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Ao.Univ.Prof. Prof.h.c. Dipl.-Ing. Dr.techn. M. Numan DURAKBASA

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Fakultät für Maschinenwesen und Betriebswissenschaften

von

Ezgi PALA

0626467

Garnisongasse 14-16 / 206

1090 Wien

Ort, Datum

eigenhändige Unterschrift

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Abstract

Since suppliers are keys to company's success, supplier selection and purchasing decision play a major role in today's business world. Organizations are viewing purchasing not only as an infrastructural or support function, but also as a strategic weapon in the way of success.

Quality is an important feature that enables firms to sustain their competitive advantage and maintain growth levels. The quality of firm's product depends not only on its quality but also on the supplier's quality. Therefore quality is one of the most important selection criterion in supplier selection and purchasing decision. Most of the leading companies are enforcing their suppliers ISO Certification.

The goal of this thesis is to illustrate all relevant aspects of purchasing decision and supplier selection criteria in compliance with management standards. The first section of the thesis illustrates the ISO 9000 Quality Management System with all relevant aspects, the second section illustrates the ISO 14000 Environmental Management System, and the last section of the thesis illustrates the integration of purchasing decision, supplier selection and evaluation process into these management standards.

Kurzfassung

Da die Lieferanten der Schlüssel zum Erfolg des Unternehmens sind, spielen Lieferantenauswahl und Beschaffungsentscheidung eine wichtige Rolle in der heutigen Geschäftswelt. Organisationen sehen die Beschaffung nicht nur als Infrastruktur-oder Support-Funktion, sondern auch als eine strategische Waffe auf dem Weg zum Erfolg. Qualität ist ein wichtiges Merkmal, damit Unternehmen ihre Wettbewerbsfähigkeit und weiteres Wachstum sicherstellen können. Die Qualität der Produkte des Unternehmens hängt nicht nur von seiner Qualität, sondern auch von der Qualität des Lieferanten ab. Daher ist die Qualität eines der wichtigsten Auswahlkriterien bei der Lieferantenauswahl und Beschaffungsentscheidung. Die meisten der führenden Unternehmen erzwingen ihre Lieferanten für ISO-Zertifizierung.

Das Ziel dieser Diplomarbeit sind alle relevanten Aspekte der Beschaffungsentscheidung und Lieferantenauswahlkriterien in Übereinstimmung mit den Management-Standards. Der erste Teil der Diplomarbeit beschreibt das ISO 9000 Qualitäts-Management-System mit allen relevanten Aspekten, der zweite Teil beschreibt das ISO 14000 Umweltmanagement-System und der letzte Teil der Diplomarbeit zeigt die Integration der Beschaffungsentscheidung, Lieferantenauswahl und -bewertung in diesen Management-Standards.

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1 Introduction

A variety of changes in the business environment including globalization, accelerates global competition, intensified environmental concerns, increased rates of technological change as well as increasingly demanding customers, fast product development cycle time, short product life cycle, increased product complexity and quality consciousness are leading firms towards development of long-term strategic partnerships with a few competent and innovative suppliers and collaborate with them in non-core process outsourcing to improve organizational performance and generate long-term advantage. This structured approach to the design of the supply chain will result in an organization that is an appropriate mix of the company's own capabilities with those partners or suppliers in a relationship that is consistent with the strategy of business.

Quality is an important feature that enables firms to sustain their competitive advantage and maintain growth levels. The quality of firm's product depends not only on its quality but also on the supplier's quality. Supplier quality has a large and direct impact on the quality positioning of organizations. The growing attention to this area of quality management reflects an understanding that a firm's quality performance (output) can only be as good as the quality performance of its suppliers (input).[1] This suggests an increasing tendency towards supplier development by organizations as supplier quality integration is found to be a critical dimension of quality excellence. Many organizations achieved success because of their tenacious zeal in enforcing strict quality standards on their suppliers. For this reason, suppliers should be selected based on how their actions will impact all competitive elements of the supply chain. This indicates that one of the competencies essential to the supply chain is an effective purchasing function.[2]

Organizations are viewing purchasing not only as an infrastructural or support function, but also as a strategic weapon.[3] It is now imperative to know that what qualifications and characteristics of supplier and their relationships with buying firm are considered important in staying competitive in global market.

In recent years the awareness of the potential for synergies between environmental performance and corporate and manufacturing performance has also been developing. Organizations of all kinds are increasingly concerned with achieving and demonstrating sound environmental performance by controlling the impacts of their activities, products and services on the environment, consistent with their environmental management systems. Organizations have also started to give an increased attention to not only their activities but also to the suppliers' environmental performance.

In this context companies select and evaluate their suppliers according to their quality and environmental performance and companies have also begun to make their purchasing decisions in compliance with their own and suppliers' quality and environmental management systems.

[1] refer to Forker, 1999, p. 243
[2] refer to Tracey, Tan, 2001, p. 174
[3] refer to Humphreys, Mak, Yeung, 1998, p. 175

2 Integrated Management System

An integrated management system is a management system that integrates all of an organization's systems and processes into one complete framework, enabling an organization to work as a single unit with unified objectives.

Integrated management provides a clear picture of all aspects of the organization, how they affect each other and their associated risks. An integrated management system allows a management team to create one structure that can help to effectively and efficiently deliver an organization's objectives. From managing employees' needs, to monitoring competitors' activities, from encouraging best practice to minimizing risks and maximizing resources, an integrated approach can help an organization achieve their objectives.

An integrated management system is aimed at organizations with a single management system which incorporate two or more management system standards (for example, ISO 9001 Quality Management and ISO 14001 Environmental Management)

Many organizations have adopted or are adopting formal management system standards and/or specifications such as:

ISO 9001: Quality Management Systems – Requirements
ISO 14001: Environmental Management Systems – Requirements with Guidance for Use
ISO/IEC 27001: Information Technology – Security Techniques – Information Security Management Systems
ISO 22000: Food Safety Management Systems – Requirements for Any Organization in the Food Chain
OHSAS 18001: Occupational Health and Safety

Implementing an integrated management system helps the company to visualize the common requirements that all those standards have. It also means less duplication and makes it easier to adopt new systems in the future.

To successfully achieve integrated management systems certification, the organization will need to demonstrate that the organization has one management system that encompasses all existing management systems standards into one structure.

Key benefits of implementing an integrated management system include:

- **Reduced costs:** By avoiding duplication in internal audits, document control, