is to improve the effectiveness of the operation, not just achieve certification.

The ISO 9000 QMS Process Model

The manner in which the Standard achieves continual improvement is by means of its process orientation. The roots of this process are inextricably wound into the QMS definition.

The characteristics of a QMS in regard to quality include the following[2]:

1. The establishment of policy and objectives by an organization to manage resources (see Appendix A);
2. The assignment of responsibilities and authority to personnel (see Appendix D);
3. The development of an organizational structure among the personnel (see Appendix B).

Based on this definition, a graphically demonstration of the functional relationships between the various parts of a QMS is possible. This concept is shown in Figure 1.5.

[2] Re: ISO 9000:2000, Clause 3.2.3.

It indicates the benefits to the enterprise in terms of increased profitability, productivity, and product performance[3].

Although there is little difficulty with the use of the Standard's sections (instead of core competencies), the approach seems to need a more extensive, careful set of reference links to send the reader from one process to another as compared to core competencies that tend to automatically link functions. But this is more style than substance.

Regardless of which model is chosen, it always has to be integrated into the flow support functions such as management review, control of documents, control of records, control of monitoring and measuring devices, internal audit, and corrective and preventive action.

It is seen in Figure 1.5 that the Standard has essentially defined a classic engineering feedback system complete with inputs, outputs, and feedback loops. The inputs of end-user requirements, quality objectives, and quality management protocols are framed by the documentation system and transformed by the implementation system to produce continuously improved processes and projects. These lead to outputs that include enhanced projects, productivity, profitability, performance, and customer satisfaction.

In summary, between the Standard's process model and the operational model—in concert with the plan-do-check/study-act models—it is possible to graphically display the most important aspects of the ISO 9001:2000 requirements designed to create continual improvement.

[3] Guidance on the Process Approach to Quality Management Systems at http://www.bsi.org.uk/iso-tc176-sc2.

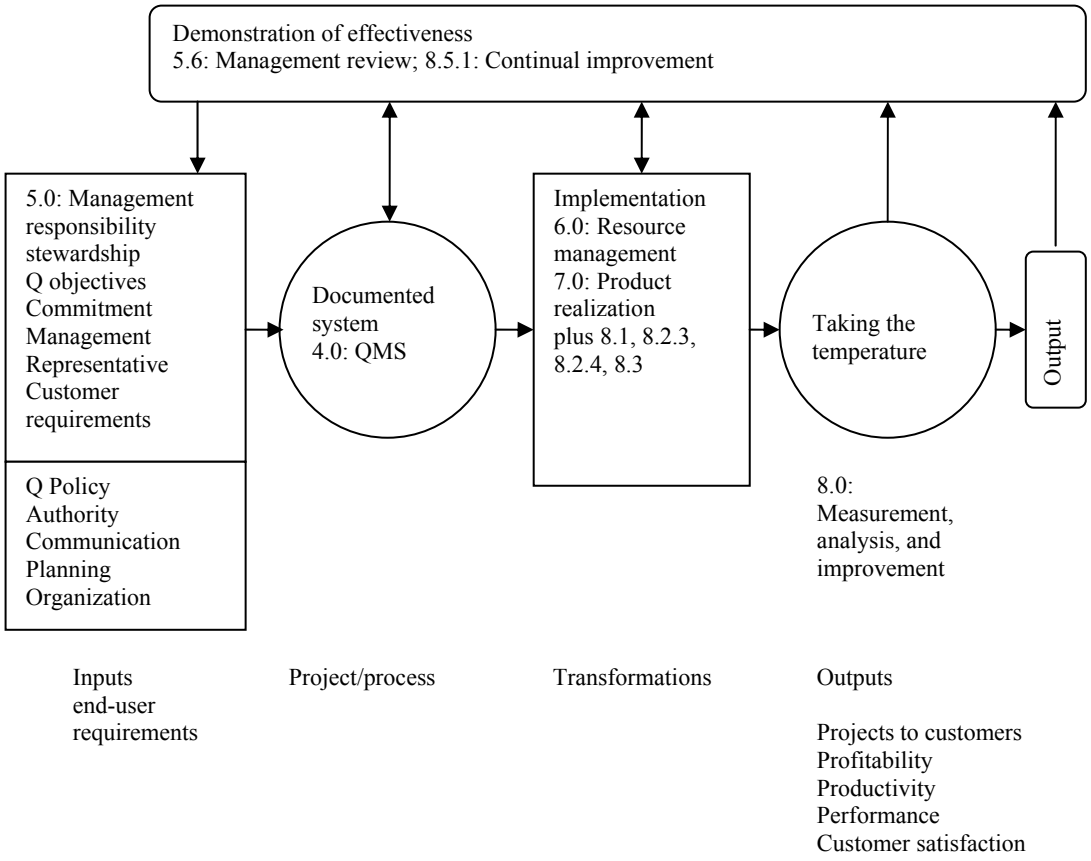

Figure 1.5 Operational model for the ISO 9001:2000 QMS.

1.3 QMS CONTINUAL IMPROVEMENT FRAMEWORK

1.3.1 Continuous/Continual Improvement

It's established that the QMS should be a blend of business strategy and quality management (an integrated QMS)—in full conformance with the Standard. This section creates the implementation framework for the approach.

The ISO 9000:2000 vocabulary specifies quality in operational terms. (The definitions are normative—they are part of the Standard, not just a guideline). The definition begins with the word "degree"[4].

[4] ISO 9000:2000: Clause 3.1.1 Quality.

Degree in the definition implies a scale associated with quality. Quality is not absolute but relative to what is acceptable from the receiver's (customer's) standpoint. The definition also tells that quality is based upon not only what the customer needs but also what the customer expects. This is what makes the fulfillment of quality so difficult—few of the customers really fully know what they need. Until receiving the result of the contract, it is not really known what the expectations are, even when there is a specification.

As a result, quality is an iterative process that depends upon specific measurements but that is always open to improvement.

Thus, when the quality process begins it is meant that high quality is defined as the ability to meet customer requirements that have been specified quantitatively. For a construction company, it might mean on-time delivery or to stay in the estimated budget. All of the requirements must be measurable and addressable in terms of metrics. Otherwise, an open-ended relationship occurs, and nobody knows when the job is done and when it is time to get paid—a common problem in contracting for either a new sun deck for a house or a QMS[5]. Whatever the metrics are, they must be subject to analysis and continual improvement. Such metrics form the basis for enterprisewide quality objectives (Olivier & Paschal, 2001).

Continual Improvement Is Intrinsic Within the Standard

The ability to define a continually improving (C/I) QMS is inherent in the Standard, and the Standard's process orientation provides a method to drive the QMS at whatever rate makes sense for the organization.

Customer-Driven Orientation

The customer orientation of the Standard was introduced at the eight quality management principles, the first of which is customer focus (where customer refers

[5] The quality means to the employee are different. (e.g., "Looks perfect, nice shape, good condition," "Do it right the first time," "Project that is workable," "The way it is supposed to be," "Get a repeat contract," "Make the customer happy," "Something I would do for myself," and "Meet customer specs").

to interactions between both internal and external parties). The essence of the customer specific standard's clauses deal with communication in regard to meeting customer requirements, customer feedback, and the enhancement of customer satisfaction. In this manner, the Standard provides with the platform for a unified QMS because the Standard's orientation is thematically aimed at an effective customer relationship.

Next, it will be demonstrated how the continuous improvement cycle—desired by both the organization and the customer—is intrinsic within the Standard.

The Cycle of Plan-Do-Check-Act

The inherent continuous/continual improvement properties of the Standard can be demonstrated if the relationship is indicated between the five operational sections and their corresponding paragraphs of the Standard and the cycle of plan-do-check-act as indicated in Figure 1.6.

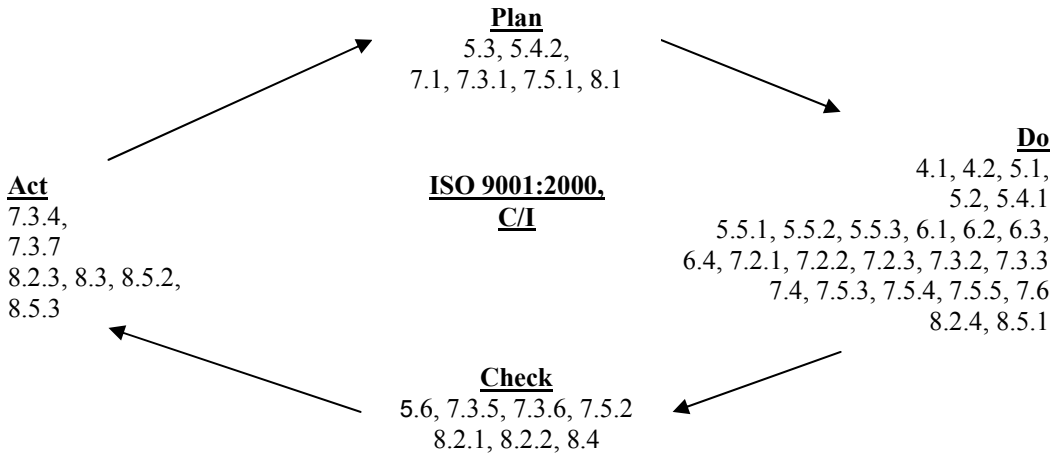

Figure 1.6 ISO 9001:2000 continuous/continual improvement cycle by paragraph.

In this diagram, each of the operational paragraphs is placed in a related category of the cycle. The exact placement of the elements is subject to conjecture, but what is important here is that there is an approximate 1:1 correspondence with the paradigm.

“Plan”. The related Standard paragraphs provide the framework in which top management:

- places its unified quality/business plans, business development strategies,
- establishes performance metrics,
- and records progress against goals to measure the effectiveness of the QMS.

“Do”. The related Standard paragraphs establish the implementation protocols within which there is design, construct, and defects maintenance.

“Check”. The related Standard paragraphs provide the mechanisms whereby the progress is monitored against quality goals so that the entire QMS can be analyzed and corrected to achieve continual improvement.

“Act”. The related Standard paragraphs establish the methods required to correct those areas that are out of conformance and to establish long-term preventive action programs.

There is operational power when all clauses are implemented. Thus, when all paragraphs of the Standard are implemented, the paradigm ensures that the system will be documented; that those documents will be used by the employees; and that there will be adequate measurements made to judge whether or not an effective performance has been demonstrated against the business/quality objectives.
The continuous improvement cycle can also be demonstrated in specific sections of the Standard (e.g., Section 7.3: Design and Development, as shown in Figure 1.7).

It is concluded that both a market orientation and the continuous improvement cycle is inherent within the Standard and as a result it is necessary to respond to every requirement to ensure that the Standard’s continual improvement integrity is maintained.

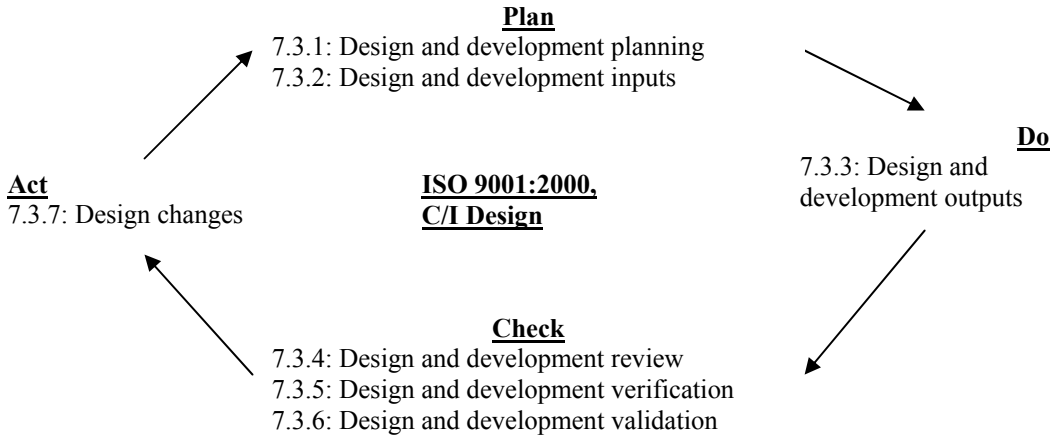

Figure 1.7 Section 7.3: Design and Development—continuous improvement cycle.

1.3.2 Mandatory Documentation Requirements

The creation of a QMS—based on the Standard—requires a fully compliant documentation system (i.e., a QMS in which each SHALL of the Standard is clearly documented).

The desire to integrate business and quality objectives, so that they are transparent, is a repetitive theme throughout the Standard and its associated guidelines (see Figure 1.8)[6].

In the ISO 9000:2000 schema, the documents are intended for the following:

- ISO 9004:2000, entitled "Quality Management Systems—Guidelines for Performance Improvements" is to be used to design the QMS.
- ISO 9001:2000 (Standard), highlighted in the center, is to be used for all contractual agreements.
- ISO 9000:2000, entitled "Quality Management Systems—Fundamentals and Vocabulary" is to be used as part guideline and part standard because the terms and definitions given in the document apply to the Standard.

[6] The ISO 9000 Family: http://www.iso.ch/iso/en/iso9000-14000/understand/selection_use/selection_use.html

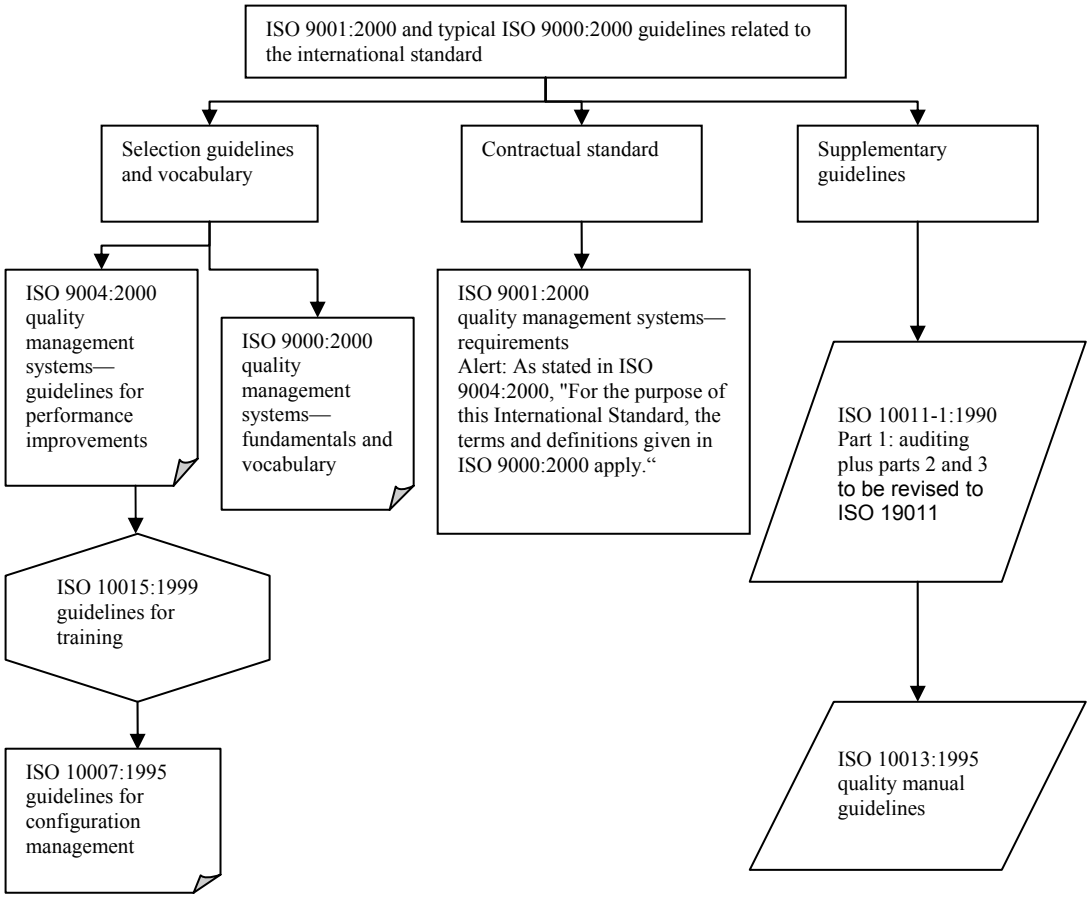

Figure 1.8 A portion of the ISO 9000:2000 Standard's documentation.

Accreditation Impact on Guidelines

The ISO 9000 family of documents focuses its guidance and requirements on satisfying the customer, and this motif is exemplified in the guidelines by stipulating that the organization's leadership should actually create a customer-oriented organization[7]. Thus, there is a clear indication of the concept of a unified business/quality imperative as a prime directive of the Standard's intent.

To fully appreciate the Standard's umbrella-documentation complexity, it is necessary to summarize all of the mandates so that a proper analysis can be achieved. The requirements are summarized in Table 1.1 (For an illustration of the concept of tiers, see Figure 2.1)

[7] Section 1.4 of ISO 9004:2000.

Table 1.1 Summary of the ISO 9001:2000 Mandatory QMS Documentation Requirements

Tier Level	**2000 Standard's Clause**	**Standard's Requirements Related to Documentation**
I	4.2.1 b)	A quality manual that contains a scope and justified exclusions.
	4.2.1 a); 5.3	Documented statements of a quality policy and quality objectives
	5.4.1	… (separate or in the quality manual)
	4.1 a)	Identification of the processes needed by the QMS and their application throughout the organization …(separate or in the quality manual)
	4.1 b)	Determination of the sequence and interaction of such processes … (separate or in the quality manual)
	4.2.2	A description of the interaction between the processes of the QMS … (included in the quality manual).
	5.6.1	A top-management review of the organization's QMS at planned intervals … (tier I record)
II	7.1	The manner in which the organization plans the processes needed for product realization (quality or control plan)
	8.1	The manner in which the organization plans the monitoring, measurement, analysis, and improvement processes needed (quality or control plan)
	4.1	Identify the control of outsourced processes
	4.2.1 c)	Documented procedures required by the Standard (contained in either the quality manual or references to them)
	4.2.3	1. Control of documents procedure
	4.2.4	2. Control of records procedure
	8.2.2	3. Internal audit procedure
	8.3	4. Control of nonconforming product procedure
	8.5.2	5. Corrective action procedure
	8.5.3	6. Preventive action procedure
III	7.5.1 b)	Controlled work instructions, where applicable and necessary
All	4.1	A documented QMS
	4.2.1 d)	Additional documents needed by the organization to ensure the effective planning, operation, and control of its processes (This is the "sleeper" requirement that drives the creation of a multitude of documents!)
	4.2.1 e)	Records required by the standard
II and IV	7.5.1 a)	Controlled information that describes the characteristics of product, where applicable
	8.2.2	Planned intervals for the Internal audits

For QMS documentation structure, a clearly defined and consistent taxonomy is required that is based upon long-established guidelines on how to propagate technical information effectively. Accordingly, the taxonomy used here is defined in Table 1.2.

Table 1.2 Taxonomy Used (with Typical Types of Documents Noted)

Document Tier	**Terminology**	**Typical Content**	**Typical Record(s)**
I	Quality manual(same definition as Standard)	Policies (i.e., response to SHALLS), process summaries and interactions, justification for exclusions, quality policy statement	Management reviews, management representative memo
II	Process documents (same definition as Standard)	Processes, standard operating procedures (SOPs), process flow charts, quality plans, control plans	Master document lists, device master record, device history record, design history files, technical files
III	Procedures (same definition as Standard)	Work instructions, work directions, test plans, calibration and maintenance plans	Quotes, sales orders, travelers and routers, inspection and test data, certificates of conformance and analysis
IV	Forms [see 4.2.1d) of Standard]	Templates and formats onto which drawings, blueprints, labels, test plans, and data are placed	CAD drawings, corrective and preventive action reports, job descriptions

QMS Design Methods

There is a series of ISO 9001:2000 QMS design rules that prescribe methods to enhance clarity, user friendliness, and compliance. Such methods include the following:

- The integration of business strategy with quality management;
- The use of the inherent continuous/continual improvement cycle;
- The need for stewardship;
- The development of effective QMS documentation structures;
- The avoidance of paraphrasing;
- The use of different documentation media;

- The development of prescriptive quality policy statements;
- The SHALL analysis method;
- The quality manual sequence methods;
- The possible quality manual configurations;
- The sector-specific requirements prescribed by ISO 9000 accreditation boards.

Armed with this set of design rules, it is possible to create an ISO 9001:2000 QMS that represents the true nature of the organization and supports its competitive advantage. In that regard, the first set of design rules is presented in Part 2.

PART 2: QMS DOCUMENTATION DESIGN FOR CONSTRUCTION COMPANIES

Within this part, QMS documentation design for construction companies in presented and a four-tier documentation hierarchy as the basis for an effectively documented QMS is established. The critical role of the quality manual as a key driver to overall QMS effectiveness is discussed in detail. Then, the lower tier documentation (i.e., processes, procedures, forms, records, and other mandatory documents) is addressed in terms of optimum documentation structure and their specific roles in the QMS hierarchy.

2.1 QMS DOCUMENTATION

All documentation requirements (SHALLS) are to be addressed to establish the key components of an effective QMS in terms of the Standard's documentation requirements, both from a mandatory basis and an implied overall effective hierarchy of documentation. Of prime importance are the mandatory documentation requirements, summarized in this section. These requirements are explicitly required by the Standard and form the umbrella under which all the other documents are contained.

To accomplish this, it is necessary first to categorize the several sets of documentation needed to produce a fully compliant and effective QMS. The four key sets are as follows:

- The Standard's mandatory documentation;
- The Standard's implied documentation;
- The registrar's required documentation;
- Required regulatory (compliance) documentation.

It is the quality manual, quality objectives, identified processes and their controls, control plans where applicable, six specific procedures, supplemental documents if

applicable, work instructions if applicable, and records that are clearly mandatory hierarchal documents in the Standard.

2.1.1 The Four-Tier Pyramid Concept

A useful icon in an effective documentation structure is to place the four tiers in the form of a documentation pyramid (see Figure 2.1) (Bradel, 2002).

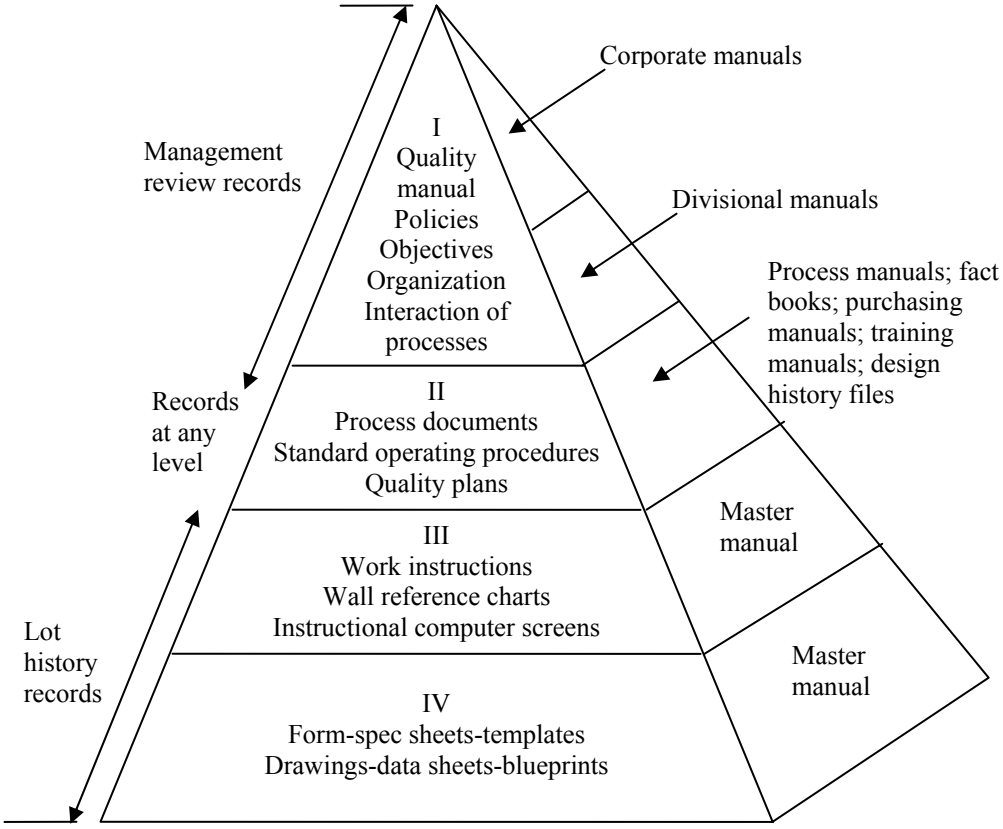

Figure 2.1 The four-tier operational pyramid concept—ISO 9001:2000 guidelines.

The four tiers can also be described in the form of a table (e.g., see Table 2.1). The matrix form provides another class of information related to the specific content of a given tier (Horn, 1994).

Table 2.1 The Four Suggested Operational Tiers of ISO 9001:2000 Documentation

Tier	ISO 9000 Category	Content Description	Deals with...
I	Quality manual Corporate Divisional Departmental	A time-independent document describing the organization's policies written in conformance with the Standard. Scope of QMS Details of exclusions Documentation of quality policy Documentation of quality objectives Description of organization Identification of processes Description of processes interactions Inclusion or reference of procedures	The organization's response to each SHALL The "rules of the house"—the methods used to ensure compliance Definition of responsibility
II	Process documents and high-level procedures SOPs Departmental operating procedures Business plans Quality plans	Time-dependent documents that describe either the overall processes of the organization or a combination of process and high-level procedures Enterprise processes Six mandatory procedures Documents needed to ensure the effective planning, operation, and control of the processes Employee handbook	Purpose—what, when, where, who, and why at a high level Flow of information from area to area, department to department, building to building
III	Lower-level procedural documents Wall reference charts Instructional computer screens Work instructions Directions	Time-dependent, detailed step-by-step work instructions on how to complete a task (e.g., at the operator or bench level)—sometimes integrated into tier II documents Purchasing work instructions Construction work instructions Training syllabus	How one does the job—tells the reader in a step-by-step fashion Provision of the necessary data to perform the tasks
IV	Unfilled-in forms, graphics, or spec sheets Templates Blueprints Schematics Specifications Drawings	Generally time-independent documents that specify the data requirements called out in the various documents and/or specific data sources, or graphically indicate requirements or state specifications Many of the forms are used as records once they are filled in and filed, although specific records are required at all levels Complementary documents to support work instructions	The forms used to demonstrate that a procedure requiring either data taking or data input was done Drawings and/or specifications used in manufacturing or troubleshooting The templates required to measure and fabricate

The four-tier structure provides levels for the type of documents that are usually encountered. However, some companies have as few as two defined levels and some as high as six defined levels. The number of levels is irrelevant. What is relevant is that they are presented in a way that aids the reader to easily navigate throughout the system.

Linkage is also defined in the Standard in that the quality manual is to either include the required procedures or reference them[1]. As a result, the tiers should be clearly linked so that it is possible to readily navigate throughout the documentation.

The use of a four-tier pyramidal structure for the QMS documentation is recommended to maximize communication to users. Once the four-tier hierarchy has been established, the total documentation system tends to behave with a waterfall effect (i.e., the number of process documents are less than the number of procedural documents, which in turn are less than the number of forms).

2.1.2 The Documented ISO 9001:2000 QMS

The Standard demands a documented QMS. Within this mandated documentation are to be found the means to do the following[2]:

1. Identify QMS processes;
2. Determine process sequence and interaction;
3. Determine operational and monitoring criteria;
4. Determine operational and monitoring methods;
5. Monitor processes;
6. Measure processes;
7. Analyze processes;
8. Achieve planned results;
9. Achieve continual improvement of such processes.

[1] ISO 9001:2000, Clause 4.2.2.
[2] ISO 9001:2000, Clause 4.1.

So the key is to document these nine mandatory requirements, identified processes. The answer is to use a tier II document that can be either contained within the quality manual or referenced to another text from the quality manual. With this assumption in mind, it is necessary to establish that the following documents are the desired complete hierarchal set of documents, either defined or implied, in the Standard:

1. A documented quality policy (tier I) (Appendix A);
2. Documented quality objectives (tier I) (Appendix A);
3. A documented quality manual (tier I) (Appendix B);
4. Six specifically defined documented procedures (tier III) (Appendix C);
5. Documents that ensure the effective planning, operation, and control of processes (this implies):
   - Process documents/SOPs/quality plans (tier II) (Appendix F);
   - Procedures/work instructions (tier III) (Appendix C);
   - Forms (tier IV) (Appendix E);
6. Records (filled and filed forms that can occur at any tier level).

As indicated in Figure 2.2, once the strategic plan is created and the stewardship established, the manual is the first critical documentation gate an organization must pass through to complete their QMS. The manual is also the primary document requested by the customer/client in their evaluation of your QMS.

It is observed in practice that a fully compliant manual—that reflects both the personality and technical competence of the organization—significantly enhances the organization's competitive position.

The next step requires a careful examination of the Standard's mandatory QMS documentation requirements taken stepwise through the four tiers.

Figure 2.2 Typical ISO 9001:2000 certification gates.

2.2 QUALITY MANUAL DESIGN

A quality manual is a document that specifies an organization's QMS[3] (see Appendix B). The Standard further specifies that the quality manual is to include the following[4]:

1. The scope of the QMS and details and justification for exclusions;
2. The documented procedures or reference to them;
3. A description of the interaction between the processes.

[3] Par. 3.7.4 of ISO 9000:2000.
[4] Par. 4.2.2 of ISO 9001:2000.

Exclusions refer to a statement of non-applicability for a particular clause. The most common exclusion is Clause 7.3 Design and Development (e.g., a construction company that erects buildings based on the architect's design would exclude Section 7.3).

The manual should tell the reader at least the following structural information[5]:

- The number of tiers chosen, their contents, and the method of labeling (see Figure 2.1);
- The method of document-to-document reference, or linkage (e.g., by either reference numbers in the text or a documentation tree);
- Whether the system is hard copy, on electronic media, or a mixture;
- The type of documents to be found (e.g., found either in manuals, in online documentation, by individual copies distributed among employees and/or locations, or on wall reference charts in which the work instruction is posted on or near the work station;
- How quality management documents (e.g., the manual) are differentiated from engineering documents (e.g., drawings and schematics);
- The identification of processes and the way that they interact, complemented by a description of their interaction.

Furthermore, it is required to include the scope of the QMS. In this regard, the quality manual should also include the following:

1. The documented quality policy and its mandatory requirements (refer to Par. 5.3 of the Standard);
2. The quality objectives and its mandatory requirements (refer to Par. 5.4.1 of the Standard);
3. The mandatory identification of the core competencies (processes) and how they are applied (refer to Par. 4.1a of the Standard);
4. The mandatory description of the interaction between the core competencies (processes) (refer to Par. 4.2.2 of the Standard).

[5] ISO 9001:2000, Clause 4.2.2.

The quality policy could just as readily be a separate document (see Appendix A). In fact, many organizations place the quality policy statement within the quality manual and then extract it for purposes of display and ready availability. Either way, the document is to be controlled, usually by signature and date of the top manager, but it could also be signed off by the entire executive team and/or the entire set of employees.

The quality objectives, along with their metrics, are to be placed within the quality manual for the same ease of distribution and overall visibility. By metric, it is meant the specific method of measurement (e.g., the ratio of awarded contracts to contracts awarded to competitors, first pass yields in test, or the percentage of construction made to schedule divided by total construction). It is not meant by this that the actual data should be placed in the manual, only the metric.

2.2.1 Manual Objectives

From the perspective of readership, the overall objectives of the manual:

- To clearly describe the organization's QMS with enough detail to make it useful for a very wide range of readers;
- To respond to each requirement of the Standard so that the defined system has the potential to achieve the full benefits of continuous/continual improvement—intrinsic within the Standard;
- To write the manual from the customer/client's perspective as the primary issue for clarity and preciseness.

2.2.2 Strategic Framework for the Manual

The Standard's imperative is that the manual should integrate enterprise strategy with quality management. It is accomplished by top management when it establishes quality policies and quality objectives that include the total organization's functions.

The blending of quantitative marketing objectives and financial metrics into the business/quality objectives creates a manual that unifies business and quality strategies into one. In this manner the manual becomes the organization's repository of operational knowledge that can form the basis of a learning organization.

Top executives are often concerned about the visibility of business metrics such as profit and loss statements and balance sheets. Such proprietary information need not be detailed within the manual. For example, marketing strategies, cash flow, and profit and loss information are readily placed in a separate business plan that is then referenced in the manual. The concern is with process so what is most important is that there exists an effective protocol that stipulates how marketing strategies are to be developed, how cash flow is to be measured and controlled, and how profit and loss information is to be used to improve the operation's corrective and preventive action programs.

Manual's Value Within the QMS

- A QMS based upon a manual that is fully responsive to the Standard results in a strategic declaration of the organization's quality and technical competence as stated in the manual in the form of prescriptive quality policy statements.
- In opposition to a fully responsive QMS, a *paraphrased* set of quality policy statements results in a less than effective QMS—by paraphrased, it is meant a playback of the Standard's descriptive requirements in the manual—as opposed to prescriptive statements that indicate the methods used to actually conform to the Standard. Paraphrased manuals lack so much useful information about the organization that they are often simply ignored as a key document to review during internal quality audits.

Cross-Functional Manual Action Teams

Most importantly, to produce an effective quality manual each section is to be written by an author who has the most operational experience within that area (e.g., a technical or operational expert).

2.2.3 SHALL Analysis

It is common to write manuals in a sequenced form that corresponds directly to the Standard's sections and clauses (i.e., a manual with eight main sections and an appendix). The entire paragraph labels that deal with Sections 4 through 8, five major sections in the Standard, which contain approximately 364 descriptive requirements in the form of either explicitly stated or implicitly directed SHALLS, use the same nomenclature as the Standard so that there is a one-to-one correlation between the Standard's structure and the quality manual's structure (see Appendix B):

- Cover pages/table of contents/document control;
- Section 1—History of the Enterprise;
- Section 2—Scope of the QMS Certification;
- Section 3—Quality Policy Statement;
- Section 4—Quality Management System;
- Section 5—Management Responsibility;
- Section 6—Resource Management;
- Section 7—Product Realization;
- Section 8—Measurement, Analysis, and Improvement;
- Appendixes.

2.2.4 Concomitance

Each SHALL denotes a specific requirement of the Standard. The requirements are often linked in such a way that they are associated (reciprocal, canonical) requirements. This associative characteristic of the clauses is defined as concomitant relationships. As a result, if any one SHALL is not adequately addressed, there is an impact on other sections of the Standard because each SHALL is a part of the Standard's overall fabric.

2.2.5 Appropriate Detail Level

Although the level of detail varies widely with quality policy statements, what is of prime importance is that enough detail be available so that the reader can use the described rules and methods to intelligently make business decisions that impact their organization.

An ISO 9000–Certified Vendor

Every day construction companies' procurement and quality personnel make joint decisions on whether to add a new key vendor to their approved supplier list. In those cases where the new supplier is ISO 9000–certified, one of the decisions that can be made is to avoid the expense of a vendor audit and rely on the depth and scope of the supplier's quality manual for the decision on whether to add the vendor to the approved supplier list (ASL). A carefully determined level of detail in a quality policy statement can be an appropriate way to decide on the effectiveness of the statement.

Example —On Work Environment Of The Construction Site

First Statement The following is a broadly stated quality policy statement in partial response to 6.4: Work Environment: "All XYZ Corporation employees shall comply with work environment procedures."

Second Statement This is also a quality policy statement on the same subject, but it is definitive: "All XYZ Corporation employees wear safety helmets and ear plugs before entering designated construction areas, as required (Re: EC Work Instruction 6.4.01)."

Example Analysis The first statement is a philosophical directive equivalent to reading back (or paraphrasing) the Standard. It uses the future tense, so it is not clear that the rule is actually in place yet. It is a common paraphrasing technique that deflates the effectiveness of the Standard. The second statement is in the present

tense and has sufficient detail to be clear to anyone reading it that this is what the organization requires—and it can be readily audited.

A slightly modified journalistic formula of who, what, where, when, how, and why is a suggested rule to keep in mind while writing quality policy statements. The five Ws and an H" as follows:

- Who = responsibility and authority
- What = the activity
- Where = location of activity
- When= frequency of activity
- Why = objective
- How = method used

The more the five Ws and an H are defined, the clearer the quality policy statement becomes. The clearer the quality policy statement is, the higher will be the rate of information within the enterprise.

A quality policy statement should be as follows:

- A prescriptive response to every SHALL in the Standard;
- Present tense as opposed to future tense;
- Clearly expressed in simple declarative prose;
- Not paraphrased;
- Of whatever length and detail is necessary to define the organization's rules and methods.

2.2.6 Quality Manual Sequences

The actual structure of the manual depends on the nature of the enterprise and the manner in which is intended to propagate information within the QMS. There are basic configurations for the manual that are compliant with the Standard's requirements:

1. Direct sequence based on the Standard's sequence (i.e., Sections 4.0, 5.0, 6.0, 7.0, and 8.0) is compliant.
2. The cycle sequence (i.e., plan, do, check, act) is compliant.
3. Operational cycle sequence (e.g., tendering, design, engineering, construction control, purchasing, test, customer service—here again the direct sequence, especially Section 7.0, approximates this sequence) is compliant.

Table 2.2 Comparison of Quality Manual Content Attributes

Attributes	Direct Sequence	Cycle	Operational Cycle
Linkage to Standard's clauses	Excellent	Good	Fair
Clarity of operational orientation	Excellent	Good	Excellent
Continuous improvement cycle	Excellent	Excellent	Fair
Coverage of support functions	Excellent	Excellent	Fair
Core competency clarity	Excellent	Good	Fair
Ease of auditing to Standard's clauses	Excellent	Good	Fair
Overall	Excellent	Good	Fair

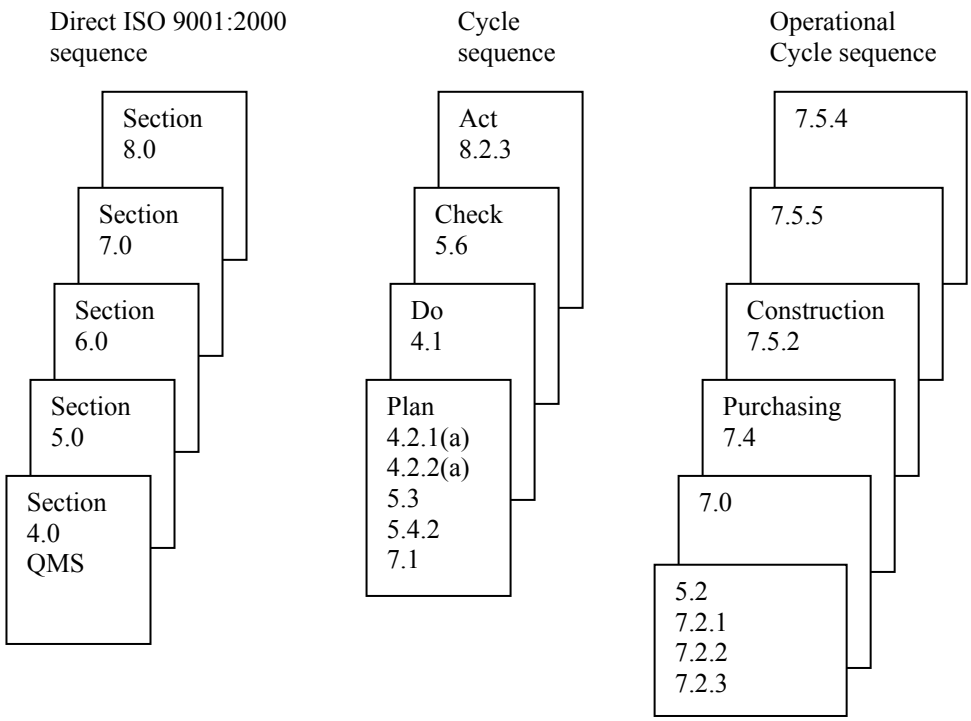

Figure 2.3 Diagram of quality manual potential sequences.

The comparative analysis for the sequences is characterized in Table 2.2 and diagrammed in Figure 2.3.

As a result, the direct sequence seems to be the best in hand for now and it provides a landscape that is unlimited in regard to core competency expression.

2.2.7 Manual Configurations

Regardless of which format is chosen for the manual's sections—direct sequence, the cycle, or operational cycle sequence—there are effectively only two unique ways to design the manual's configuration:

1. Model I—stand-alone document that deals only with policy, scope, justified exclusions, the interaction between processes, and references to procedures;
2. Model II—integrated document that contains both policy, justified exclusions, the interaction between processes, and the procedures.

The Stand-Alone Configuration—Model I

The stand-alone manual clearly references each lower tier document that it directly effects (e.g., the manual's Section 8.5.2: Corrective Action would send the reader to an SOP entitled "Corrective Action Procedure." (Guidance on this subject is found in ISO 10013, "Guidelines for Developing Quality Manuals.")

The Integrated Manual Configuration—Model II

In an integrated manual, the quality policy statements and the lower tier documents—especially tier II—all appear in the same document. In practice, in smaller companies, the manual and the set of SOPs are often distributed together.

2.2.8 Multidivisional Manuals

In very large organizations with multidivisional requirements, each division responds in kind to the various corporate quality policy statements in order to form a cohesive and coherent body of corporate knowledge. Each division also shares the top-most

level II documents (e.g., document control procedures, corrective and preventive action procedures, internal audit programs, and training manuals). Tier III and tier IV documents are designed expressly for use by a given division.

Table 2.3 Comparison of Corporate Versus Divisional Manuals

Subject	**Corporate Manual**	**Divisional Manual**
5.6: Management Review	Discusses the quarterly management review held at the corporate offices with divisional managers present Describes the various corporate preparatory meetings that take place prior to the quarterly review	Discusses the monthly divisional management review that feeds the corporate quarterly review Also discusses the divisional preparatory meetings held locally prior to the monthly review
4.1: General QMS Requirements	Describes the entire QMS and references corporate standard operating procedures (CSOPs) or corporate process documents (CPDs) Discusses the various ways that the divisions interface with both the corporate office and other divisions	Describes the response to the CSOPs via divisional work instructions (DWIs) Describes specific interface functions with corporate and other divisions Divisional SOPs or process documents are optional and are generally redundant
7.2: Customer-Related Processes	Describes the highest level business development policies and methods References the corporate business development process manual	Describes the method used at the divisional level to meet the corporate business development policies. Describes the response to the corporate business development process by means of DWIs.

2.2.9 Potential Manual Readership

Of all the ISO 9000 documents, it must appeal to the widest set of readers. As a result, the purpose of the manual must be carefully couched in terms of its users. The potential readers of the manual are classified in Table 2.4.

The potential readership for the manual is extremely diverse and must comply with an ever-expanding set of user needs.

Table 2.4 Classification of Potential Manual Readers

Potential Readers	**Includes**	**Reader Decision Needs**
Customers/ clients/ partners	Executives Quality assurance managers Operations managers Sales representatives Investors Interdivisional organizations	To audit or not to audit To buy or not to buy To invest or not to invest Initially based on the scope and completeness of the quality manual
Employees	Executives Managers at all levels Architects Engineers Supervisors Technicians Assemblers Buyers Internal quality auditors	Is the organization really committed to quality? How can I participate? What is expected of me as a quality person? What are the quality rules of the house?
Sub-suppliers	Subcontractors Vendors Interdivisional organizations	What level of quality is required? How will I be measured? What type of supplier audit can I expect? Will I be rewarded for my work?
Third-party ISO 9000 evaluators	Assessors Registrars Accreditation boards Third-party experts	Degree of compliance to SHALLS Dedication of top management Potential for continual improvement and effectiveness of the quality system The extent to which quantitative methods are used to measure effectiveness

2.3 PROCESS DOCUMENT DESIGN

The tier II document is expressed in many different ways, all of which are identical. For example:

- SOP;
- Process document;

- Hub document;
- Quality-assurance procedure;
- Quality or control plan.

The process document describes the time-dependent behavior of the system after it has been defined in terms of quality policy statements. It is actually the first document that should be drafted prior to any other, including the quality manual (or alternately, the quality policy manual or quality system manual).

Development of Processes

The business process discussion is a part of the manual because a description of the interaction between the processes is required to be within the manual. The sequence and interaction of the processes are identified in terms of the input and output activities in that the output of one phase becomes the input to the next phase.

There is no specific way to write the document, and here it will be demonstrated by two methods that can be used to compose the initial draft:

- a process table approach; for example the Steward of the related part brings his team together and creates a department-to-department process document that carefully maps the interfaces or “hand-offs” from one department to another
- a cyclic flow chart approach; the Steward for the related part brings the executive group together and creates a cyclic flow chart to diagram the entire development process

Process Document Application

Another application of the recommended process document in QMS structures is illustrated in Figure 2.4. In this figure, each circle directly attached to the executive process represents a process document, including the executive process itself.

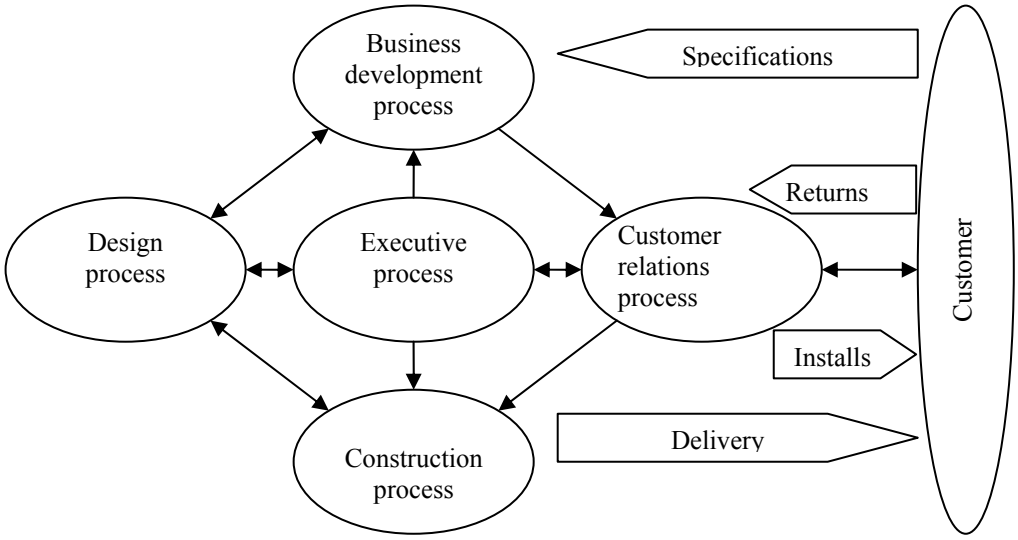

Figure 2.4 Organizational business process.

For example, the engineering design process document would send the reader to such procedures as reinforced concrete design guidelines, mechanical installation design guidelines, engineering document control, engineering standards, and design transfers to construction.

In this manner, there is a clearly established link between the quality manual prescriptive quality policy statements, the organization's core competencies expressed as process documents, and the procedural documentation.

2.3.1 The Tier II

With reference to ISO 9000:2000, Par. 3.4.5, a procedure is a document that informs how to accomplish either an activity or a process. In other words, if a process document is to be created, the document is called a procedure. The common terminology ranges from standard operating procedure, to quality systems procedure, to quality-assurance procedure.

Explicitly, a process document is not a mandatory document. Implicitly, it can be—if it is in the form of a procedure that is required. For example, the audit process could

be documented in the form of a SOP that would then be mandatory because an audit procedure is mandatory.

With reference to ISO 9000:2000, Par. 3.7.5, a quality plan tells you that procedure(s) and resources are required by those who do work, regardless of the type of work that has to be done. It has inputs (procedures, resources, people), transformations (inputs applied and changed), and outputs (projects, buildings, processes, contracts). As a result, quality plans are really process documents. The terminology used includes quality-assurance plan, construction control plan, and design control plan. Work orders are sometimes in the form of a quality plan. This is why the requirements for plans are placed under the category tier II documents in Table 1.1.

It is important to realize that none of the formats are final. They are simply convenient templates to use to increase information flow. That is the sole purpose of the taxonomy—to make the tasks easier to follow and understand. It is free to innovate to suit the purposes. Tier II and tier III formats are often mixed together. If it works, it is possible to use it.

2.3.2 Quality Plans—Optional

The optional requirement for quality plans is stated as a note in ISO 9001:2000, 7.1: Planning of Product Realization.

The quality plan is termed as optional because the Standard uses the term as a note and notes are informative (guideline) as opposed to normative (required).

Quality or control plans are useful in all types of organizations. Table 2.5 is the first page of a quality plan that could be used for a general contractor. Documentation requirements are separated into operational and quality-control references.

Table 2.5 Quality Control Plan for the New Construction Project (Sample Page)

Stage	Step	On-Site Activity (Refer to Project Management Procedures)	Operational Documents	Quality and Safety Control Activities	QC Documents/ Standards
I. Job files	1.0	Set up site office Files (Appendix F)	Project management procedures stage II	Site preparation	Site preparation checklist
	2.0	Superintendent files			
	3.0	Prepare for receipt of contract			
II. Mobiliza-tion and start up	1.0	Develop site utilization plan and mobilize temporary facilities	Project management procedures stage IV	Site preparation Post Occupational Health and Safety Association (OHSA) poster Hard hat required sign Location of MSDS sheets	Site preparation checklist Form S.3.4
	2.0	Post required signs			
	3.0	Review building requirements			
	4.0	Establish charge accounts			
	5.0	Arrange for equipment delivery			
	6.0	Establish safety procedures		Hazard communication engineering MSDS sheets Company safety program OSHA form no.200 First-aid equipment. Protective gear GFI protection requirements	See Appendix S: Safety Reports and Forms in the Project Management Procedure
	7.0	Complete site checklist: Company policy Safety program Substance abuse program Hazard communication program	SITEPREP Form R.8		
	8.0	Prepare access to job site	NSC change order	Crossing required	Railroad rules
III Design and engineering	1.0	Subcontractors provide applicable drawings	Final design package	Design package reviewed by engineering	Plans and specs
	2.0	Survey and stake out areas	Plans	Check for accuracy of the layout Field notes	Owner bench marks and baselines are used
	3.0	Locate structures and lines	Plans	Check for accuracy of the layout Field notes	

2.3.3 Process Flow Charts

A flow chart without reference to associated documents is only half the story. Also, not all information can be readily placed in a flow chart without obscuring its clarity. As a result, there is always room for supplemental text and complementary tables (e.g., lists of document numbers, forms to be used, and special instructions to the user).

- Primary information—most importantly, if a flow chart is chosen as the means of communication, it should be the primary source of information. Flow charts can be used successfully in both the manual and in lower tier documents. Flow charts are an excellent technique to use to describe both process and the interaction of processes.
- The combination of a supplemental text and a flow chart form the informational document.

2.4 PROCEDURE DESIGN

Due to Par. 4.2.1(c) of the Standard, there are certain documented procedures that are clearly required as part of the QMS (see Appendix C). However, only six are stipulated:

1. Control of documents (Par. 4.2.3);
2. Control of records (Par. 4.2.4);
3. Internal audit (Par. 8.2.2);
4. Control of nonconforming product (Par. 8.3);
5. Corrective action (Par. 8.5.2);
6. Preventive action (Par. 8.5.3).

The rest is up to the organization if more procedures are necessary. However, it is clear that more documented procedures are needed just to put the tier II requirements somewhere.

If the sector-specific requirements (e.g., constructional requirements) are to be included, it is important not only to adopt the ISO 9001:2000 process structure but to continue to expand clauses to cover sector-specific mandatory conditions.

2.4.1 The Special Case of Work Instructions—Optional

Par. 7.5.1(b) of the Standard conditionally calls for work instructions as part of the QMS (see Appendix C). They are to be available as applicable and as necessary.

A good work instruction is a type of document that is kept at the workbench level and used in day-to-day operations. The document is designed for and generally used by an individual worker, in a work center, working on a very specific task.

2.5 FORMS AND THE CONTROL OF RECORDS

Forms/formats represent tier IV of the documentation pyramid (see Appendix E). They are essentially templates within which data/information is deposited for analytical or informational purposes. When a form is filled in with data and signed and dated by the observer and filed away for a specific period, it is termed a *record*.

Records are basically historical documents and are part of the analytical linkage that forms an information context in parallel with the operational process. The Standard in 4.2.3: Control of Documents reminds that records are to be controlled and that they form a unique category of documentation.

It is unnecessary to create documents so that every tier is covered. If it is required to go from the manual to a form (e.g., the format for management reviews), it has to be done. It is not necessary to create an SOP and a work instruction to get to that form.

Par. 4.2.1(e) of the Standard is very clear about records as mandatory documents. Appendix B of the ISO Guidance on the Documentation Requirements of ISO 9001:2000 provides a list of such records. The required records are given in a

descriptive manner, and it is up to the organization to clearly define which specific records are to be kept.

A record is basically a historical document that contains information that is worth keeping for some time. They are usually filled-in forms, but they can be in the form of memoranda, reports, or e-mails.

The Standard's vocabulary requires that a record should contain useful information that either lists achieved results or provides evidence that some operational activity was performed.

To create a meaningful set of records requires that not just use the category construction records, but to define construction records explicitly (e.g., purchase orders, construction drawing changes, application changes). We also specify where they are kept (e.g., maintained in the construction files cabinet). Further, it has to be specified who maintains the records (e.g., maintenance of the records is by the construction administrative supervisor). In addition, it has to be specified retention time (e.g., all records are kept for the current year plus 2 years). Finally, it has to be specified who can destroy records (e.g., records cannot be destroyed without the direct approval of the controller). It is usually best to avoid specifying the exact nature of record disposal and state that it is at the discretion of top management (e.g., the controller).

2.6 OTHER MANDATORY DOCUMENTS

It is possible to list the mandatory organizational requirements as:

- Mandatory Requirements from the Registrar

The registrar requires that the employee certification scope has to be defined because this is one of the parameters used to calculate how many assessors are required for how many days to effectively complete a certification assessment. The assessors need to know exactly how the personnel are distributed over what areas of the facility as a function of departmental activities. A common and effective way to do

this task is by means of an organizational chart or an equivalent table (see Appendix B).

- Responsibility and Authority Required by the Standard

Clause 5.5.1 of the Standard mandates that responsibility and authority within the organization must be defined clearly and such information has to be propagated throughout the organization. At a typical organizational chart all levels of the organization are to be defined. Quite often, the charts are found as an appendix to the main body of the manual. The actual names of employees are not required.

- Job Descriptions

Job descriptions can also be used and they should clearly indicate the requirements for education, necessary skills, acquired training, and related experience to the degree required for a given employee position or title (see Appendix D).

2.6.1 Nonmandatory Sensible Requirements

The charge to the authors to create a reasonable volume of documents and to keep the corporate economics in mind is expressed in Par. 4.2.1: General of the Standard as note 2 and is therefore not mandatory but is to be considered a guideline.

At issue here is the tendency to overwrite—usually a good 40% more than is necessary for an effective presentation. It usually takes a few years after certification to streamline the system. Typical forms of redundancy include the following:

- Policy statements in the quality manual repeated in the tier II and tier III documents;
- Tier III documents that repeat the same procedures as the tier II documents;
- Flow charts with associated text pages that state the same information;
- Master lists repeated in labeled text in procedures such as a master records list with a list of records repeated in a procedure. One or the other is sufficient as long as all the necessary record requirements are met.

PART 3: QMS IMPLEMENTATION

Within this part, QMS implementation is developed and organizational issues in regard to leadership, QMS planning, documentation implementation, and the impact of carefully planned internal audits is discussed.

3.1 THE QUALITY MANUAL SCOPE OF EFFORT

A considerable effort is required by top management to produce a stand-alone ISO 9001:2000 sequenced manual that integrates business strategy with quality management. It is an iterative activity that peaks approximately one-third of the way into the process and then requires some level of maintenance up to the certification assessment. After certification, maintenance is normally required prior to a surveillance assessment and when the organizational and operational structure makes significant changes.

To some degree the number of hours required can be estimated to create a fully compliant manual if it is assumed there are the following:

- A process construction;
- A staff of 100 employees—20% of which are managers and construction supervisors;
- A quality-assurance department;
- A management representative who is also a full-time manager;
- A full-time clerical support;
- A part-time consultant (approximately 25% of the time on site during the pre-certification effort);
- A training program that includes documentation-writing skills for some employees;
- A documentation system that already exists in the form of some basic work instructions and operational formats;
- A plan that shows that the designated employees write, edit, and research for three hours for every hour that the consultant had been on site.

Table 3.1 XYZ Corporation's Quality Policy Manual Timeline

Manual Phases	**Scheduled Months for Actions in Gray**											
Months from kick-off	1	2	3	4	5	6	7	8	9	10	11	12 cert
Initial drafts due												
First draft review												
Final draft review												
First master published												
Master review after continuous improvement audit												
Master review after readiness assessment												
Master review after certification audit												
Total writer/editor/ research days												
ISO management representative	32	8	8	4		2		2		2	8	2
Technical writer		40	16	4		2		2		2	4	2
Clerical		40	16	8		4		4		2	8	2
ISO administration subtotals (hrs)	32	88	40	16		8		8		6	20	6
General manager	8	4	2	1		1		1		1	1	1
Engineering manager	12	6	3	2		1		1		1	1	1
Construction manager	12	8	4	2		1		1		1	1	1
Purchasing manager	8	4	2	1		1		1		1	1	1
QA manager	16	12	8	6		4		2		1	4	2
Development manager	8	4	2	1		1		1		1	1	1
HR manager	8	4	2	1		1		1		1	1	1
Finance manager	4	2	1	1		1		1		1	1	1
Supervisors			16	4		1		1		1	1	1
GM & staff subtotals (hrs)	76	44	40	19		12		10		9	12	10
Grand total (hrs)	108	132	80	35		20		18		15	32	16

Grand total of hours = 448 employee hours

ISO administration = approximately 27 days

Approximately = 56 employee days

GM and staff = 232 hours = approximately 29 days

The estimate scales with size and project complexity, so plus 50% and minus 20% is possible. Table 3.1 illustrates a typical scenario and plan for the manual.

As indicated in Table 3.1, to create a manual of approximately 50 pages requires a considerable effort of the entire staff— the time to certification assessment is 12 months from the program kickoff date, approximately 56 employee days. The effort includes team meetings and considerable dialogue. This estimate assumes that the development of processes has been completed before work begins on the manual.

As indicated, the load is greatest on quality assurance because it had been assumed that at least internal quality audits and metrology have been assigned to that group, along with inspection and testing.

The result of such an effort is a manual that makes sense to all of its readers and propagates a favorable impression of the organization both from a strategic and technical standpoint.

3.2 QUALITY MANUAL ISSUES

Quality manual issues are evaluated in two sub-topics, hard-copy manual issues and online-manual issues.

3.2.1 Hard-Copy Manual Issues

Manual Control

In practice, a pure hard-copy system is the most expensive and time consuming to maintain, and it is best to limit the number of controlled manuals to essential personnel [e.g., document owner (often the site manager), ISO 9000 management representative, and the registrar].

Uncontrolled copies usually need to be released by the owner. However, the manual should have some sort of disclaimer (e.g., “The contents of this uncontrolled manual

may not be at the latest revision level"). Because the manual is usually revised on the average of about twice a year (e.g., after a surveillance assessment and after organizational changes), the currency of the document is not a big issue and uncontrolled copies are not really a concern.

Manual Revisions

It is important to minimize the number of times per year that changes are made to the manual to minimize printing costs. Such costs can be very significant when you consider the cost of labor and distribution control. It is best to collect minor changes and do a rewrite periodically unless there has been some major action taken (e.g., reorganization, third party audit that resulted in non-conformances, merger/acquisition activities, or a business scope upgrade).

Manual Distribution

The creation and distribution of the manual must comply with the requirements of Element 4.2.3: Control of Documents of the Standard.

3.2.2 Online Manual Issues

With the advent of enhanced information technology networks, many organizations are either already networked or plan to be in the near future. Any move to place the manual online will have an immediate impact in the ease of control. It is common to find both the certificates of registration and the manual on an organization's website.

However, as the manual serves as an excellent marketing tool, there is still a need to produce uncontrolled hard copies. In other words, an online manual tends to always end up a mix of electronic and hard-copy media. This is often true for the entire documentation system because drawings, blueprints, schematics, data sheets, and construction tags, for example, tend to remain as hard copy, especially in smaller companies. Larger companies tend to favor more electronic files via scanned documents, but this requires an extensive and sophisticated computer system.

Key Factors

The decision to go online involves the solution of a number of critical factors. A few examples of some key factors include the following:

- *Structured hypertext:* The use of hypertext alone will not guarantee an effective system unless the entire documentation structure is logically designed on the basis of hierarchal need. The online manual's cover page is an excellent location to place hyperlinks, not only to the manual's sections, but to the master lists for all the tiers.
- *Available expertise:* Even if the choice is made to go with off-the-shelf quality management system software, it is necessary to have someone on board who is a computer expert, in conjunction with a dynamic training program.
- *Training issues:* The moment the decision is made to go online, the training must begin immediately. Online systems require far more training than hard-copy systems.
- *Projection systems:* To avoid an unacceptable level of dropped hard copy in an online system (e.g., for meetings or training sessions), it is advisable to install projection systems that are driven by the computers.

3.3 HUB DOCUMENTS

A handy universal bucket (hub) document is a center of information flow. The manual need only reference this one document in each major clause and the hub document will then take the reader to the appropriate supplementary lower tier documents.

System can be simplified and made more user-friendly without compromising the system's basic integrity. For example, an alternative method of display would be by means of a documentation tree (see Figure 3.1).

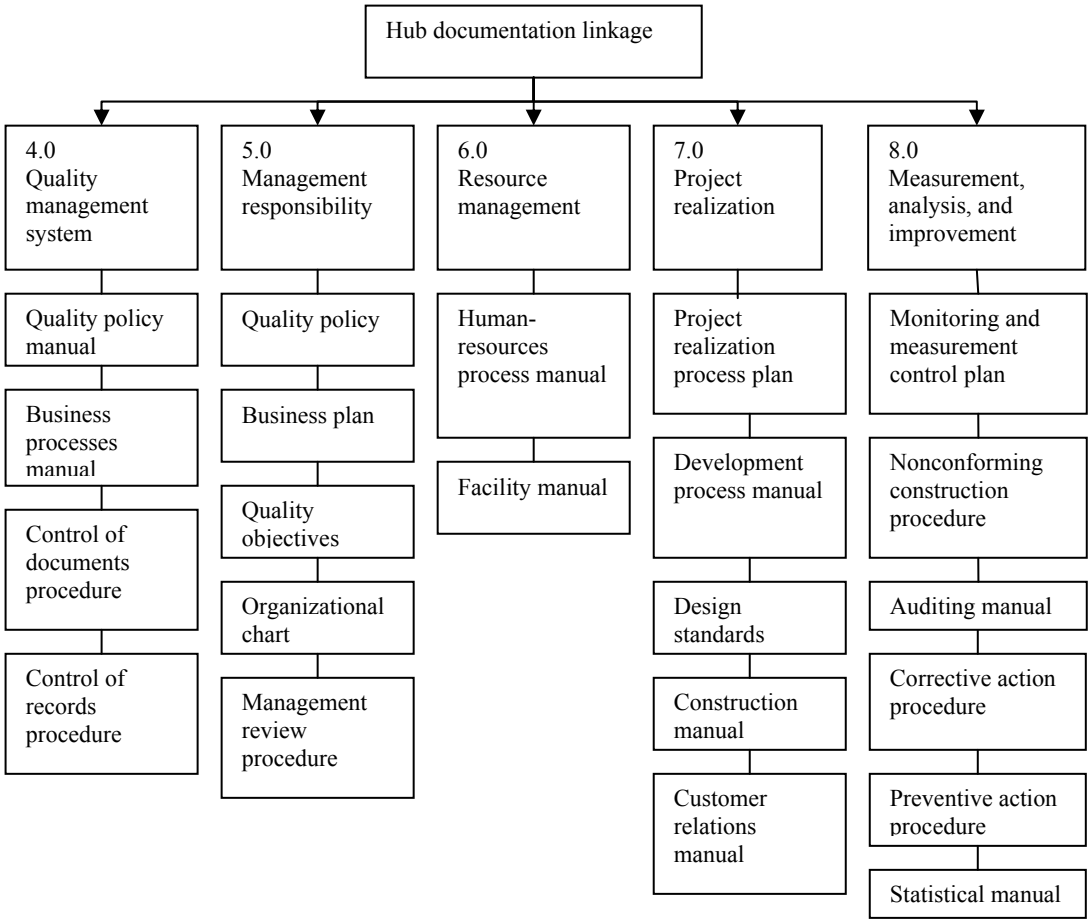

Figure 3.1 Hub documentation linkage tree (simplified).

- In most cases, there is only one hub document per major clause (e.g., Clause 6.2: Human Resources Process Manual).
- Several hub documents are used within a section when they either represent unique processes or require a summary statement (e.g., the business plan is a partial response to all of Section 5.0 and is a hub document because of its scope and multiple topics).
- A project realization manual is used in Section 7.0 as a hub document to contain the various procedural requirements for the construction process.
- Hub documents are invariably very high level process or standard operating procedural documents, including quality and control plans.

3.4 LEADERSHIP

Clearly, the QMS needs an organizational home[1]. It requires the following:

- Ownership and oversight by top management;
- A way to be created, controlled, and revised;
- Acceptance by all users;
- Evidence that it is worthwhile.

For most users, the QMS is something that suddenly appears and is overwhelming with its unaccustomed vocabulary and demands. As a result, it is important to create a documentation system that

- Is worth reading;
- Contains phraseology familiar to the construction industry;
- Is relatively easy to work with (user friendly);
- Truly represents the policies, processes, procedures, and formats of the organization.

For example, in the case of the manual, the manual is actually distributed in such a way that all QMS users can obtain a copy if they so desire. A document that states the strategic position of the enterprise should not be considered as non-appropriate for the average user to read. Par. 5.5.3: Internal communication of the Standard requires that top management ensures that appropriate communication processes be established within the enterprise to alert users on the effectiveness of the QMS.

There is an effective way to ensure that the manual is compliant and distributed appropriately and represents the organization's personality. This is to assign various staff members (stewards) with specific sections of the Standard so that they are responsible for the documentation, implementation, and demonstration of effectiveness of each ISO 9000 clause down through all operating levels of the

[1] Many companies prefer to use other terms such as *champion* rather than *steward*. Terms such as *process champion* and *subprocess champion* are used.

system. The stewards may take on roles such as process steward, sub-process steward, and section steward. This approach is important because the Standard requires that quality objectives be established at relevant functions and levels within the organization (Par. 5.4.1: Quality Objectives).

As a result, it is not just that top management establishes quality objectives, but that operational areas also establish objectives that support the top level objectives.

At the 90% point, the QMS is fully operational and ready for fine tuning. However, the fine-tuning process is never ending, so it is best to follow the rule of diminishing returns. When this behavior is obtained, the QMS needs to be shaken periodically to see what falls out, and that is done through the internal audit process. That is what "taking the temperature" is all about. It is the essence of Section 8 in the Standard, which contains, for example, both the internal audit and corrective and preventive action.

3.4.1 The Stewards Take The Temperature

The key to a successful QMS—one that helps to achieve the quality goals and objectives—is the ability to measure either the progress against those goals and objectives or the lack thereof! Someone has to be responsible for this task. In Table 3.2, the cycle of plan-do-check-act is used to create a quantitative matrix for this measurement purpose.

A key duty of the steward is to input the scorecard**.** The scorecard is kept up to date weekly by the ISO 9000 management representative based on inputs from the stewards.

Table 3.2 Taking Corporation's Temperature—ISO 9001:2000 Readiness Chart

C/I Elements	Relative Percentage (%)								
Month	**Mar**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	
Goal	**Launch Phase**	**First Draft Process Documents**	**First Audit Verification and Validation**	**Final Draft QM**	**Management Review**	**Internal Readiness Assessment**	**Registrar's Document Review**	**Registrar's Certification**	**Activities Where Points Will Come From**
Plan—executive									
Management reviews	30	50	50	60					2 Management reviews (15)
Quality manual	5	70	80	85					Readiness audit
Objectives metrics	30	50	60	70					Quantitative analysis
Demonstration of effectiveness	5	50	55	60					Full corrective and preventive action with customer complaints
Do—operational									
Process documents	5	60	65	75					Complete development
Procedural documents	30	40	50	55					Readiness audit
Format documents	30	50	60	70					Construction, test
Implementation	30	40	50	55					Engineering, Development
Master records lists	5	30	50	70					Construction, test
Master documents lists	5	30	50	60					Construction, Development
Approved vendor lists	5	30	70	75					Purchasing, engineering
Master calibration lists	5	30	50	50					Internal calibrations
Training program	30	40	50	55					Construction, Development
Check—internal									
Customer satisfaction	30	50	60	65					Survey analysis
Quality audits	5	30	50	60					5 points each
Verification process and project	30	50	80	85					Readiness audit
Act–effectiveness									
Data analysis	5	35	50	70					Complete intranet
Corrective actions	5	40	50	65					Analyze
Preventive actions	5	40	60	60					Make a list
Customer complaints	30	50	60	65					Analyze
Continual improvement	30	50	60	65					Trending

Note: 90% implies readiness for the initial assessment.
Guide: startup required = 5%; a clear base exists = 30%; mid-game to ISO readiness = 35–70%; endgame =75–85%; ready for initial assessment = 90%.

The Standard lists a number of directives that can be used to create a matrix that defines stewardship. The essential role of a steward is to ensure that the QMS contains:

- An effective and visible quality policy statement;

- A program management plan to guide the team's activities;
- A controlled documentation system;
- A set of quality objective metrics and goals at all levels of the organization that includes customer satisfaction metrics;
- A clearly defined set of team responsibilities and authority to document, implement, and demonstrate the effectiveness of the QMS via verification and validation analysis;
- Clear channels of communication to all groups involved in the creation process;
- Documented appointment of an ISO 9000 management representative;
- A dynamic presentation role in the top management reviews to clearly define the status of the QMS creation process for the steward's team.

Steward's Information Objectives With regard to communication, each steward ensures the following of their channels of information:

- There is a technical correlation from quality policy statement down to the lowest documentation levels.
- There is an effective link between each quality policy statement and the lower tier documents.
- The entire documentation system is complete.
- The documented system is completely implemented.
- The channel is helping to achieve the quality objectives.
- The continual improvement programs are effective.

3.4.2 Team Leaders

It is customary for the stewards to assign cross-functional teams to handle the more broad reaching requirements that touch several operational areas. The leader for such a group is sometimes called the team leader and for more complex activities can hold the title of program or project manager. Their responsibility is to ensure that specific

cross-functional programs are effectively managed. Such programs include the following:

- *ISO 9000 management representative:* usually the quality-assurance manager, if such a position exists. Often found to be the president or head of operations when the QA function is not formally designated. Lower level employees are sometimes used with a dotted line authority to the top manager.
- *Total audits manager:* usually led by the QA manager if the function exists, otherwise stewarded by another manager (e.g., controller, head of operations, director of safety). Refer to Clause 8.2.2: Internal Audit.
- *Training manager:* usually performed by the human-resources manager if that function exists, and, if not, it can be shared by all local area managers (e.g., all department heads are responsible for the training and documentation of their staffs). Refer to Clause 6.2: Human Resources.

These assignments can take many forms. Preferably an effort has to be made to evenly distribute the stewardship responsibilities among top management. Unfortunately, it often happens that operations and quality assurance end up with an inordinate level of activity compared to the other departments. This type of situation is to be avoided when possible, as everyone in the company is usually already overloaded.

Cross-Functional Team Organization

Each organization should structure their teams in a way that best fits their purpose. It is helpful when design and construction teams form. Impressive action team awards and plaques are used to create the ownership required in response to the tremendous efforts put out by the teams. The results in bottom-line dollars saved are quite remarkable and over 5 to 10 years can be in the billions of dollars for multibillion dollar companies (Defeo, 2001).

Organizations Without Explicit Design or Quality- Assurance Functions

For those organizations without an explicit design or quality-assurance department, both teams would be led by the construction manager. The engineering team would focus on process and civil engineering themes that, although they do not include design, still require engineering discipline.

In this case, the prescriptive response would be like this:

7.3 Design and development exclusion: The organization does not design and develop its projects but receives this information in the form of a construction release package from its customers. The construction release includes the bill of quantities, printed design and application drawings, engineering change orders, and test procedures. The organization is required to obtain authorization from its customers for any changes that affect form, fit, function, reliability, safety, or other regulatory or statutory requirements.

Team Effectiveness

There is an open need for cross-functional teams in the effective implementation of the Standard so that the quality improvement team (QIT) can effectively integrate the functional areas of corrective action, preventive action, customer complaints, and nonconforming construction. For example, the QIT could consist of members from QA, engineering, construction, customer service, and finance.

This area, the Elements 8.3, 8.5.2, and 8.5.3, requires the most intensive training and takes the longest to optimize. There are some suggestion offers in this regard:

- Use SCARs to manage the interface with subsuppliers (subcontractors) as defined at receiving/receiving inspection. Nonconforming material reports (NCMRs) are also often used for this purpose and limited to incoming material issues.
- Limit 8.3: Control of Nonconforming Product to nonconformance reports (NCRs) that occur after incoming (receiving) and prior to delivery.
- Limit corrective action reports (CARs) to the internal quality audit findings and for big-time nonconformances that require a team. By their nature,

CARs are expensive and time consuming. Allow local area managers and supervisors to correct small-time issues with on-the-spot corrective actions. Keep a log of such actions for trend analysis.

- Assign one person to decide on the level of CAR responses (e.g., manager of QA). Filter out those that can be handled quickly without a lot of paper work and those that really need some time and effort and are worthy of documentation and trend analysis.
- Run the preventive action program via memos and reports. Stay away from a specific format.
- Assign one person to filter the customer complaints for the required response (e.g., manager of construction).
- Assign one person to take primary responsibility for the overall review and trend analysis of the databases (e.g., manager of quality assurance, manager of operations). That person manages the preparation and reporting functions of the quality improvement team with regard to trend data and analysis. This function directly supports the requirement 8.4: Analysis of Data and 8.5.1: Continual Improvement.

3.5 CERTIFICATION AUDITS

As a rule, when a section is rated at 90% or higher, it is ready for the initial systems assessment (i.e., certification assessment sometimes called the “A-1”). That means that, alternately, they are ready to do the pre-assessment (PA-1) to fine tune the system prior to the certification audit.

Some companies choose to go directly to the certification audit. However, according to experiences a pre-assessment is a better idea. The entire open nonconformance reports (NCRs) should be rigorously responded to and considered closed by the organization prior to the PA-1. There must be no majors anywhere in the system at that point, so that it will be possible to truly judge the status of the QMS with all of the documentation in place. This rule also holds after the PA-1 and prior to the

certification assessment so that it will be possible to judge the effectiveness of the QMS with all the documentation and implementation in place and operational. Most companies are able to accomplish this task with a good deal of hard work. This means that all of management must be part of this commitment to excellence.

You cannot fail an initial assessment of the direct sequence manual, unless you simply quit. One does not fail a third-party assessment but gets non-conformances that need to be corrected. The worst case is a major finding that could delay the certification process by up to three months and cost some more to pay the registrar's lead assessor to come back and clear the nonconformance. This is the primary reason that so many consulting groups will agree to guarantee certification/ registration[2].

The steward's task is to make sure that there are no major findings possible. This is accomplished via in-depth internal audits by well-trained auditors. The audits should be evenly distributed throughout the creation process and not left to the last moment prior to the document review. The audits not only increase the probability of a major nonconformance-free certification assessment, but they form the base of a dynamic corrective and preventive action program.

Inevitably there will be minor findings at the initial systems assessment, the first surveillance, the second surveillance, the recertification assessment, and the re-recertification assessment. That is what continuous improvement is all about. It is possible to come up with nonconformances with corporations that have been audited for over 8 years.

There, can be major findings. By major findings it is meant that, for example, an ineffectual management review, a poorly managed training program, a lack of internal quality audits, and a corrective and preventive action program that is uncertain and loosely managed. The stewards must pay close attention to these areas. One of the traps in the management review process is for the top manager to use the

[2] "ISO 9000 Consultants Guide," *Quality Digest,* May 2001, p. 69, at http://www. qualitydigest.com.

management review as an enthusiastic session instead of focusing on the enterprise's deviations from its planned goals based on firm and quantitative metrics.

Another danger area is the loss of internal auditors due to downsizing, disinterest, and promotion. It is important to maintain a constantly trained group of auditors to cover such contingencies. A safe level of auditors depends on the organization's size in both people and square meter and the degree of outsourcing. Today, there are situations where the organization consists of one person in the site and everything else is outsourced. It happens and people get certified.

3.5.1 Audit Focus

An experienced assessor pays special attention to the requirements in the following:

- *Section 4: Quality Management System*—In this set lies the superstructure of the QMS and where change is controlled, especially with regard to processes and continual improvement.
- *Section 5.4: Planning*—This determines how closely quality objectives are planned and measured.
- *Section 5.6: Management Review*—This contains the review of continual improvement drivers of internal audits, customer feedback, process performance, project conformity, preventive and corrective actions taken, and the manner in which top management responds to required change and opportunities for improvement.
- *Section 7.3: Design and Development*—Special attention is to be directed to the design review, verification, and validation functions.
- *Paragraph 8.2.2: Internal Audit*—This looks especially at whether all areas of the organization have been audited against all appropriate paragraphs and the audits have included all pertinent regulatory requirements.
- *Paragraph 8.5.2: Corrective Action*—This applies especially the management of customer complaints.

- *Paragraph 8.5.3: Preventive Action*—This requirement indicates clearly the degree to which the organization is either reactive to non-conformances or takes a proactive perspective (e.g., performs risk analysis and designs in safety and introduces best practices to all operating groups based on improvements in one group to prevent nonconformities) (Hiebler & Thomas & Charles, 1998) not only during the initial assessment but at every subsequent surveillance assessment.

Special attention to these requirements ensures that the continuous improvement cycle is maintained throughout the life of the ISO 9000 program. When the cycle is enforced, the odds are very high that the corporation will derive the benefits inherent from an effective QMS (Hendricks & Vinod, 1999).

3.5.2 Assessor Role

The role of the assessor is to teach and clarify. If this goal is met, the assessor feels fulfilled at the end of a long and intense audit, and the client feels that the effort was worth it.

In the search for added value, it must be always considered whether the finding will be of economic value to the enterprise. There is a fine line between conformance to the Standard and worth to the client. It is vital that the organization continually stretch its processes for improvement but not stretch beyond its economic boundaries. The auditor can play an important role in this scenario.

3.5.3 Structure of the Audit

To carry out an effective audit of the Standard requires the application of the pertinent clauses of the Standard against every enterprise process. This ensures that each sub-process is covered in detail. Table 3.3 uses the same core competencies as shown in Figure 1.2.

The example, shown in Table 3.3, is based on a small organization hierarchy. It is assumed that the departmental processes contain the following sub-processes:

- Executive: business plan, management review, and steering committee;
- Business Development: construction managers, marketing, development, and quotation;
- RDT&E: research and development, design, support, engineering change, and document and engineering records control.
- Constructions: QA&RA, constructions, project control, purchasing, inventory control, and delivery;
- QA&RA: ISO management representative, document and record control, metrology, corrective and preventive action, audits, quality control inspection, reliability, and data analysis and trending;
- Finance: human resources, management information systems, financial control and analysis, and cost of quality support;
- Human resources: hiring, training, and employee development;
- Servicing: customer service, maintenance, repair, and installation.

The chart suggests which clauses to apply to which process and thereby suggests which employees are to be interviewed. The planned date of the audit and auditors could also be placed in the box instead the star. Other usual audit activities are also implied, such as auditing the distribution of documents throughout the facility, auditing records in various file cabinets, asking employees what they believe the quality policy means and who they think is the ISO 9000 management representative, and examining the status of training.

To formulate such an audit structure (Russell, 2001), it is important to realize that this process-oriented scenario has an intrinsic hierarchal structure of the type shown in Table 3.4.

Table 3.3 Audit Plan for a Typical Construction Enterprise

Processes	**1. Executive**	**2.Business Development**	**3. RDTE**	**4. Constructions**	**5. QARA**	**6. Finance**	**7. Human Resources**	**8. Service**
ISO Clauses								
4.0: Quality Management System								
4.1, 4.2.1, 4.2.2:					*			
4.2.3, 4.2.4:			*		*			
5.0: Management Responsibility								
5.1, 5.2, 5.3, 5.4.1, 5.4.2, 5.5.1, 5.5.2, 5.5.3, 5.6:	*							
6.0: Resource Management								
6.1:	*							
6.2:							*	*
6.3, 6.4:				*				*
7.0: Product Realization					*			
7.1:				*	*			
7.2.1:		*	*					*
7.2.2:		*						*
7.2.3:		*			*			*
7.3:			*					
7.4, 7.5.2, 7.5.3, 7.5.5:				*	*			*
7.5.1:				*				*
7.5.4:		*		*	*			*
7.6:			*		*			*
8.0: Measurement, Analysis, and Improvement								
8.1:		*		*	*			*
8.2.1:	*	*			*			*
8.2.2:					*			
8.2.3:	*	*	*	*	*	*	*	*
8.2.4, 8.3:				*	*			*
8.4, 8.5.1:	*				*	*		
8.5.2, 8.5.3:	*				*			*

Table 3.4 Possible Hierarchal Organizational Structures

Small Organization	**Large Organization**
I Total process	I Total process
II Departmental processes	II Divisional processes
III Functional processes (subprocesses)	III Departmental processes
	IV Functional processes (subprocesses)

3.5.5 Tip of the Iceberg

When the day of the initial assessment arrives, it is important to realize that the assessors' observations represent the tip of the iceberg. They only see what they need to see in order to assure themselves that the organization has a workable QMS that will most likely produce a reasonable payback in a reasonable time. At least 90% of the non-conformances lie below the surface.

It is common to feel that the organization has fooled the assessors once they leave. On the other hand, the organization knows it is there. So it needs to fix it. Otherwise, it will surely be found in a surveillance audit. Worst yet, it is a hole in the system through which profit dollars fall—and that is the whole point of an effective QMS—to fill those holes.

3.5.4 Dynamics of the Initial Assessment

At the close of the initial assessment, the lead assessor recommends certification, either with or without condition. The registrar's executive board approves and issues the registration numbers and certificates. The several possible conditions for approval include the following (these vary considerably from registrar to registrar):

- All NCRs cleared during initial assessment—recommend certification without condition;

- Minors left to be cleared after initial assessment, but plans accepted—recommend certification but hold issuance until all are cleared or hold clearance for first surveillance;
- Make sure there is a clear plan to be followed up at first surveillance;
- Some minors can be declared concerns to be monitored at the first surveillance;
- Opportunities for improvement—potential economic savings; these are to be acted upon at the discretion of the auditee.

The exception is in regard to major non-conformances. They are usually treated as follows:

- Majors left to be cleared during initial assessment require a return audit of those areas within usually 90 days, then recommendation to certify (Although it is possible to have the registrar declare the organization noncertifiable, it is not a case that comes across. The only situation, under which this might occur, is if the facility has obvious safety and/or hazardous waste nonconformances so that the assessors cannot perform their audit in a safe manner).
- Majors can be downgraded during the initial assessment to avoid this problem. The resulting minor can then be treated as discussed in the recommended-for-approval protocols. Downgrades are highly discretionary on the part of the lead assessor and must be examined in the context of the observed overall effectiveness of the audited QMS. Some registrars have strict protocols for downgrades.

What is abundantly clear during the initial assessment is that the essence of the Standard is to state with great clarity who manages, performs, verifies, and validates the processes and sub-processes for documentation, implementation, and demonstration of effectiveness.

PART 4: QMS EFFECTIVENESS

Within this part, the key change in philosophy from the previous ISO 9001 version is described. The critical area of quality objective design is then discussed in some detail in regard to formulation, implementation, and analysis.

The Standard mandates that the organization continually improve the QMS effectiveness. Activities that illustrate continual improvement can be obtained by means of such requirements as the quality policy, quality objectives, audit results, analysis of data, corrective and preventive action, and management review (Par. 8.5.1: Continual Improvement of the Standard).

Par. 8.4: Analysis of Data mandates to use quantitative methods in the analysis of data, which demonstrates not only how suitable and effective the QMS is but where its effectiveness can be continually improved. If the organization is doing well, how does it intend to do better? If it is in trouble, how does it intend to dig its way out? In both cases, quantitative analysis attempts to seek out as a third-party assessor, and this is the intent of the Standard.

4.1 QUALITY OBJECTIVES

One of the most powerful methods used to measure QMS effectiveness is to carefully track the organization's progress toward the achievement of its quality objectives. The quality objectives must be written in language that is meaningful to the users and defined by a metric that is uniquely measurable.

Depending on the experiences of the registrars, the development of quality objectives is one of the most difficult areas of ISO 9000 responsiveness. The primary reason for the observed difficulty appears to be confusion over what constitutes a quality objective and how it should be stated.

Par. 3.2.5 of ISO 9000:2000 offers a definition of a quality objective in the sense that it is something related to quality that one seeks. Several notes indicate that the quality policy provides the framework for the quality objectives that are intended to flow down through the organization.

4.1.1 The Components of a Quality Objective

The five major components of a quality objective:

1. General statement;
2. Metric;
3. Target (goal);
4. Presentation by champion;
5. Flow downs.

Table 4.1 Examples of Quality Objective Components by Site Size

Site Size	Statement	Metric	Target	Presentation by Champion	Flow Downs
Small (<50)	Minimize company's late deliveries	Late deliveries divided by all deliveries	<1% Late deliveries	Construction manager graphs percentage by month over all delivery	Impacts construction
Midsize (>50 but <500)	Maximize corporate construction throughput	First pass yields for each construction site	>85% First pass yields	Construction manager graphs percentage by month by construction sites	Impacts construction assembly and test and purchasing
Large (>500)	Maximize divisional proposal wins	Bids won divided by total bids (by division)	>40% Winning proposals.	Vice president of business development graphs percentage by week by division	Impacts divisional Business development

In Table 4.1, it is indicated how three different-sized sites might respond to three different quality objective statements. The key difference for site size is exemplified in the form of presentation. As the sites increase in size, it is necessary to increase both the number of categories and the frequency of review periods to effectively track the larger set of data. For example, for a small site, all the deliveries are counted, independent of construction type, because the number of customers is

limited—it could be just one—whereas for the mid-sized site, the graphs are plotted for each construction site.

For each quality objective statement, there is a clearly defined metric, target, form of presentation, and a statement with regard to flow down. For each impact, a subsidiary quality objective statement is required. Table 4.2 illustrates typical flow-down impacts.

Table 4.2 An Example of Construction Flow-Down Quality Metrics

Construction Primary and Supporting Quality Objective(s)			
Primary objective: deliver project as specified by the customer-agreed-to delivery date			
Metric	Target	Champion	Intranet location
Percentage of deliveries that meet delivery date	>95%	Vice president of construction	Delivery.xls
First support objective: reduce NCMRs in assembly			
Metric	Target	Champion	Intranet location
Number of NCMRs per construction site	Zero	Assembly supervisors	NCMRs.xls
Second Support objective: optimize first pass yields			
Metric	Target	Champion	Intranet location
First pass yields per construction site	80%	Vice president of construction	Project Yields.xls
Third support objective: optimize vendor/subcontractor evaluation on-time deliveries			
Metric	Target	Champion	Intranet location
Vendor percentage on-time deliveries	>98%	Purchasing supervisor	VendorsOT.xls
Fourth support objective: optimize response to nonconformities			
Metric	Target	Champion	Intranet location
Response time to resolve nonconformities assurance	Minimize	Vice president of quality	NCRTime.xls

In Table 4.2, it is indicated how each primary objective that has been established by top management is assigned a metric, target, champion, method of presentation (on an intranet), and what the flow-down objectives could look like (Accardi, 2001). The exact number of flow-down levels is highly dependent on the site size. The flow-down objectives fulfill the Standard's requirements to do the following:

- Meet requirements for construction;
- Be established at relevant functions and levels within the organization;
- Be measurable.

The table considers construction's primary quality objective: "Deliver project as specified by the customer-agreed-to delivery date." Then, the impact of other departments that are essential to the successful achievement of this objective are considered, and objectives are established for those departments in a way that supplements construction's efforts. The flow down carries through four stages and involves the participation of assembly supervisors, the purchasing supervisor, and the vice president of quality assurance in support of the vice president of construction.

4.1.2 The Framework for Quality Objectives

Quality objectives are an integral part of the QMS design framework. Each component of the QMS imperatives flows down to the next level in a continuous movement. The order begins with a strategic statement of the overall site's scope of certification and industrial position. From this framework, the vision, mission, quality policy statement, and then quality objectives are established. Typical ISO 9001:2000 quality policy statements could be included as part of the quality manual text. The site's complete strategic framework also includes its process-based QMS, the manner in which customer needs and expectations are fulfilled, and the manner in which the quality policy is propagated throughout the site (Cianfrani & Joseph & John, 2002).

4.2 QMS STYLES

It is impossible to disregard the importance of QMS styles while trying to catch up effectiveness. The topics of inherent, broad readership requirements; the negative impact of a paraphrased manual; publication media choices, and effective writing styles are addressed to illustrate their impact on QMS effectiveness.

4.2.1 Readership and Form

The creation of the ISO 9000 documentation system is an iterative process whereby each document tends to support other documents. As a result, the question arises as

to which document to create first. There are several ways to approach this question, and all three approaches will have some percentage of the others in practice:

- *Top-down method*—Begin with the manual's quality policy statements and then create the lower tier documents.
- *Bottom-up method*—Work from the set of lower tier documents to create the quality policy statements in the manual.
- *Process-flow method*—Start with a flow analysis of the organization's processes and create the manual and lower tier documents concurrently.

All of these methods are observed in practice to some degree and believed that the most effective approach overall is to begin with an analysis of the organization's processes first (i.e., the process-flow method) (McLymont & Zukerman, 2001).

The Standard does imply a form of style in Par. 4.2.1: General Documentation Requirements, Note 2, which advises that QMS documentation can vary considerably between organizations due to differences in size, complexity, and personnel, among others. This implies that the Standard allows the organization to custom fit the documentation to the organization's sophistication and complexity. Just like,

- Design engineers require primarily guidelines.
- Experienced mid-level constructors need a minimum of procedures.
- Test operators need more detailed process sheets to properly perform their functions.

Linear Estimate

A rule with regard to necessary detail can be offered (see Figure 4.1).

When the manual is written for the customer, and especially for the new customer—in a clear, concise manner, filled with specific information for decision makers—it is an effective document for all other readers.

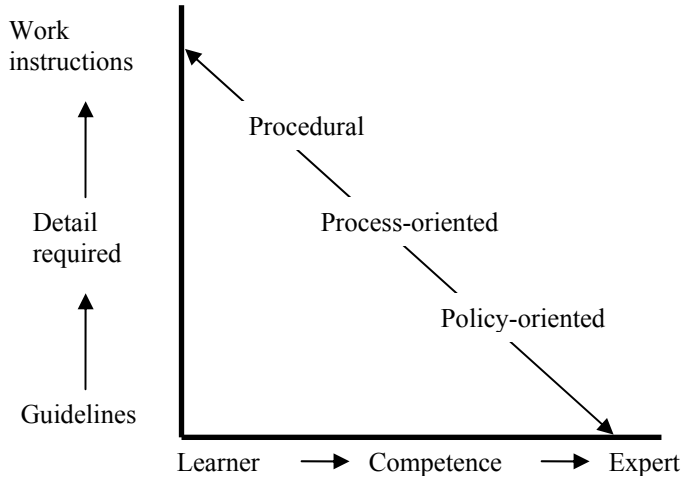

Figure 4.1 Documentation rule to "consider the reader."

4.2.2 The Adverse Effects of Paraphrasing

Paraphrasing trivializes the Standard. For example, those organizations where the manual has been highly paraphrased, the tendency is not to audit the manual during internal quality audits. Auditors know when something isn't worth their time and effort. In those cases, of course, the manual falls behind in its currency and relationship to enterprise reality (e.g., out-of-date organizational charts, processes, and quality objectives).

There are typically two classes of paraphrasing:

- Class I—a direct restatement of the Standard with minor modifications;
- Class II—a table of contents list of where to find information in the lower level documents based on a direct restatement of the Standard.

Paraphrased Class I Characteristics

The best way to define this issue is to give an example of a paraphrased quality policy statement. It is chosen the Standard's requirement, 8.2.2: Internal Audit. The following is a typical direct paraphrasing of this requirement (essentially word by word of the Standard's text):

XYZ's managers who are responsible for the area being audited shall ensure that actions are taken without due delay to eliminate detected nonconformities and their causes. Follow-up activities shall include the verification of the actions taken and the reporting of verification results.

In the direct method of paraphrasing, all or nearly all of the Standard's text is used as a quality policy statement. As a result, a manual written in this fashion

- Looks, reads, and feels like the Standard itself;
- Has little to differentiate the text from that of a competitor;
- Fails to define the prescriptive rules of the house.

Moreover, the paraphrased text maintains the future tense, so it is not clear if this is what is going on now or later.

Paraphrased Class II Characteristics

Another technique commonly used to paraphrase is to put the language into a table of contents format. A typical pattern for 7.6: Control of Monitoring and Measuring Devices is as follows:

The XYZ Corporation's control of monitoring and measuring devices procedure demonstrates to do the following (refer to Doc. # MET-2-005):

- *Determine the measurements to be made and accuracy required;*
- *Identify all monitoring and measuring devices that can affect construction quality;*
- *Define the process employed for the calibration of monitoring and measuring devices;*
- *Identify monitoring and measuring devices with suitable indicators or approved ID records;*
- *Maintain calibration records;*
- *Assess and document the validity of previous inspection and test results when monitoring and measuring devices are found to be out of calibration;*
- *Etc, etc, etc.*

The table of contents approach at first glance almost sounds and looks like a prescriptive set of quality policy statements. But difference is clear when responsive statements are actually used.

Recommended Quality Policy Statement Response

- The identification, calibration, and adjustment of all equipment at the XYZ Corporation are the responsibility of operations engineering. Calibration plans are managed via logs that are maintained to indicate calibration cycles and frequency.
- Calibration labels are used on all test, measurement, and inspection equipment to alert operators that calibration is adequate or due. If calibration is overdue, operators are to immediately alert operations engineering and suspend using the equipment until calibration is completed.
- All equipment is sent out for independent calibration to companies selected on their capability with regard to using nationally known standards. Operations engineering maintains logs of all of these transactions.
- A Paradox database file, CALIBRAT.DB, is maintained listing calibration status for all equipment on a calibration cycle.
- Etc, etc, etc.

The following can be maintained about paraphrasing:

- In its restatement of already known phrases of the Standard, it offers the reader minimal organizational information and obscures the uniqueness of the quality management system
- It fails to clearly instruct the executive staff of the importance of continuous improvement and the manner in which the staff is to achieve this goal.
- It does not permit the reader to grasp the organization's technical and construction personality.
- It negates the business development potential of the manual—it makes every organization sound like every other organization, and why any

organization would want to be seen as undifferentiated from its competitors.

- It is a form of intellectual dishonesty because it trivializes the intent of the Standard, which is to provide a clearly stated and definitive top-down, executive view of the organization.
- It has been found to be a tool used primarily by a single author instead of a group of technical experts, thereby diluting the technical integrity of the manual.
- It makes the manual so useless in the eyes of internal auditors that they don't even bother to audit it.
- It makes the manual so useless in the eyes of the customer that they cannot use it as a reliable tool in decision making.

Paraphrasing is considered unacceptable in any manual. The formation of informative quality policy statements will force the organization to better understand its QMS and will orient its intellectual efforts in the direction of continual, enterprise improvement.

4.2.3 Publication Media

It is vital to select the publication media type (i.e., hard copy, electronic [online], or a mixture) that best suits the organization's capabilities. The documents must be controlled in some fashion. The following are some examples of control:

- Stamped;
- Controlled versus uncontrolled check marks;
- Different colored icons or strips or pages;
- Page count noted;
- Provisions made for the issuance of uncontrolled manuals (e.g., to staff, employees, customers/clients, and subcontractors);

- Provisions made for the issuance of hard copy in online systems for training, revision control, and the use of hard-copy documents for specified limits of time by project personnel.

Generic Numbering System

In many cases, the documentation system is a mixture of online and hard copy. This raises the issue of just what type of numbering system will work concurrently. One possible approach is to have the online format as shown in Table 4.3.

Table 4.3 Numbering System for Online Format

Dept	**Tier II**	**2**	**852**	**12**	**01**
(Directory)	(Subdirectory)	(Level)	(Element of Standard)	(Document)	(Revision level)

In this table:

- Only eight integers or alphas are needed.
- The department and tier II levels do not require a number because they are in computer directories and subdirectories.
- The level number is either 1, 2, 3, or 4 for the various tiers.
- The element of the Standard would run from 004 to 853.
- The document number runs from 01 through 99.
- Revision control runs up to 99.

4.2.4 Writing Style

The manual, in order to satisfy such a diverse audience and to meet the needs of its customers, should follow several style guidelines (Russo, 1997).

Short Paragraphs and Sentences

- One idea per paragraph.

- Normally it is possible to write about 40% more than is necessary. It will take about two years after the certification to clean up the documents so that they are effective.

Simple Declarative Sentences

Simple declarative sentences must be used. Examples:

- The planning function at XYZ is the responsibility of construction control.
- Construction control supplies the materials department with a daily list of raw material requirements by means of the MRP system.

Redundancy

Redundancy must be avoided in documentation. Redundancy confuses the reader and forces the assessor to compare redundant sentences. Invariably they will differ and this may cause a nonconformance based on the degree of difference. The classic places for redundancy occur between tier II and tier III documents, and between flow charts and their attendant text, which usually just repeats the flow chart information.

Table of Contents (TOC)

A useful table of contents should be built and the relationship between the TOC sections and the specific clauses of the Standard has to be indicated at the highest level of the Standard as possible. (i.e. see Table 4.4 and Table 4.5).

Table 4.4 Example of a Directly Referenced Manual TOC

Manual Section	Section Title	Standard Reference Element Number
1	Scope of the QMS	1.0
2	History of the Enterprise	—
3	Organization Vision and Mission	—
4	Quality Management System	4.0
5	Management Responsibility	5.0
6	Resource Management	6.0
7	Product Realization	7.0
8	Measurement, Analysis, and Improvement	8.0

Table 4.5 Example of an Indirectly Referenced Manual TOC

Manual Section	Section Title	Standard Reference Clause Number
1	Quality Manual	4.2.2
2	Quality Policy	5.3
3	General Requirements	4.1
4	Management Commitment	5.1
…	…	….
18	Corrective Action	8.5.2

Referenced Documents

A clear reference to the associated lower tier document maintains the interest of the reader. There are a number of ways to link, for example:

- *Direct reference:* "The business development process is described in Doc# 7-2-001-0206, entitled 'Standard Operating Procedure for Business Development.'"
- *Indirect reference:* "The lower tier process documents for business development are listed in Appendix A, entitled 'Master List (or Document Tree) of Lower Tier Documents by Manual Section.' The related documents are found under the column (tree) denoted as business development."
- *Hyperlink:* "Please use the icon entitled 'Design Control Process_' for further information."
- *Hybrid systems:* Systems that contain both electronic and hard-copy files are the most common documentation systems in use. It is imperative to clearly define which documents and records are online and which are hard copy. Most importantly, it is vital to clearly define if electronic signatures are in use, how the software is validated, and how the electronic signatures are protected

Graphics Usage

Graphics are better be used whenever possible for tables, figures and flow charts. This is especially true for online systems, where only a portion of the total document can usually be seen at a time.

Language Type

It is important to minimize organizational jargon but keep the industry language. Acronyms such as CEO, COO, and CFO are fairly well recognized internationally. However, short forms like DQA (director of quality assurance), and DCA (document control administrator) that may or may not be familiar within the organization place a burden on the reader.

It is better to spell out the titles every time than to rely on the reader's memory. However, the manual is read by experts and the language of the industry should not be thrown away. On the contrary, stream-of-consciousness technical writing is a quick way to lose the reader.

Present Tense

It must be avoided to use the future tense, either it is happening or it is not. The use of SHALL and will leaves the issue hanging and cannot be readily audited. SHALL is used in the Standard because it is a future requirement of the organization. Once the organization has responded to the SHALL, it is now in the present. As an example, instead of "Every department manager shall hold a monthly quality review session with their staff," it is preferred "Each department manager holds monthly quality review sessions with his or her staff."

If it is necessary to include a future event, the future tense is appropriate (e.g., "In 2003, the present tracking system will be replaced with an MRP system"). Also present continues tense must be avoided too.

Active Voice

Active voice must be stressed within a sequence of subject, verb, and object.

- *Preferred:* The president has designated the director of quality assurance as the ISO management representative,
- *Avoid:* The ISO management representative has been designated by the president as the ISO management representative.

4.3 QMS BENEFITS

Grounding on the mentioned design and implementation system, the benefits to be gained from a QMS that is fully compliant with the Standard and integrates business strategy with quality management is outlined in Table 4.6. It is assumed that the fully responsive techniques discussed here have been chosen to create the QMS.

Summary of Global Mandatory Requirements As a handy check-off list, the following global documentation has been shown to be mandatory (although there are requirements that are partially discretionary):

- A QMS;
- A quality manual (tier I);
- Documented quality policy (tier I);
- Documented quality objectives (tier I);
- Identification of processes (tier I);
- Sequence and interaction of the processes (tier I);
- Management reviews (tier I);
- Process plans (tier II);
- Monitoring, measuring, analysis, and improvement plans (tier II);
- Six documented procedures (tier II);
- Work instructions as applicable (tier III);
- Other documents needed to ensure the effective planning, operation, and control of its processes (all tiers);

- Records as required (exist at all tier levels)—to indicate objective evidence of effective operation;
- Documents that describe product characteristics (tier III);
- Method of linkage between tiers;
- Declaration of the ISO management representative;
- Description of the organization to be certified;
- Specific description of responsibility and authority of at least the top management;
- Inter and intra organizational interfaces;
- Demonstration of the effective implementation of the system;
- The use of sensible levels of documentation;
- The effective management of customer complaints;
- Declaration of factored items (if applicable);
- Master list of current Standards and codes.

Table 4.6 Benefits of the Unified QMS

Type of Reader or Function **Type I—Readers**	**Benefits**
Site manager	Significantly improved communication at all levels; opportunity to modify processes based on a more complete perspective
Executive staff	Obviously strong correlation between the completeness of the manual and the overall knowledge of the executive staff with regard to business policy
Customer	Dramatic improvement in communication and acceptance for more demanding contracts
Third-party registrars and assessors	Exceptional clarity leads to a far more effective assessment at a greater depth into the organization
Subsuppliers	Significantly improved grasp of your objectives and how to respond to them
All decision makers	The availability of clear and concise information significantly improves the decision-making process
Type of Reader or Function **Type II—Organizational Objectives**	**Benefits**
Response to organizational objectives	Exceptional response at all levels of the organization in the measurement and publication of enterprise metrics
	A powerful framework within which to establish quantitative quality objectives throughout the enterprise and to categorize them in terms of metrics and goals/targets
	A signal to all employees that the main purpose of the ISO 9000 certification is to improve the effectiveness of the operation, not just achieve certification
Type of Reader or Function **Type III—The QMS**	**Benefits**
Tier II documentation	Very strong influence on the completeness and effectiveness of hub documents and knowledge of business processes
Tiers III and IV documentation	Appears to have a minor effect. It had been observed exceptional tier III performance with incomplete manuals

PART 5: PERCEPTION AND EXPERIENCES ON ISO 9000 STANDARDS IN CONSTRUCTION COMPANIES

The meaning of quality and the implementation of effective and efficient quality control systems have been the main concern for the management of companies that are today leaders in the international market. Today, with the globalization of economy and the rapid development of technology, international competition is fierce and the quality of both products and services has become a matter of survival. This is the reason that has led to the systematic and rapid development, implementation and spreading of modern and flexible quality systems. These systems have already offered a great deal of support to the competence and profitability of the companies that have managed to apply them successfully.

Recently, considerable effort has been expended in the implementation of quality assurance systems in the construction industry. The construction industry is a business sector that plays a substantial role in a country's national economy. This role is even more important in developing countries whose infrastructure appears to have serious problems. In such cases, the construction industry can offer substantial support to both the rational and systematic development of the various business sectors, and the basic economic measures of the national economy. To succeed in this task, the management of construction companies need to work very hard and take into consideration criteria like quality, cost and time.

5.1 PROFILE OF THE CONSTRUCTION INDUSTRY

The construction industry is characterized by a number of elements which differentiate it from other known business sectors like manufacturing and services. The differences apply to products, technology and organization, product market and competition structures, capital market, labor market and environmental effects.

Hart (1994) states that both manufacturing and construction are complex processes with the major difference between them lying in their end products. In construction projects, the production process ceases to exist after the project has been completed. At this point, the product of the construction project is the actual finished facility, building or other work product. Any improvement in that process is theoretically not possible, although data gathered may be used to improve any future relevant processes. There are many other characteristics of this sector whose importance may vary (Forecasting and Assessment in Science and Technology, 1993). These characteristics are summarized in the following.

For the products of this sector, it is possible to point out the following:

- They tend to be unique because they are single, custom-made and not easily substitutable goods, built to specifications provided from the customer.
- They are produced on the location of consumption which means that they show territorial immobility.
- They have very long life-time or temporal immobility. The investments and usage of them are tied down for a long period of time.
- Even as they decay, construction products can still be repaired. Therefore, a large proportion of construction work is maintenance work.

For the technological and organizational characteristics of this sector, it is possible to point out the following:

- Concentration of production at one location is impossible, as machinery and equipment have to be moved regularly.
- The use of traditional rationalization methods (standardization, series production and division of labor), as well as the application of specialized machinery and advanced technology, is limited mainly due to the uniqueness and immovability of the products.
- Labor intensity is high and capital intensity is low (the fixed capital investment is one of the lowest among all industries). As a consequence, labor productivity is low in construction.

- The technology of the sector has always been characterized by what Piore and Sabel (1984) have called ‘flexible specialization’.
- Because production takes place at the location of consumption and these locations are territorially dispersed, the industry itself is also one of the most territorially dispersed ones.
- The low degree of capital intensity implies limited specialization of firms with regard to the types of products.
- The small average firm size and fierce mutual competition, resulting in narrow profit margins, do not allow the great majority of firms to invest in research and development activities.
- Firms often form temporary joint ventures for bidding and executing of large projects.

For the product market of this sector, it is possible to point out the following:

- The relationship between a construction firm and its customer is one of executor and instructor.
- Typical for the industry is the separation of product design and construction.
- A construction firm has to sell something which has yet to be built, often under conditions which are partly beyond its control, such as the weather, the situation of the construction site, etc.
- The market structure is asymmetric, often with a series of temporary monopsonies, since tendering is the predominant way of getting a project.
- The limited degree of product specialization makes functional market segmentation limited. However, regional market segmentation is quite significant.
- Competition is based more on price and less on quality and time-span of delivery.
- Competition is often fierce, even destructive, forcing firms to bid under price, depending on the business cycle.

- Quality control is necessary but difficult. Fierce competition has induced entrepreneurs occasionally to use cheaper and lower quality building materials or to ‘adulterate’ their products in other ways.

For the capital market of this sector, it is possible to point out the following:

- Construction products tend to be very expensive goods and therefore it is rare that they are paid for in cash. They have to be financed.
- Interest rates and more general developments on capital markets are a major factor influencing the demand for construction industry products.

For the environmental effects of this sector, it is possible to point out the following:

- The construction industry is generally a producer of large amounts of waste materials. However, it is also a user of these materials.
- The products are directly connected with the location where they are produced.

For the labor market of this sector, it is possible to point out the following:

- Labor is an important cost factor in this industry. This fact encourages the use of ‘black’ labor and also labor subcontracting.
- There is high labor mobility due to on-site-production, low capital intensity and high entrepreneurial risk.
- The sector has significant health and safety problems.

The logical progression of the activities of a construction project in order to establish a clear and complete picture of the nature of the construction activities is the basic work-flow pattern as (Hart, 1994):

1. Project fundamental concept
2. Feasibility and other special studies
3. Design criteria and preliminary design
4. Detailed design
5. Materials procurement

6. Engineering support
7. Site mobilization and initiation of earthwork
8. Structural and civil activities
9. Installation of roof and vertical enclosures
10. Installation of mechanical and other equipment
11. Installation of electrical equipment
12. Finishwork and specialty items
13. Modifications and maintenance
14. Finished facility

5.1.1 The concept of quality

Quality can be defined in several ways. A definition proposed by Arditi and Gunaydin (1999) defines quality in terms of conformance to the agreed requirements of the customer and a product or service free of deficiencies. The term ‘‘quality’’ should not be used as an expression of degree of excellence, as may be implied by a dictionary definition. This term should be used and defined as ‘‘a measure of fitness for purpose, in the sense of meeting the needs of a customer, at a price commensurate with the extent of those needs.’’ ISO defines quality as the totality of characteristics of an entity that bear on its ability to satisfy stated or implied needs (ISO 2000).

The construction end product is not a repetitive unit, but an endeavor that may be unique in its design and composition. Internal and external factors such as community response, construction cost, and time of delivery must be addressed in the design and construction of a building. Quality in construction can be viewed as part of a triangle in which the contractor must attain the cost level as planned, meet the schedule deadlines, and achieve the required quality level. An equitative balance among these three aspects is considered as ideal. However, quality may be the first of these components to be disregarded or sacrificed in favor of increased cost savings and time reductions.

As stated earlier, there is both a regional and international necessity for the introduction and implementation of advanced quality control systems in construction projects. This is for several reasons: fierce competition, the growing needs of the project owners (customers) and the need to comply with industry standards for safety and environmental protection.

According to Rahman (1993) and Rahman *et al*. (1996), the basic motives driving the introduction of quality in the construction industry are the following:

- reduction of production cost;
- improvement of safety;
- on-time completion of projects;
- establishment of a healthy framework of competition.

Before looking at the basic elements of quality control in the construction industry, it is important to define the meaning of quality for this business sector. Quality has a three-fold meaning in construction (Hart, 1994): it means getting the job done on time; it means ensuring that the basic characteristics of the final project fall within the required specifications; it means getting the job done within budget. A quality construction project has to comprise all these dimensions. Actually, quality in construction is directly connected with conformance to specifications and fitness for use.

It is well known that with more affluent, educated and quality-conscious customers, the expectations for quality construction projects will continue to grow rapidly. These expectations include the following:

- protection of the environment of the project;
- functional and practical design;
- products that are defect free during all stages of the project;
- close cooperation with both suppliers and subcontractors;
- improved relation between cost and value;
- maximized return on investment (ROI).

The nature of these quality characteristics shows that the quality issue in the construction industry can be considered from two different levels. These levels are the industry level and the project level.

According to Hart (1994), it is very important to define the quality requirements of the whole project, as well as each step within the project, early on in the project. The identification and compliance with applicable codes, standards and customer requirements is best addressed early in the conceptual design phase of the project. Such a practice best prepares a construction firm both in bidding procedures (where they are applicable) and in having time to prepare a better and more functional design.

The assessment of quality in a construction project involves two components: quality assurance and quality control. Quality assurance is considered as a ‘‘system of controlling the provision of a product or service so as to satisfy the needs of the customer’’ (Chini 1999); it is identified as an external quality system, covering activities aimed at inspiring confidence in the client regarding the product or service being provided. Quality control is the ‘‘specific implementation of the quality assurance program and related activities’’ (Arditi and Gunaydin 1999).

Several approaches to quality assurance and control in construction have been proposed and adopted in recent years. These include; (1) partnering, which attempts to improve the communication flow on a specific construction project; (2) business process reengineering, which is a fundamental and radical approach to process redesign in terms of meeting customer demands (Jaafari 2000); (3) constructability reviews, which consist in a review of the project plans and specifications in an effort to improve the quality of the construction process and the completed product; (4) value engineering, which attempts to improve the value and optimize the life-cycle costs of a facility from the preconstruction phase; and (5) total quality management (TQM), which is an operational philosophy that emphasizes continuous improvement of all facets of an organization.

5.1.2 Quality assurance

Aggressive competition, both at the regional and international level, has imposed higher quality levels in almost all business activities and sectors. To ensure their position in the emerging international market, construction firms in many countries are actively engaged in trying to achieve internationally accepted quality levels. Terms like quality control, quality assurance and quality management are more or less a part of the normal terminology of the construction industry.

For the construction industry, ISO 9000 series for quality assurance systems certification represents a framework for improvement of its organization and quality. The development of the quality assurance system follows a parallel orbit with that of manufacturing industry. Of course, the developmental procedure has certain fundamental differences as compared to that of manufacturing, but these are mainly due to the different characteristics of the construction production process and other operational activities. The critical characteristics that differentiate quality assurance implementation are the following:

- the great differentiation of products and production processes;
- the long life cycles of construction projects;
- the wide use of subcontracting;
- the difficulty in uniform evaluation of overall construction quality due to the scarcity of relevant standards;
- the differentiation of production sites and project participants.

There are two levels at which to consider the development and implementation of a quality assurance system in construction industry: the organizational level and the project level. The second level sets the overall (organization-wide) quality policy and quality system procedures, while the first level focuses on implementing the applicable elements of the quality system to each different project.

The main elements of the quality assurance system are the same as in manufacturing operations, including (a) quality manual, (b) quality system procedures, (c) work instructions and (d) quality system documentation.

Usually, system development is done by external consultants with the cooperation of the middle management of the firms. Overall responsibility for the quality system after its development, implementation and certification lie with the most senior executive, usually the Chief Executive Officer. The responsibility for project quality assurance activities lies with senior management representatives, who are usually called project managers. The essence of a quality assurance system is the requirement that each project has a comprehensive quality plan in the framework of the general organizational quality system.

It is important when implementing an effective quality assurance system to be able to differentiate it from those of the competitors. To achieve this, managers and quality assurance experts try to assess the organization's strengths and weaknesses objectively and pragmatically, and base system development on this assessment.

ISO 9000 is a set of defined standards, rather than a management philosophy, that was created to provide uniform quality assurance standards for product manufacturing and service providers in a globalization perspective and has been adopted by numerous organizations all over the world.

5.2 ISO 9000 IN CONSTRUCTION

Due to the generic nature of ISO 9000, it has also been implemented in the construction industry. Specifically, and following the 1994 revisions scheme, ISO 9001 and 9002 can be applied to construction-related firms. The former standard addresses design, development, and servicing capabilities, whereas the latter addresses the same elements except for design control. The elements required of an organization certified to ISO 9000 have continuously been identified with manufacturing procedures. Nevertheless, they have been adapted for construction

procedures and are believed by some parties to cover a wide scope of quality related activities of construction-related firms. Both Chung (1999) and Nee (1996) have illustrated the interaction and application of the requirements of ISO 9000 in construction activities.

ISO 9000 has gained wide acceptance in the global construction market. Construction has the third highest number of certificates of all industrial sectors at a worldwide level, behind only electrical and optical equipment and basic metal/fabricated metal products. According to data published by the International Organization for Standardization (ISO 2000), approximately 25,273 construction-related firms had achieved certification up to 1999. This accounts for 7% of the total number of certified companies in all industrial sectors. Far East countries rank among the most vehement advocates of standardization in the construction industry; in fact, Korea (with 4,096 certificates in 1999) and China (with 2,051 certificates in the same time period) rank first and third in the list of countries with the highest number of ISO 9000 certificates in the construction industry. In countries like Australia, certification is becoming mandatory for all construction organizations wishing to do business with government agencies and major private companies. Europe is increasingly requiring knowledge of ISO 9000 for construction companies, with support from the European Union. Countries such as Italy, the Netherlands, and Switzerland have the most certifications in the construction sector for the European continent; they rank second, seventh, and eighth in the world, respectively. However, acceptance of the standards in Europe still experiences problems, especially since the European construction industry is traditionally fragmented.

Construction firms for a variety of reasons pursue ISO 9000. Ideally, the main motivator for certification should be the achievement of quality in a company's internal procedures in order to optimize resources and better satisfy customers' requirements. Many organizations are pursuing certification in order to satisfy specific requirements from one or more customers. This is true for firms working or targeting projects for owners that are either certified to ISO 9000 or require certifications for their suppliers. Other organizations at a worldwide level are

obtaining certification due to increasing government requirements. This is true for local and international firms working in Asian markets, where ISO 9000 is increasingly becoming a mandatory requirement for bidding in public projects. Other firms take advantage of ISO 9000 as an effective marketing tool through an improved company reputation.

The application of ISO 9000 in construction has its advocates and opponents. Supporters believe that ISO 9000 can be applied successfully in construction and can generate substantial benefits. It is believed that a construction company's operations can improve through the establishment of a quality system designed to standardize corporate procedures (Chung, 1999). ISO 9000 is also considered as an effective control mechanism that seeks to reduce waste and labor inefficiencies in a process so that quality in the production and delivery process can be ensured. From another point of view, ISO 9000 certification provides proof that an optimal level of quality is being obtained throughout all stages of the product's quality cycle (Love and Li 2000), therefore expanding a company's marketing opportunities.

ISO 9000 certification in construction firms has been strongly debated and consistently criticized by other parties. They state that the interface of the standards with the special characteristics and properties of the construction industry can generate problems. It is arguable whether construction procedures can be standardized at all (as it can in the manufacturing industry), knowing that the product of construction is in a sense always unique, the processes of construction involve a variety of professionals and tradesmen, and the environment where these processes are carried out is often exposed to aggressive elements (Chung, 1999). Besides, the generic nature of the standards often leads to differences in interpretations, and the implementation, use, and impact of ISO 9000 can vary between companies and countries (Bubshait and Al-Atiq 1999), being difficult to measure and monitor. Usually a contractor is required to finish a project within a specified time frame, at an agreed price, and at a certain standard of workmanship in order to maintain the required quality. These are considered conflicting goals running in three different directions, and usually quality is the first to be sacrificed (Tam et al. 2000). An

increased emphasis in fast tracking can also hinder quality efforts because of unclear specifications, insufficient specification reviews, mistakes made early in the project, and problems of constructability (Low 1997).

The acceptance of ISO 9000 standards in the construction industries is not as wide as in other industries, such as manufacturing. There are special features in the construction industry that limit the implementation of the ISO 9000 standard. The following are some of these features (Phenol 1994; ‘‘Quality’’ 1992):

- A construction project is usually a unique collection of people, equipment, and materials brought together at a unique location under unique weather conditions, while most manufacturing is a system of mass production wherein all of these factors are consistent with producing typical products over and over again.
- Performance testing in construction is generally not feasible as a basis for acceptance.
- It is common to have separate contracts for design and construction.
- It is not feasible to reject the whole constructed project after completion while attached to the purchaser’s land.
- Decisions to reject a defective part of a constructed project need to be taken promptly before succeeding parts are constructed or installed.
- The number of parties involved in the constructed project’s procurement is more than those involved in manufacturing procurement. Achieving quality construction requires effort from all parties. This makes the interface and responsibilities of the various individuals and organizations more complicated than in manufacturing.
- The organizational structure of a construction company varies depending on the nature of the project, while the same structure in a manufacturing company is almost unchanging. This affects the smoothness of communication and interface between the responsible individuals.
- Turnover of manpower in construction is higher than in manufacturing, which affecting the precision of long-term plans.

- Construction projects are very complicated and their execution may take years.

The generic nature of the standards often leads to differences in interpretations. In turn the implementation, use, and impact of ISO 9000 standards can vary from company to company and from country to country. The concept of ISO 9000 has been viewed in various ways; as a means of improving the overall quality of operations; as the requirements of customers to be complied with; as a necessary response to competition; as a way to reduce cost; as a means to improve the flow of activities and coordination in the organization; as a strategy to have better sales through an improved quality image; as a way to maintain competitive edge in the industry, etc. (Bhuian and Al-Zamil 1996; Lamprecht 1992). Thus, the impact of ISO 9000 standards may vary depending on how it is perceived by companies.

5.3 GLOBAL NUMERICAL ANALYSIS OF ISO IN CONSTRUCTION INDUSTRY

A questionnaire survey was conducted by Dissanayaka, S. M. among construction companies during February/March 1999. The questionnaires were mailed to the selected organizations and they were requested to fill in and return these in self-addressed envelopes or to fax them before the deadline. Twenty four responses were received before the deadline. After follow-up with some organizations, another nine responses were received, totaling 33.

Motivators behind the implementation of ISO9000-certified quality systems in construction companies are (Figure 5.1):

1. To qualify to tender for public projects 88%
2. To meet customer expectations 64%
3. To improve the quality of work done 52%
4. To gain competitive advantage 48%
5. To increase efficiency and productivity in all areas of operation 45%
6. As part of a larger improvement strategy 42%

7. To satisfy top management's corporate directive 33%
8. To reduce costs of operation 12%
9. To compete more effectively for overseas projects 6%
10. Others

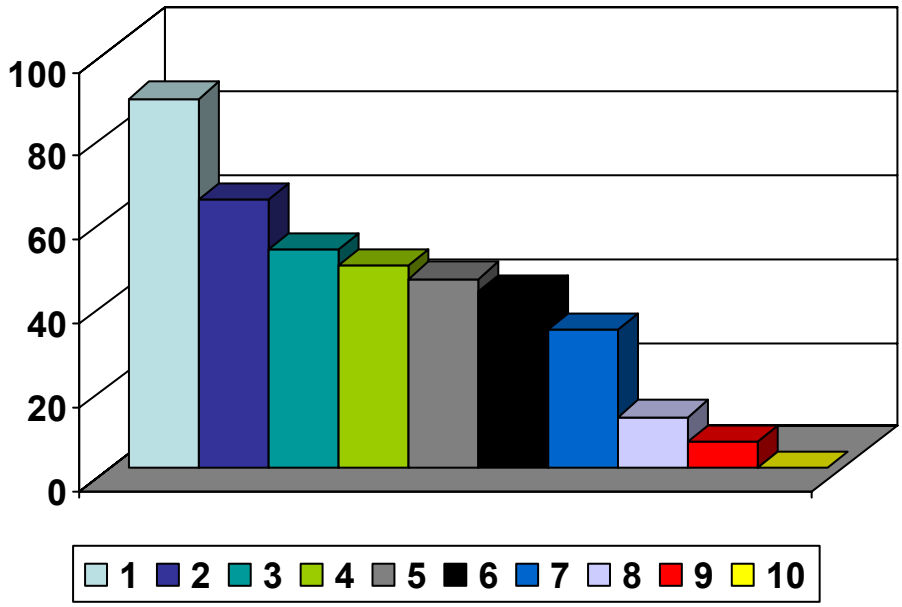

Figure 5.1 Motivators for the implementation of ISO-certified quality systems

Perceived positive outcomes /advantages/benefits from implementing ISO 9000-certified qualitysystems in construction companies are (see Figure 5.2):

1. More systematic record keeping 97%
2. Improved internal communication 91%
3. Improvements in internal performance appraisal systems 82%
4. Enhanced competitiveness of company 82%
5. Continual improvement of operation 81%
6. Less rework or repair 79%
7. Greater client satisfaction 76%

8. Having a valuable marketing tool 75%
9. Client perceives higher quality of work done 70%
10. Stronger customer focus 67%
11. Higher efficiency in operation 64%
12. Fewer problems in defects liability period 61%
13. Better risk management 61%
14. Better access to domestic markets 58%
15. Improved external communication 52%
16. Improved supplier relations 45%
17. Better access to overseas markets 44%
18. Shorter project completion time 13%

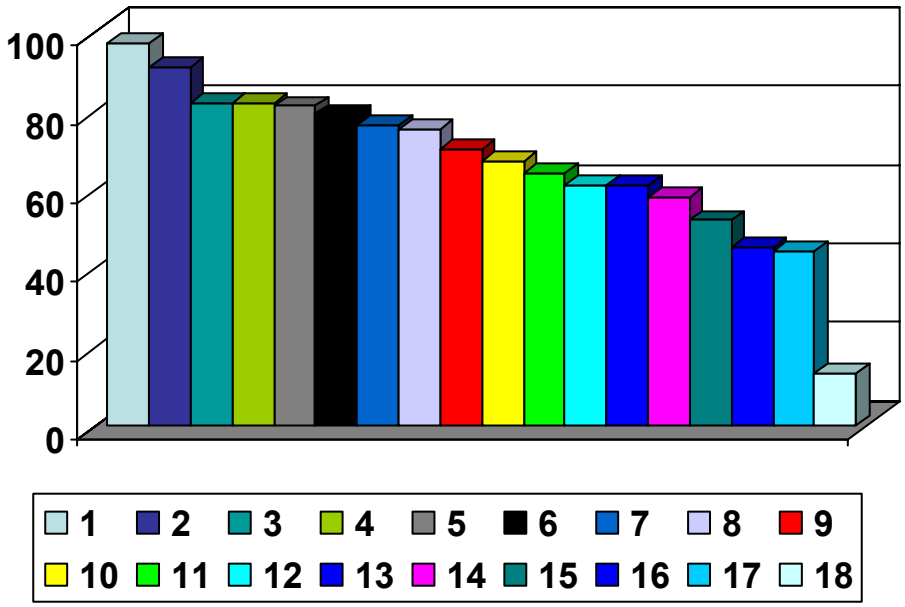

Figure 5.2 Perceived advantages for implemented ISO 9000 QMS in construction industry

Perceived negative outcomes/disadvantages/drawbacks of implementing ISO 9000-certified quality systems in construction companies are (see Figure 5.3):

1. More paperwork 100%
2. More time spent in management 85%
3. Increased bureaucracy 63%
4. Higher overall project cost 58%
5. Less flexibility in operation 42%
6. Increased staff discontent 35%
7. Lower productivity 13%

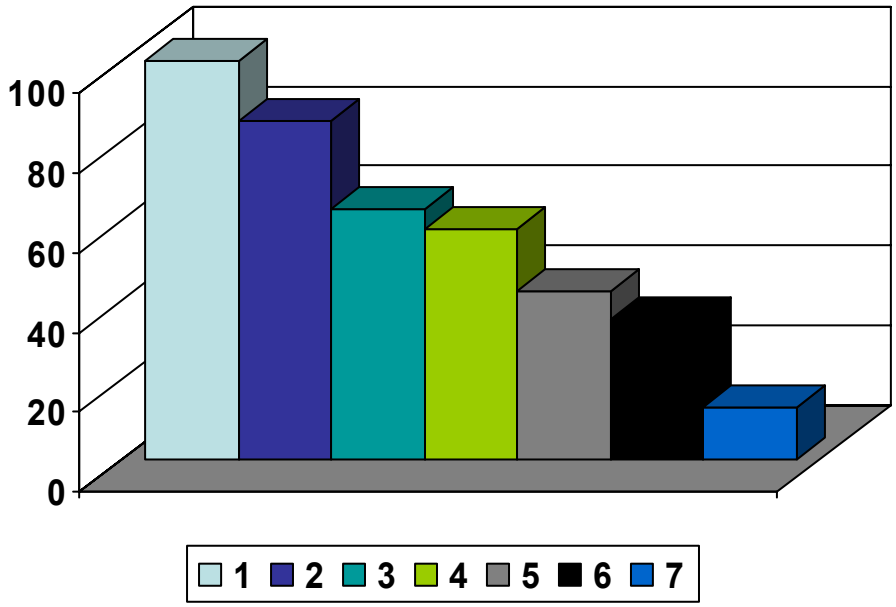

Figure 5.3 Perceived disadvantages for implemented ISO 9000 QMS in construction industry

5.4 XYZ CORPORATION FINDINGS OVER ISO PROCESS

Financial perspective

Time required for quality work: The company set aside time for quality work. The amount of time is not measured, but the data revealed the following. Two people were engaged in quality matters full-time and every employee underwent a half-day

training course in quality techniques. The time required for quality work was judged to be of great importance but was only partly measured.

Control of inspections: Inspections were not viewed as an effective approach to quality management. Efforts were made to minimize inspections and to concentrate quality efforts to early stages of the process. It was felt that the inspections carried out should be as close as possible to the activity involved. The company also stressed the point that quality assurance is not the same as making inspections. It is noted for example, 'Inspections are costly' and 'Checklists do not help'. Control of inspections was deemed to be of high importance but was not measured.

Certification cost: The direct costs were those connected to certification, i.e. the costs associated with engaging an accredited certification agency. The company merely stated that certification 'is not inexpensive'. The company wanted to gain certification. The certification cost was judged to be highly important, but was only partly measured.

Customer perspective

Customer satisfaction: The Company was convinced that the maintenance of a quality system was worthwhile. However, customer satisfaction was judged to be of moderate importance and was seldom measured.

ISO 9000 certification: Certification of the quality system was the goal of the company. According to the respondents, a quality system should encompass the whole company, not simply a particular section, or a particular department. It appeared that repeated internal auditing of a quality system was something the company was basically in favor of. The company thought that those of their suppliers that had a certificate were better than those who did not. ISO 9000 certification was judged to be highly important and was easily measured.

Zero defects at delivery: Zero defects at delivery was judged to be of moderate importance and was seldom measured.

Process perspective

Competitiveness: There were high expectations that the implementation of a quality system would increase the company's competitiveness. Although no one provided any concrete example of this, there was a strong belief in the relationship between quality systems and competitiveness. Respondents maintained, for example; 'A quality system makes the product better and cheaper', 'A quality system generates more projects', and 'Quality assurance is a matter of survival'. Competitiveness was judged to be of great importance but was not measured.

Efficiency: The Company regarded a quality system as being identical to a system aimed at attaining greater efficiency. Although the company was convinced that work on quality led to an increase in efficiency, there was no definite concept of how great the gain was. There was also the fear that bureaucracy would increase and that the routines of a quality system were not completely realistic. Efficiency was judged to be of great importance but was not measured.

Follow-up: The Company could identify any concrete strategy for achieving positive effects in connection with quality work, although they expressed the opinion that following-up the effects of a quality system was important. The only concrete measure employed was the number of negative assessments found in the final inspection protocol and the time required for correcting errors. Follow-up was judged to be of moderate importance and was not measured.

Innovation and learning

There were no key factors that indicated that the company found the organization and learning perspective important or that tried to measure any key factors associated with it. This may partly be explained by the lack of requirement for systematic improvements in the standard.

Current Image of ISO to XYZ Corporation

The total effect of a quality system cannot be fully measured in practical or in theoretical terms. This is, in part, due to the complexity of the matter and to

continuous changes occurring in the environment. However, this does not amount to giving up, and declaring it impossible to evaluate the effects. It is important that all routines in the quality system that fail to contribute to quality improvement and efficiency are removed. A management control system such as a quality system is not static, but must be altered and remolded continuously based on changes that occur in the situation in which the company finds itself. Accordingly, the weight placed on a specific measure may, and should, change over time.

The question for the company is whether the implementation of quality systems really makes a difference. While it is tempting to conclude that investments in quality systems increase organizational performance, there is little (if any) evidence that this is the case. Many of reports in the popular press, as well as in academic journals, are based on success stories. Failures are seldom reported; hence the average report is skewed towards too optimistic a point of view. Unfortunately, many investments in quality systems appear to be based more on blind faith than on facts.

The cost of quality has many definitions; one is the cost of quality management plus the cost of rework (Neese and Ledbetter, 1991). The cost of rework has been investigated and found to be considerable in relation to the contract sum in the construction process (Josephsson, 1994). Surprisingly enough, the rework cost was not mentioned by the company as a way of measuring the cost of quality.

The secret lies not in discovering one magic tool, but rather in learning which tools to use, how and when (Rigby, 1993). Most companies today operate in a turbulent environment with complex strategies that, though valid when they were launched, may lose their validity as business conditions change (Kaplan and Norton, 1996). Tools are only valuable if they improve results, and improved results will only occur when companies establish the capability to serve customer needs better than their competitors (Rigby, 1993).

PART 6: CONCLUSION

The inevitable change of construction industry directs the companies to implement QMSs. As the international projects take part in the scope of the construction companies especially the need to implement an internationally recognized QMS comes out to scene.

The ISO 9001:2000 QMS represents an international consensus on good management practices with the aim of ensuring that the organization time and time again deliver the project that meet the client's quality requirements. These good practices have been distilled into a set of standardized requirements for a quality management system, regardless of the scope of the construction firms, its size, or whether it is sole owned or a group of companies.

In this study, QMS documentation design and implementation is placed on a scientific foundation. A number of design rules are proposed that produce compliant quality manuals—and, as a result, compliant quality management systems. Such systems integrate business strategy with quality management and thereby form the organization's total QMS strategic enterprise position.

The design rules may be used in any order that fits. More rules that are appropriate to the specific enterprise needs can be added. What is key, however, is that the design rules be used somewhere in the process as a foundation and context for the QMS. The rules will create self consistency and diminish redundancy as well as promulgate clarity and vigor throughout the entire creative process.

The use of the proposed rules, applied to the case study of XYZ Construction Co. within the whole study, result in a more user-friendly, effective, and affective QMS.

Constructors derive the benefits of implementing ISO 9000-certified quality systems despite some perceived drawbacks expressing that, on balance, the benefits of a quality system outweigh its negative outcomes/drawbacks.

Based on the literature reviewed and the surveys among construction companies, it is observed that the majority of ISO 9000-certified constructors are in general agreement as to the net benefits, as well as on many of the positive and negative outcomes that may emerge from the implementation of the ISO 9000-certified quality systems. Strategies therefore need to be formulated to boost the net benefits, by strengthening the potential for commonly identified positive outcomes and addressing/ameliorating issues that have led to commonly cited negative outcomes (such as more paperwork). A constructor-specific toolkit that had been tried to develop here may also be improved to provide guidelines for orienting ISO 9000 system requirements towards particular construction industry processes and productivity needs.

The outcomes that had been achieved throughout the whole text and that had been shortly listed above show that the aim of the study has been mainly obtained. The next phase may be considered as to examine the relevance of ISO 9000 certification in the pursuit of TQM and other forms of continuous quality improvement in construction organizations.

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APPENDIX A

QUALITY POLICY AND OBJECTIVES OF XYZ CONSTRUCTION CO.

(Kalite Politikası ve Hedefleri)

Kalite Politikası ve Hedefleri

XYZ İNŞAAT çalışmalarının devamını sağlayacak istikrarlı kaynakları yaratıp, geçmiş bilgi ve tecrübelerini günümüz bilgi ve teknolojileri ile birleştirmek,

XYZ İNŞAAT'ın başarısını ve kalitesini etkileyen süreçleri sürekli olarak geliştirmek ve iyileştirmek,

Kalite yönetim sisteminin sağlıklı ve etkin kurulumunu sağlayarak maliyetleri düşürmek,

Faaliyetlerin gerçekleştirilmesi için nitelikli ve deneyimli elemanlar ile kalifiye insan gücü oluşturmak,

Müşteriyi en önemli değer olarak görmek, kalitesi ile müşterilere, verimliliği-rekabet gücü ile şirkete ve gerçekleştirilen her işe yeni değerler eklemek, XYZ İNŞAAT kalite politikasının ana düşüncesini oluşturur.

Yönetim ve denetimin etkinliğini arttırarak, ülkemizde ve uluslararası piyasada XYZ İNŞAAT'ın imajını güçlendirmek kalite hedefleri arasındadır.

Kalite, şirketimiz için ulaşılacak bir hedeften daha çok, devamlı geliştirilmesi ve sürekli-lik göstermesi gereken bir süreçtir. XYZ İNŞAAT, kalite hedef ve politikaları ile müşteri memnuniyeti ve yasal zorunluluklar gözetilerek sistem şartlarının uygunluğunu gözden geçirip 'sürekli iyileştirmeyi, geliştirmeyi ve büyümeyi' sağlayacaktır.

23.09.2005

APPENDIX B

QUALITY MANUAL RECORD & CONTENTS OF XYZ CONSTRUCTION CO.
ISO 9001:2000 CERTIFICATE

(Kalite El Kitabı – Kayıt ve İçindekiler)
(ISO 9001:2000 Sertifikası)

HAZIRLAYAN / PREPARED BY: KALİTE YÖNETİM TEMSİLCİSİ QUALITY MANAGEMENT REPRESENTATIVE	ONAY / APPROVED BY: YÖNETİM KURULU BOARD OF DIRECTORS

REVİZYON TAKİBİ / REVISION DETAILS

REVİZYON REVISION	TARİH DATE	AÇIKLAMA EXPLANATION
0	23.09.2005	Yeni / New

DOKÜMAN NO DOCUMENT NO	DOKÜMAN ADI	NAME OF DOCUMENT	YAYIN TARİHİ DATE OF PUBLICATION	REVİZYON NO REVISION NO
0.0	Kayıt ve İçindekiler	Record and Contents	23.09.2005	0
1.1	Şirket Profili	Company Profile	23.09.2005	0
2.1	Kapsam	Scope	23.09.2005	0
3.1	Terimler ve Tanımlar	Terms and Definitions	23.09.2005	0
4. KALİTE YÖNETİM SİSTEMİ / QUALITY MANAGEMENT SYSTEM				
4.1	Genel Gereksinimler	General Requirements	23.09.2005	0
4.2	Dokümantasyon Şartları	Documentation Conditions	23.09.2005	0
5. YÖNETİM SORUMLULUĞU / MANAGEMENT RESPONSIBILITY				
5.1	Yönetimin Taahhüdü	Management's Commitment	23.09.2005	0
5.2	Müşteri Odaklılık	Customer Focus	23.09.2005	0
5.3	Kalite Politikası	Quality Policy	23.09.2005	0
5.4	Planlama	Planning	23.09.2005	0
5.5	Sorumluluk, Yetki ve İletişim	Responsibility, Authority and Communication	23.09.2005	0
5.6	Yönetimin Gözden Geçirmesi	Management Review	23.09.2005	0
6. KAYNAK YÖNETİMİ / RESOURCE MANAGEMENT				
6.1	Kaynakların Sağlanması	Providing Resources	23.09.2005	0
6.2	İnsan Kaynakları	Human Resources	23.09.2005	0
6.3/ 6.4	Alt Yapı – Çalışma Ortamı	Infrastructure – Working Environment	23.09.2005	0
7. ÜRÜN GERÇEKLEŞTİRME / PRODUCT REALISATION				
7.1	Ürün Gerçekleştirmenin Planlaması	Planning Product Realisation	23.09.2005	0
7.2	Müşteri ile İlişkili Prosesler	Customer-related Processes	23.09.2005	0
7.3	Tasarım ve Geliştirme	Design and Development	23.09.2005	0
7.4	Satınalma	Procurement	23.09.2005	0
7.5	Ürün ve Hizmetin Sağlanması	Product and Service Provision	23.09.2005	0
7.6	İzleme ve Ölçüm Cihazlarının Kontrolü	Control of Monitoring and measurement Equipment	23.09.2005	0
8. ÖLÇME, ANALİZ, İYİLEŞTİRME / MEASUREMENT, ANALYSIS, IMPROVEMENT				
8.2	İzleme ve Ölçme	Monitoring and Measurement	23.09.2005	0
8.3	Uygun Olmayan Ürünün Kontrolü	Control of Non-conforming Products	23.09.2005	0
8.4	Veri Analizi	Data Analysis	23.09.2005	0
8.5	İyileştirme	Improvement	23.09.2005	0
9. EKLER / ENCLOSURES				
9.1	Süreç Yapısı	Process Structure	23.09.2005	0
9.2	Organizasyon Şemaları	Organisation Schemes	23.09.2005	0
9.3	Prosedür Listesi	Procedure List	23.09.2005	0

DANAK
Reg. nr. 5008

FORCE-Dantest CERT

FORCE TECHNOLOGY

Quality Management System Certificate
Certificate No.: EF-CKL-9001-057

This is to certify, that the Quality Management System of

XYZ İnşaat Taahhüt ve San. Tic. A.Ş.
İSTANBUL

Ashgabat Office:
TURKMENISTAN

Moscow Office:
RUSSIA

fulfils the requirements of

DS/EN ISO 9001:2000
Quality management systems

The scope of the certificate is:
General contracting works including design-build services completed on a turn-key basis where required

The basis for certification appears from the enclosure.

The certificate is issued in conformity with:
- FORCE-Dantest CERT's rules for certification of systems, conforming to EN 45012
- General terms for certification of systems, FORCE-Dantest CERT ABC-sys 14th edition, September 2003.

The certificate is valid until 31st December 2008,
provided that the surveillances mentioned in the enclosure have been carried out and signed by the FORCE-Dantest CERT Lead Auditor. The surveillances can be performed between two months before and one month after the planned dates.

Manager, FORCE-Dantest CERT

2006-01-13
Date of issue

Certification Manager

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APPENDIX C

SAMPLE PROCEDURE AND WORK INSTRUCTION OF XYZ CONSTRUCTION CO.

(Prosedürler ve Talimatlar)

LOGO	PROSEDÜR	DOKÜMAN NO : 4.01
		REVİZYON : 00
	Proje Yönetimi	SAYFA :
		TARİH : 23.09.2005

Hazırlayan	Sistem Onayı	Yürürlük Onayı
Genel Koordinatör	Kalite Yönetim Temsilcisi	Yönetim Kurulu

REVİZYON TAKİBİ

REVİZYON	TARİH	AÇIKLAMA
00	23.09.2005	Yeni

1. Amaç

Bu prosedürün amacı, sözleşmelere göre gerçekleştirilen tüm XYZ İNŞAAT projelerinin zamanında, bütçe limitleri dahilinde, belirlenen kalitede gerçekleştirilmesini ve Proje sözleşme şartlarının tam olarak yerine getirilmesini güvence altına almaktır.

2. Kapsam

Bu prosedür, XYZ İNŞAAT tarafından yürütülen tüm yapım projelerinde uygulanır.

3. Referanslar

3.1 İlgili Dökümanlar

ISO 9001 Madde 7.5 ve 8.2.4

Proje Yönetim Planı

4.01-A.01 Proje Yönetim Planı Akış Şeması

3.2 İlgili Kayıtlar

4.01-F.01 Organizasyon Şeması

4.01-F.02 Atama Tablosu

4.01-F.03 Proje Eğitim Planı

4.01-F.04 Girdi Kontrol, İşaretleme ve Muhafaza Tablosu Formu

4.01-F.05 Muayene ve Test Planı

4.01-F.06 PYP Master ve Dağıtım Listesi

4. Tanımlar

Proje Müdürü: Projenin tüm gerçekleştirme ve uygulama sorumlusudur.

Şantiyeler Müdürü: Tüm şantiyelerin uygulama ve Yönetimini sağlar

5. Sorumluluklar ve Personel

5.1 Onay ve Yürürlük

Bu prosedür Yönetim Kurulu Üyelerinden herhangi bir yetkilinin onayıyla yürürlüğe girer .

5.2 Prosedürün Kullanıcıları

Tüm Proje Müdürleri ve onların bağlı olduğu Uzmanlık Grupları sorumlu oldukları projelerin bu prosedür doğrultusunda planlanmasını ve yürütülmesini sağlamaktan sorumludurlar.

6. Prosedür

6.1 Genel

XYZ İNŞAAT'ın kalite ile ilgili politikaları ve yaklaşımı doğrultusunda yürüttüğü faaliyetler sonucu meydana getirilen yapıların kalitesinin İşverene ve nihai kullanıcıya etkin şekilde yansıtılması, proje yönetiminde sağlanan etkinliğine bağlıdır.

Bu anlamda proje yönetimi faaliyetleri yoğun olarak, işveren ile sözleşmenin imzalanmasından itibaren başlar ve nihai yapının işverene tesliminde ve kesin kabullerin yapılması ile sonuçlanır.

Proje Yönetiminde etkinlik ve beklenen faydanın sağlanması, projenin iyi bir şekilde planlanması ve planların etkin şekilde uygulanmasına bağlıdır.

Bu prosedürde tanımlanan yöntemler XYZ İNŞAAT'ın taahhüt ettiği yapıların zamanında, istenen kalitede ve bütçe dahilinde bitirilmesi için gerçekleştirilmesi gereken planlama, takip kontrol, geçici ve kesin kabul süreçlerini tarif eder.

6.2 Mobilizasyon

6.2.1 Şantiye Şefinin atanması ve işin devredilmesi

Proje sözleşmesinin imzalanmasından hemen sonra Yönetim Kurulu taahhüt edilen projenin yürütülmesi için bir Şantiye Şefi atar. Şantiye Şefinin seçiminde XYZ İNŞAAT içinde bulunan mevcut personelin nitelikleri ile sözleşmenin gerekleri/şartları göz önünde bulundurulur.

Şantiyeler Müdürüne imzalanmış sözleşmenin bir nüshası ve Teklif dökümanları devredilir. Proje geliştirme / teklif aşamasından, sözleşmenin imzalanmasına kadar geçen süre içinde oluşan diğer belge ve kayıtların bir kopyası da verilir.

6.2.2 Mobilizasyon çalışmaları

Şantiyeler Müdürü/Proje Müdürü sözleşmeyi inceledikten sonra mobilizasyon çalışmalarını başlatır:

- **Proje çekirdek organizasyonunun belirlenmesi**

Proje organizasyonunu kuracak ve şantiye kuruluş faaliyetlerini başlatacak kişiler belirlenir ve bunlar arasında görev dağılımı yapılır. Görev dağılımı aşağıda konuları kapsamalıdır :

- **Proje Yönetim Planının Hazırlanması**

Bu prosedürün ileri bölümlerinde açıklanan "Proje Yönetim Planı"nın hazırlanması ile ilgili sorumlu kişi(ler) tayin edilir.

❖ **Mobilizasyon Planının Hazırlanması**

Mobilizasyon Planı, sözleşmenin Şantiyeler Müdürü/Proje Müdürü tarafından incelenmeye başlanması ve Şantiye yer teslimi aşamasından itibaren hazırlanmalıdır. Mobilizasyon süratli bir şekilde gerçekleştirileceğinden bu plan için belirli bir formatı yoktur. Ancak Mobilizasyon Planı içine asgari olarak aşağıda konular dahil edilmelidir :

- İşyeri dosyasının açılması ve yer teslimi

İşveren'den şantiyenin kurulacağı yerin, görevlendirilmiş kişi (ler) tarafından teslim alınması.

- Gerekli izinlerin alınması

Proje gereği, şantiyenin kurulacağı ve imalatların yapılacağı tüm yerler için gerekli yasal izinlerin alınması (örn. iş yeri açma, çalışma izni, kazı yapma, vb.). Tüm izinler işin başında alınması gerekmiyorsa, projenin hangi aşamasında hangi izinlerin alınması gerektiği belirlenmelidir. (Örneğin İşyeri dosyası sözleşme imzalandıktan sonra ve yer tesliminden önce açılmalıdır.)

- Kamp kurulması / Yerleşim

Şantiye sahası içi veya dışında XYZ İNŞAAT personelinin ve taşeron personelinin ikamet edeceği yerlerin belirlenmesi. Şantiye yönetim organizasyonun kurulacağı yerlerin belirlenmesi. Kamp için gerekli malzemelerin (konteyner, prefabrik ofis, vb.) temin edilmesi, Ambar, atölyeler, makina parkı, üretim tesisleri gibi yardımcı ünitelerin yerlerinin planlanması ve kurulması.

- Makina / Ekipman tedariki

İlk çalışmaların yapılması (kamp kurulması, yolların açılması) ve daha sonraki aşamalarda proje kapsamında kullanılacak makinalar için bir tedarik planı hazırlanması ve bunların temini

- Personel temini

Proje mobilizasyonu ile birlikte projede görev yapacak kilit personelin ve niteliklerinin belirlenmesi ve temin edilmesi.

- Taşeronların seçimi

Yemek, güvenlik, ulaşım ve mobilizasyonla ilgili tüm faaliyetlerin yürütülmesi için servis hizmet taşeronlarının seçilmesi ve yerleştirilmesi.

6.3 Proje Yönetim Planının Hazırlanması

Proje Yönetim Planı, projenin mobilizasyon aşamasından sonra yürütülecek ve sözleşme şartlarının nasıl karşılanacağını gösteren genel yönetim planıdır.

XYZ İNŞAAT'ın taahhüt ettiği tüm işler için bir "Proje Yönetim Planı" hazırlanması zorunludur. Bu plan Şantiyeler Müdürü/Proje Müdürü tarafından hazırlanır. Yönetim Kurulu Üyelerinden herhangi bir yetkilinin onayı ile yürürlüğe girer.

Projelerin büyüklüğüne, karmaşıklığına, işveren/kontrolörlük gereksinimlerine ve sözleşme şartlarına göre "Proje Yönetim Plan"larının detay seviyeleri değişiklik gösterebilir. XYZ İNŞAAT'ın yürüttüğü projelerin içeriği, kapsamı, büyüklüğü ve işin niteliğinin çok değişken olması sebebiyle, Proje Yönetim Planının içeriği ve formatı belirli kalıplarla sınırlandırılmamıştır. Asgari gerekleri karşılamak şartıyla, içerik ve formatı, her Proje kendi ihtiyaçlarına göre belirleyebilir.

6.3.1 Proje Yönetim Planı İçeriği

Proje Yönetim Planı asgari olarak şunları içermelidir:

1. Proje Tanıtımı, Kapsamı & Hedefleri

- **Projenin genel tanıtımı**

Projenin dışarıdan gelen bir kişinin anlayabileceği dilde tanıtımı (örn. Projenin adı, başlangıç ve planlanan bitiş tarihleri, İşin bedeli, işveren bilgileri, müşavir firma bilgileri, ortaklık yapısı, sözleşme tipi, Projenin teknik tanıtımına ilişkin bilgiler vb.)

- **XYZ İNŞAAT'ın projedeki yeri ve iş kapsamı**

XYZ İNŞAAT'ın projede hangi işleri yapacağı, işlerin kapsamı/sınırları.

- **Proje takibinde kullanılacak genel tanımlar**

Projenin başından sonuna kadar geçerli olacak ve kullanılacak tanımlar (örn. projenin adı, adresi, telefon / fax / e-mail, muhasebe kodu, logolar, vergi dairesi, vergi no'su, vb.)

2. Organizasyon yapısı / Görev paylaşımı

- **Projenin organizasyon yapısı**

Projeyi yöneten / yürüten Merkez, Şantiye, İşveren ve Kontrollük teşkilatını da içeren organizasyon yapısıdır. Organizasyon yapısı bir organizasyon şeması şeklinde çizilebilir. Organizasyon şemasında sadece ünvanların / pozisyonların yer alması tavsiye edilmektedir (uygun görülürse 4.01-F01 Organizasyon Şeması formatı kullanılabilir).

- **Atama Tablosu**

Organizasyon yapısında yer alan kilit görevlerin hangi kişi tarafından yerine getirildiği gösterilmelidir. Bu amaçla uygun görülürse 4.01-F02 Atama Tablosu formatı kullanılabilir.

- **Görev Tanımları**

Projede görev alan ve organizasyon şemasında yer alan kilit pozisyonlar için görev tanımları. Görev tanımları ilgili "ünvan"ların veya kişilerin nelerden sorumlu olduklarını ve varsa özel yetkilerini tanımlamalıdır.

3. İşveren / Ortak / Kontrollük İlişkileri

Bu bölüm altında işveren, ortak ve/veya kontrollük ile ilişkilerin nasıl yürütüleceği tarif edilmelidir.

Tarifler aşağıda ki konuları kapsayabilir:

Yazışmalar : kim, nasıl, hangi konularda yazışmalarda bulunabilir.

Toplantılar : hangi zamanlarda, hangi toplantılar, kimlerle, hangi amaçla yapılır.

Problem/Hata : hangi problem / hatalar kimlere nasıl bildirilir.

Mutabakat : hangi konularda kimlerle mutabakat sağlanması gerekir. Mutabakat nasıl yazılı hale getirilir.

4. İş Programı

İşin başında projenin aşamalarını, sürelerini ve faaliyetler arası ilişkileri gösteren iş programı hazırlanarak bu bölümün altında veya proje yönetim planının ekinde verilmelidir. Proje yönetim planı Primevera, MS Project vb. programlarla hazırlanmalıdır.

Uygulama işlerinin programı, tasarım programına bağlı olacağı için, iş programı tasarım programı ile senkronize edilmelidir. Bu amaçla tasarım programı (varsa) bu bölüm altında veya yapım programına entegre şekilde verilmelidir.

5. Makina/Ekipman Programı

Projenin başından sonuna kadar ihtiyaç duyulacak makina ve ekipmanların bir listesi hazırlanmalıdır. Makina/Ekipman ihtiyaç listesi faaliyetleri gerçekleştirmek için gerekli olan makina / ekipman tiplerini, kapasitelerini vermelidir (marka, model v.b bilgilerin bu programda yer almasına gerek yoktur.)

İş programına göre makina/ekipmana ne zaman ihtiyaç duyulacağı ve ne kadar süre projede tutulacağı belirtilmelidir.

Makina ekipman ihtiyaçları 4.03 Makina/Ekipman Hareketleri Prosedürüne uygun şekilde sağlanır.

6. Personel Programı

Projenin başından sonuna kadar ihtiyaç duyulacak personelin niteliklerine ve/veya ünvanlarına göre bir listesi hazırlanmalıdır (vinç operatörü, kalıpçı, demirci, vb. gibi belirlenmelidir - isimlerin bu programda yer alması gerekli değildir). Taşeron personeli de bu listeye dahil edilmelidir.

İş programına göre personele ne zaman ihtiyaç duyulacağı ve ne kadar süre tutulacağı belirlenmelidir. İnsan Kaynakları El Kitabı'na uygun şekilde sağlanır.

7. Malzeme/Tedarik Programı

Projenin başından sonuna bir malzeme ihtiyaç programı belirlenmelidir. Varsa ihale şartnameleri içinde bulunan veya teklif/sözleşme aşamasında geliştirilen metrajlar baz alınarak malzeme ihtiyacı belirlenebilir.

Yapıda kullanılacak belli başlı malzemelerin yanısıra mümkün olduğunca yardımcı ve sarf malzemelerde planlanmalıdır.İş programına göre hangi malzemelere ne zaman ihtiyaç duyulacağı (termin tarihleri) belirlenmelidir.

Sözleşme şartlarında veya verilen tekliflerde malzemeler ile ilgili spesifikasyonlar verilmiş ise, Proje Yönetim Planının bu maddesi altına bunların spesifikasyonları eklenmeli veya ilgili teknik şartnamelere atıfta bulunulmalıdır. Diğer malzemeler arasında hangileri için malzeme spesifikasyonları hazırlanacağı belirlenmelidir.

Malzeme tedarikçileri seçimi 5.03 Tedarikçi ve Taşeronların Seçimi ve Performans Takibi prosedürü ve malzeme satınalımı ise 5.02 Satınalma ve Lojistik prosedürüne uygun şekilde sağlanır.

Malzeme tedarikçisi seçimi ve satınalma işlemlerinin, herhangi bir nedenden dolayı yukarıda verilen prosedürlerden farklı şekilde yürütülmesi gerekiyor ise bu madde altında yöntemler detaylı şekilde açıklanmalıdır.

8. Bütçe

Yönetim Kurulu Başkan Yard., ve Proje Yöneticisi mutabakatı ile bu madde altında projenin bütçesi eklenebilir. Proje bütçesinin burada yer alması uygun görülürse Proje Yönetim Planı'nın kimlere gösterilebileceği tarif edilmelidir. Burada yer almamasının kararlaştırılması durumunda bu bölüm boş geçilir ve bütçe ile ilgili tüm konular ayrı takip edilir.

Tüm projeler için gelir/gider ve nakit akımına ilişkin proje bütçesinin oluşturulması zorunludur.

9. Doküman ve kayıtların yönetimi

Proje süresince üretilecek dokümanların nasıl yönetileceğinin tarifleri bu bölüm içinde verilmelidir.

İlk önce proje süresince kontrol altına alınacak tüm dokümanların bir listesi hazırlanmalıdır. Kontrole tabi dökümanlar :

- Taahhüt edilen işlerin gerçekleştirilmesinde referans olarak kullanılan,
- XYZ İNŞAAT veya başkaları tarafından revize edilebilen dokümanlardır.

Kontrol altına alınacak dokümanlar için :

- Kim tarafından üretileceği ve onaylanacağı,
- XYZ İNŞAAT içinde kim tarafından yayınlanacağı/teslim alınacağı,
- Kimlere nasıl ve kaç kopya dağıtılacağı,
- Eski dökümanların nasıl ve kim tarafından kullanımdan kaldırılacağı ,

gibi konular net bir şekilde tarif edilmelidir.

Ayrıca şantiye Teknik Ofis bünyesinde bir çizim ofisi kurulması gerekli görülürse (örn. as-built çizimlerinin hazırlanması, onaylanması, dağıtımı, dosyalanması, imalat çizimlerinin vb.), çizim ofisinin görevleri ve süreçleri bu madde altında tarif edilmelidir.

10. Girdi Kontrol / İşaretleme / Muhafaza

Bu bölüm altında projede kullanılacak malzemelerin girdi kontrollerin yapılması, işaretlenmesi, muhafaza edilmesi yöntemleri tarif edilmelidir.

Malzemelerin kabulünde hangi malzemenin;

- nasıl ve neye göre kontrol edileceği,
- kontrol sonuçlarının nereye kayıt edileceği,
- kabul edilmesi durumunda işaretlenip / işaretlenmeyeceği
- işaretlenmesi gerektiğinde, nasıl işaretleneceği,
- özel muhafaza koşulları var ise bunların nasıl sağlanacağı,

konusunda yöntemler tarif edilmelidir.

Uygun görülürse 4.01-F.04 Girdi Kontrol Planı kullanılacaktır..

11. İmalat Yöntemleri

Bu bölümde projede uygulanacak özel imalat (yapım) yöntemlerinin tarifi eklenmelidir.

Ayrıca imalat esnasında yerine getirilecek özel şartlar vb. koşullar tarif edilmelidir. (örn. perdeleme, örtme, vibratör kullanımı, vb.).

12. Muayene/Test Planı

Bu bölümde iş programına ve imalat yöntemlerine uygun olarak hangi aşamada,

- Hangi kontrollerin,
- Ne kadar sıklıkta,
- Nasıl,
- Kim tarafından

yapılacağının planı/tarifi verilmelidir. Ayrıca hangi gerçekleştirilen kontrollerin kayıtları nerede tutulacağı ve elde edilen sonuçların kabul kriterleri belirlenmelidir. Kabul kriterleri +/-, min. veya maksimum tolerans olarak verilebileceği gibi, belirli bir standard veya yönetmelik içinde verilenlere veya belirli bir numuneye de referans verilebilir.

Uygun görülürse 4.01-F05 Muayene ve Test Planı formatı kullanılacaktır.

13. Kalibrasyon/Doğrulama

Bu bölümde kontrol (muayene/test) amaçlı kullanılan ve kalibrasyon ve/veya doğrulamaya tabi olan ölçüm ekipmalarının, markası, seri no'su ve tanım numaralarını içeren 4.04-L.01 Ölçüm, Muayene, Test ve Deney Cihazları Listesi hazırlanmalı ve verilmelidir.

Listede yer alan her bir ekipmanın kalibrasyon yöntemleri, kabul kriterleri ve kalibrasyon periyodları belirlenmelidir.

Kalibrasyon faaliyetleri 4.04 Ölçüm/Test Ekipmanlarının Kalibrasyonu prosedüründe detaylı şekilde açıklanmıştır.

14. Uygunsuzluk Bildirimi

Bu bölümde projede ne tip uygunsuzlukların kayıt edileceği ve nasıl/kime raporlanacağı tarif edilmelidir.

Tespit edilen uygunsuzlukların kimler tarafından değerlendirmeye tabi tutulacağı, düzeltici/önleyici faaliyetlerin tanımlanması ve onaylanması sorumlulukları ve bunlar ile ilgili tutulacak kayıtlar tarif edilmelidir.

Uygun görülürse 1.05 Uygunsuzlukların Yönetimi ve Düzeltici Faaliyetler prosedürü uygulanabilir. Uygun olmaması durumunda bu prosedür içinde tarif edilen prensiplerin nasıl yerine getirileceği detaylı şekilde tarif edilmelidir.

15. Hakediş / Raporlama

Bu bölümde hakediş işlemlerinin nasıl gerçekleştirileceği tarif edilmelidir:

- Hesaplama için bilgi toplanması (hangi bilgiler, nasıl toplanacak)
- Hesaplama / Raporlama yöntemleri.
- Sorumlu(lar)
- Mutabakat
- Fatura kesimi için hangi bilgilerin nasıl raporlanacağı.

Ayrıca bu bölümde Projenin bağlı olduğu Proje Müdürü veya Üst Yönetime dahili proje değerlendirmesi için hangi raporların hazırlanacağının tarif edilmesi (rapor formatları).

6.3.2 Proje Yönetim Planı – Opsiyonel İçerik

Projenin büyüklüğü, faaliyet kapsamı ve işveren/sözleşme gereklerine göre Proje Yönetim Planı içinde ayrıca şu bölümler oluşturulabilir:

16. Sigorta İşlemleri

Bu bölümde proje ile ilgili sigortalar tarif edilmelidir. Sigorta poliçilerine atıfta bulunularak, sigortalar ile ilgili işlemlerin nasıl yürütüleceği tarif edilmelidir.

17. Stok yönetimi

Bu bölümde proje/şantiyede stok sahası olarak tanımlanan yerlere malzeme girişinin nasıl yapılacağı, sahada kullanım için nasıl çıkış yapılacağı ve tedarikçiye iadesinin nasıl yapılacağı tarif edilmelidir (talep formu, irsaliyeler, vb.tarif edilmelidir).

Ayrıca şantiyede oluşturulan Ambar/Stok yönetimi ile ilgili, raf sistemleri, kodlama, giriş ve çıkışlar da bu bölüm altında tarif edilmelidir.

18. Eğitim İhtiyaçları Planlaması ve Kayıtları

Projede görev alan/alacak personelin eğitim ihtiyacı tespit edilerek, Proje Yönetim Planında belirtilebilir. Eğitim ihtiyaçlarının tespiti, eğitim planlaması ve eğitim kayıtları ile ilgili uygulamalar 6.01 Eğitim prosedüründe tarif edilmiştir. Bu başlık altında proje/şantiye için tanımlanan eğitimlerin planı yer almalıdır. Uygun görülürse eğitim planı 4.01-F.03 Proje Eğitim Planı formatında hazırlanabilir.

19. Tasarım ve Geliştirme

Şantiyede tasarım ve/veya geliştirme çalışmaları yapılması öngörülüyorsa, tasarım sürecinin / prosedürün tarifi : (Bkz. 3.01 Tasarım Prosedürü)

Tasarım Planlaması

Organizasyon ve Tasarım iş programı

Tasarım girdileri

Tasarımın dökümante edilmesi

Tasarım hangi aşamalarda gözden geçirileceği – onaylama sistemleri

Tasarım sürecinde gerçekleştirilecek "doğrulama" faaliyetleri (deneyler,deneme uygulamaları, testler, vb.)

Tasarım değişikliklerinin nasıl yapılacağı

20. Özel Sözleşme Koşulları

Proje Yönetim Planı'nın standart içeriğinde olmayan özel sözleşme şartları var ise, bunların nasıl yerine getireleceği bu bölümde tarif edilir.

21. İstatistiksel yöntemler

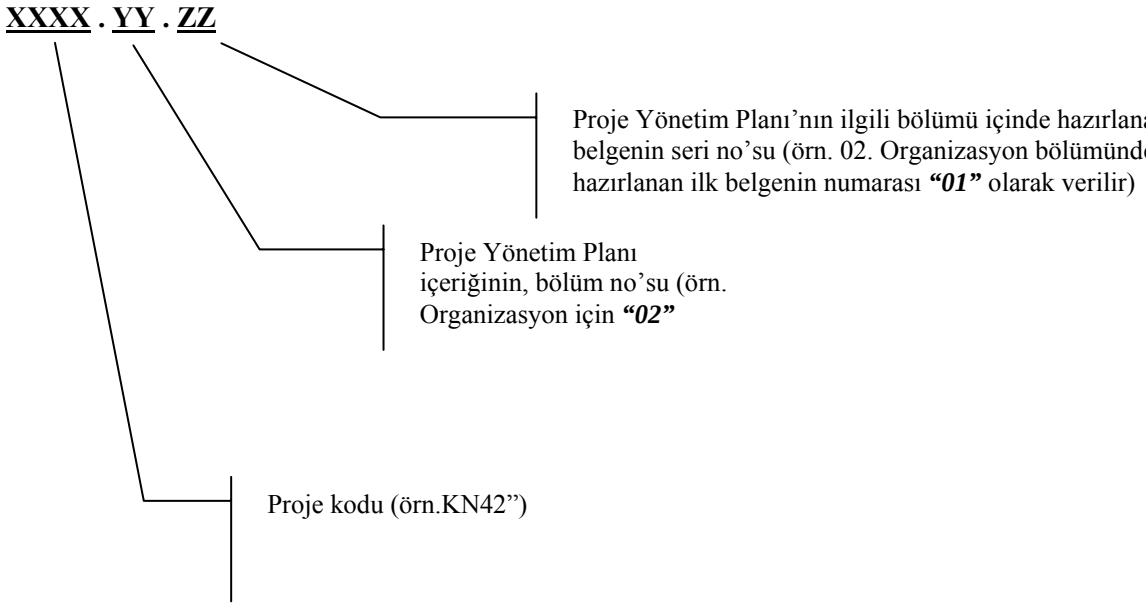
Projenin teknik gereksinimleri gözönüne alınarak ürün, proses ve malzeme kontrollarında, uygunsuzlukların değerlendirilmesinde, düzeltici ve önleyici faaliyet geliştirmede kullanılacak istatistiksel yöntemler belirlenir ve uygulama planı şeklinde gösterilir. Bu yöntemlere ilişkin ayrıntılı açıklamalar için referans dokümanlar belirtilir ve bu dokümanlara erişim sağlanır.

Beton ve çelik imalatların kontrolleri için çeşitli kontrol çizelgeleri, regresyon-korelasyon analizleri uygulanabilir.

Gerektiğinde, hatalı üretim, durma kayıpları, uygunsuzlukların değerlendirilmesinde pareto analizinden, hata kaynaklarının araştırılmasında neden-sonuç sorun analizinden faydalanılabilir. Hassas proses kontrolu gereken durumlarda proses yeterlik analizi kullanılabilir.

6.4 Proje Yönetim Planı Dokümantasyonun Kodlanması

Her bir proje için hazırlanan Proje Yönetim Planı içinde bulunan ve projeye özel hazırlanan dokümantasyon (formlar, talimatlar, metotlar, vb.) özel sisteme göre kodlanır:



Örnek : KUKLA TİYATROSU Proje Yönetim Planı'nın 02. Organizasyon bölümünde hazırlanan ilk belgenin kodu "**KN42.02.01**" şeklinde verilir.

6.5 Doküman Kontrolü ve Revizyon Takibi

Proje Yönetim Planı'nın içinde bulunan tüm dokümanların revizyonlarını takip etmek amacıyla bir master liste oluşturulur. Bu master listede Proje Yönetim Planı içindeki dokümanların revizyon durumları görülebilmelidir.

Uygun görülmesi durumunda 4.01-F06 Proje Yönetim Planı Doküman Master ve Dağıtım Listesi formatı kullanılabilir.

Dokümanlar ilk yayınlandığında yeni bir doküman olduğunu göstermek amacıyla revizyon durumu belirtilmez veya "Rev. 0" olarak işaretlenir. Bundan sonraki revizyonlarda Rev. 1, 2, 3, 4…..n, revizyon durumları belirtilir.

XYZ İNŞAAT prosedürlerinin ek'inde tarif edilen standardize edilmiş dokümanlar kullanılması durumunda, dokümanlara projeye özel kod verilmez. Bunun yerine dokümanların üzerindeki kod numarası kullanılır. Kullanılan dokümanın hangi projeye ait olduğunu göstermek amacıyla bir tanım ilave edilir. (örn. projenin adı, kodu vb.)

7. Dağıtım ve dosyalama

7.1 Proje Süresince

7.1.1 Dokümanlar

Proje Yönetim Planı içindeki tüm dokümanların orijinalleri bir bütün olarak ilgili Proje Yöneticisi veya yetkilendireceği kişi tarafından proje süresince muhafaza edilir.

Proje Yöneticisi veya yetkilendireceği kişi, Proje Yönetim Planı'nı bir bütün veya içindeki dokümanları ayrı olarak ilgili kişilere dağıtımını sağlar.

Proje Yönetim Planındaki dokümanların bir kısmının veya tamamının revize edilmesi durumunda, dokümanın dağıtımının yapıldığı tüm birimlere revize edilmiş dokümanların birer kopyası master liste ile birlikte gönderilerek eski (geçersiz) kopyaların imha edilmesi istenir. Güncelliğini yitirmiş bir belgenin kullanıcılar tarafından muhafaza edilmesi gerekli olduğu durumda, geçersiz olan dokümanın üzerine "İPTAL" yazılarak paraflanır.

Proje Yöneticisi veya yetkilendireceği kişi, proje süresince kullanılmış ve geçerliliğini yitirmiş tüm dokümanların orijinallerini gerekiyorsa muhafaza eder.

7.1.2 Kayıtlar

Proje Yönetim Planı içinde tarif edilen ve üretilen tüm kayıtlar, proje süresince şantiye ve ilgili birimler tarafından muhafaza edilir.

7.2 Proje Bitiminde

7.2.1 Dokümanlar

Proje bitiminde, Proje Yönetim Planının projedeki güncel kopyası, mümkünse elektronik ortamda, değilse basılı kopya olarak 1.03 Kayıtların Yönetimi, Dosyalama ve Arşivleme prosedürüne göre işlem görür.

7.2.2 Kayıtlar

Proje süresince üretilen tüm kayıtlar, 1.03 Kayıtların Yönetimi, Dosyalama ve Arşivleme prosedürüne göre işlem görür.

LOGO	TALİMAT	DOKÜMAN NO : 5.02-T.01
		REVİZYON : 00
	MERKEZ SEVKİYAT AMBARI ÇALIŞMA TALİMATI	SAYFA :
		TARİH : 23.09.2005

Hazırlayan	Sistem Onayı	Yürürlük Onayı
Satınalma ve Lojistik Müdürü	Kalite Yönetim Temsilcisi	Yönetim Kurulu

REVİZYON TAKİBİ

REVİZYON	TARİH	AÇIKLAMA
00	23.09.2005	Yeni

1. Amaç

Bu talimat, gelen malzemelerin belirlenen özelliklere sahip olup olmadığının değerlendirmesinin yapılarak, tanımlanmış depolama alanlarına, kullanılacağı bölgeye hasar görmeyecek şekilde taşınması,durumlarının kontrolü, depolanması ve ambar malzeme giriş çıkış kurallarının belirlenmesi, amacıyla hazırlanmıştır.

2. Kapsam

Bu talimat. sözleşme gereği taahhüt edilen işleri yerine getirmek üzere şantiye sahasına ve/veya ambarlarına gönderilecek malzemeleri, girdi kontrolü, depolanması ve sevkiyat işlemlerini kapsar.

3. Referanslar

3.1 İlgili Dökümanlar

ISO 9001:2000 6.3-6.4-7.4.3

5.02 Satınalma ve Lojistik Prosedürü

5.03 Taşeron/Alt Yüklenici Seçimi ve Performans Takibi Prosedürü

5.02-L.01 Elektrik/Mekanik Kontrol Listesi

3.2 İlgili Kayıtlar

5.02-F.10 Ambar Giriş Formu

5.02-F.11 Ambar Çıkış Formu

5.02-F.12 Elektrik/Mekanik Kontrol Onay Formuna

Tanımlar

Herhangi bir tanım yoktur.

5. Sorumluluklar ve Personel

5.1 Onay ve yürürlük

Bu talimat Yönetim Kurulu'ndan herhangi bir yetkilinin onayından sonra yürürlüğe girer. Bu talimatın yürütülmesinden Satınalma ve Lojistik Müdürü Sorumludur.

5.2 Talimatın Kullanıcıları

Satınalma ve Lojistik Müdürlüğü.

6. Talimat

- Proje satınalma yetkilileri ambara gönderecekleri malzemeyi önceden depo sorumlusuna bildirmelidir. Malzemeyi sipariş eden kişi, sipariş formunun bir nüshasını Güneşli depo sorumlusuna gönderecektir. Bu sipariş formunda doğal olarak malzeme miktarı, diğer bilgiler ve teslim tarihi mevcuttur.
- Malzeme ambar sahasına ulaştıktan sonra satıcı irsaliyesine göre sayım yapılarak teslim alınır.
- Malzeme teslim alma işlemi 5.03 Taşeron/Tedarikçi Seçimi ve Performans Takibi Prosedürüne göre yapılır.
- Her malzeme ilgili şantiye için ayrılan bölümde depolanır.
- Özellikli veya hassas malzemelerle ilgili özel durumlarda yapılması gereken işlem proje grupları tarafından depo sorumlusuna bildirilir.
- Ambar sorumlusu teslim aldığı malzemelerle ilgili 5.02-F.10 Ambar Giriş Formu hazırlayarak Satınalma ve Lojistik Müdürlüğüne gönderilir.
- 5.02-F.10 Ambar giriş Formu üzerinde ihracat işlemleri için malzemenin miktarı,ağırlığı,hacmi ve ambalaj şekli belirtilir.
- Malzeme sevkiyat sırasında zarar görmeyecek şekilde uygun olarak ambalajlanmamış ise ambalajlama işlemi yapılır.
- Proje gruplarının ve/veya malzemeyi ambara yollayan yetkili kişinin özel bir talimatı olmadığı durumlarda malzemenin ne şekilde ambalajlanacağına ambar sorumlusu karar verir. Özel durumlar için verilecek talimatlar yazılı olmak koşuluyla herhangi bir şekilde olabilir
- İhracat departmanından malzemenin sevk bilgisi (taşıma şekli,yükleme tarihi v.s.) alındıktan sonra malzeme yüklemeye hazır hale getirilir ve 5.02-F.11 Ambar Çıkış Formu hazırlanarak Satınalma ve Lojistik Müdürlüğüne gönderilir.
- Malzeme sevk irsaliyesi hazırlanarak Satınalma ve Lojistik Müdürlüğüne gönderilir.
- Herhangi bir şekilde sevk edilmesinden vazgeçilen veya bozulan, kırılan, hasarlı malzemeler, 'Sevk edilmeyecek malzemeler' alanına konur. Bu alana konması mümkün olmayan ama sevk edilmeyecek olan malzemelerin üstüne görünür bir şekilde durumunu izah eden bir etiket yapıştırılır.
- Sevk edilmeyecek malzemeler alanı veya bölümü bu ibareyi taşiyan bir tabela ile önceden belirlenmiş olacaktır.
- Depoda uzun süre kaldığı için hava ve iklim koşulları veya başka bir nedenle bozulan malzemeler için ilgili proje grubu yetkilisi ile beraber tutanak tutularak yapılacak işlem kararlaştırılır.
- Elektrik/Mekanik olarak kontrolü gereken malzemelerin ve ekipmanların kontrol işlemleri için proje bazlı 5.02-L.01 Elektrik Mekanik Kontrol Listesi hazırlanır. Hazırlanan bu liste dahilindeki kontroller yerinde veya merkez ambarda kontrol edilerek 5.02-F.12 Elektrik- Mekanik Kontrol Onay Formuna kaydedilir.

7. Dağıtım ve Dosyalama

Bu prosedürün basılı veya bilgi işlem sistemi üzerindeki kopyası tüm birimlere dağıtılmalıdır.

APPENDIX D

SAMPLE JOB DESCRIPTIONS FROM ORGANIZATIONAL MANUAL OF XYZ CONSTRUCTION CO.

(Organizasyon El Kitabı / Görev Tanımları)

Görev Tanımları	Job Description

Unvanı	Proje Sorumlusu	
Bölümü		
İlk amiri	Genel Koordinatör	
Doğrudan bağlı unvanlar		
Yokluğunda vekalet eden	Kısa vadede : Proje Sorumlusu Uzun vadede : Proje Sorumlusu	
Görevin ana amacı	Alınan projelerin kontrat şartlarına göre koordinasyonu sağlamak ve projesi neticelendirmek.	
Gerekli bilgi ve beceriler	Asgari: Üniversite mezunu olmak (Mimar), yabancı dil (ingilizce), Proje bazında genel koorinasyonu sağlamak için proje, tasarım, uygulama, malzeme, iş programı, sevk ve idare tekniklerini bilmek.	Tercih: Daha önce fiilen, birden fazla, kapsamlı Yurtiçi ve Yurtdışı proje uygulamalarında bulunmuş, aynı zamanda idari koordinasyonunda da çalışmış deneyimli olmak.
Performans değerlendirme kriterleri	Alınan Projeleri en uygun bütçe, kalite ve sürede bitirmek.	

Görev ve Yetki Kapsamı

- Projelerde firma ve/veya taşeronları tayin etmek için gerekli çalışmaları yapmak.
- Gerekli konularda tasarım çalışmaları yapmak.
- Projelerde ilgili disiplinler ve uzmanlık konularında koordinasyonu sağlamak.
- İş proğramına uygun malzeme akış programını hazırlamak ve gerçekleştirmek.
- Siparişe giren malzemelerin projeye uygunluğunu kontrol etmek (teknik yeterliliğini kontrol etmek,teslim sürelerinin iş programına uygunluğunu kontrol etmek vs.)
- Gerekli malzemelerin piyasa araştırmalarını yapmak.
- Gerekli aşamalarda şantiyedeki uygulamaların projeye uygunluğunu kontrol etmek.
- Kalitenin iyileştirilmesi, geliştirilmesi ve yürütülmesi için prosedürlere ve talimatlara uymak

Görev Tanımları	Job Description

Unvanı	İnşaat Formeni	
Bölümü	Saha	
İlk amiri	İnşaat Teknikeri	
Doğrudan bağlı unvanlar		
Yokluğunda vekalet eden	Kısa vadede : İnşaat Teknikeri Uzun vadede:	
Görevin ana amacı	Saha Mühendisi ve İnşaat Teknikerinin verdiği tüm talimatları yerine getirmek.	
Gerekli bilgi ve beceriler	Asgari:	Gerek: Şantiyelerde daha önce çalışmış olmak.
Performans değerlendirme kriterleri	İnşaat alanında yapılan tüm imalatlarda tecrübeye sahip olmak ve bağlı bulunan elemanlarla verilen talimatlarını yerine getirme yeterliliğine sahip olmak.	

Görev Kapsamı ve Yetkileri

- İnşaat sahasındaki güvenlik, işçi sağlığı vs. gibi konularda kontrolü ve düzeni sağlamak.
- Şantiye içi saha düzeni, işçi puantajı, makina ekipman puantajı gibi konularda sorumludur.
- Kendisine verilen tüm talimatları, sahada işçi veya taşerona uygulatmak.
- Taşeronların çalışma organizasyonlarını saha içerisinde sağlamak.
- Saha Mühendisine ve İnşaat Teknikerinin verdiği işleri yapmak.
- Kalitenin iyileştirilmesi, geliştirilmesi ve yürütülmesi için prosedürlere ve talimatlara uymak

Yetkileri

Yukarıda verilen görev ve sorumluluklarına yerine getirilebilmesi için İnşaat Formeni aşağıda verilen yetkiler ile donatılmıştır:

Kendine verilen görev ve sorumlulukları yerine getirmek amacıyla, mahiyetindeki belirli birimleri ve / veya kişileri görevlendirmek.

APPENDIX E

SAMPLE FORMS OF XYZ CONSTRUCTION CO.

(Formlar)

LOGO

MALZEME TALEP FORMU

Disiplin: **Talep Tarıhı:**

Talep No

Askabat Dahili Yazisma Ref.No:

Santiye Askabat / Istanbul Yazisma Ref.No:

Adi Soyadı CC:

IMZA

ATT:	
CC:	

Proje Mud.Onayi yön.kur.baskan yrd.

Kod No	Malzeme	Brm	Metraj	Stok	İstenen m.	Marka / Aç	Masraf kod	Deadline
NOT:								

LOGO	**AMBAR GİRİŞ FORMU**

Tarih : ……..
Seri No. :…….

MALZEME KOD No:	MALZEME TANIMI	MİKTAR	AĞIRLIK	HACİM	AMBALAJ

AMBAR SORUMLUSU ONAY

APPENDIX F

PROJECT MANAGEMENT PLAN CONTENT OF XYZ CONSTRUCTION CO.

(Proje Yönetim Planı - İçerik)

Proje Yönetim Planı (içerik)

1. **Proje Tanıtımı, Kapsamı & Hedefleri**

   Projenin genel tanıtımı

   Polimeks İnşaat'ınn projedeki yeri ve iş kapsamı

   Proje takibinde kullanılacak genel tanımlar (Adı, no'su, vb.)

2. **Organizasyon yapısı / Görev paylaşımı**

   Projenin organizasyon yapısı (merkez, şantiye, işveren ve kontrollük teşkilatı dahil)

   Projede görev alacak pozisyonların görev tanımları, özel yetkileri ve atama listesi.

   Periyodik proje toplantı tanımları (POLIMEKS İNŞAAT organizasyonu).

3. **İşveren / Ortak / Kontrollük İlişkileri**

   İşveren, ortak ve/veya kontrollük teşkilatı ile ilişkilerin nasıl yürütüleceği (yetkili kişiler, yazışmalar, toplantılar, vb.)

   İşveren, ortak ve/veya kontrollük teşkilatı ile mutabakat sağlanması gereken konular.

4. **İş Programı**

   İş programı (Primevera, MS Project, excelvb.)

   (Tasarım iş programı)

5. **Makina/Ekipman Programı**

   Makina/ekipman ihtiyaç listesi

   İş programına göre makina/ekipman tedarik programı

6. **Personel Programı (taşeron dahil)**

   Personel ihtiyacı (adet vinç operatörü, kalıpçı, demirci, vb.) ve nitelikleri

   İş programına göre personel yükleme programı

7. **Malzeme/Tedarik Programı**

   BOQ

   Malzeme spesifikasyonları / standartları

   Malzeme tedarik programı / sorumlulukları.

8. **(Bütçe)(İsteğe Bağlı)**

   Proje bütçesi (kar/zarar, nakit akışı, bilanço)

9. Doküman ve kayıtların yönetimi

Projede kullanılan paftaların teslim alınması, dağıtımı, revizyon takibi, dosyalaması.

Projede kullanılacak diğer dokümanların temini, dağıtımı ve revizyon takibi.

Projede üretilen kayıtların toplanması, dosyalanması ve muhafazası.

10. Girdi Kontrol / İşaretleme / Muhafaza

Proje malzemelerinin girdi kontrollerin yapılması, işaretlenmesi, muahafaza edilmesi yöntemleri.

Proje stok sahalarına malzeme girişi, çıkışı ve iadesi.

11. İmalat Yöntemleri

Projede uygulanacak özel imalat yöntemlerinin tarifi (method of statements).

İmalat esnasında yerine getirilecek özel şartlar (örn. perdeleme, örtme, vibratör kullanımı, vb.)

12. Muayene/Test Planı

İş programına ve İmalat yöntemlerine uygun hangi aşamada,

- Hangi kontrollerin,
- Ne kadar sıklıkta,
- Nasıl,
- Kim tarafından

yapılacağının planı/tarifi.

Hangi kontrollerin kayıtları, nerede tutulacağı.

13. Kalibrasyon/Doğrulama

Projede kalibrasyona tabi olan ölçüm ekipmanlarının listesi.

Kalibrasyon yöntemleri, kabul kriterleri ve kalibrasyon periyodları.

14. Uygunsuzluk Bildirimi

Projede ne tip uygunsuzlukların kayıt edileceği ve nasıl/kime raporlanacağı.

15. Hakediş / Raporlama

Hakedişlerin nasıl yapılacağı ve nasıl raporlanacağı.

Proje süresince hangi periyodlarda hangi raporların hazırlanacağı (rapor formatları).

16. Sigorta İşlemleri 17. Stok yönetimi 18. Eğitim İhtiyaçları 19. Tasarım ve Geliştirme

20. Özel sözleşme koşulları 21. İstatistiksel Yöntemler

AUTOBIOGRAPHY

Ender Çerçi was born in 1975. He had completed his primary school education at Levent İlkokulu between 1981-1986, and high school education at Kadıköy Anatolian High School between 1986-1993. Then he had the chance to study architecture at Mimar Sinan Fine Arts University which was his childhood dream to be. During his education he had internship experience at Korkmaz Yiğit and Yapı Merkezi where he had worked on the subway project for İzmir, İzray. He had graduated from his university in 1999 with a degree of high honors list of the dean.

He has started his professional career in 1998 in İmge Mimarlık where he had worked on several design and construction projects located in İstanbul. He is now working in Polimeks Construction Co. as a project director where he has the management responsibility of large scale monumental and governmental buildings that have been constructed in Turkey and Turkmenistan. During his career he had attended several training programs including ISO 9001:2000 Training Certificate Program.

He had carried his master on, “Construction Management Program”, in Mimar Sinan Fine Arts University and prepared a thesis on quality management in construction industry.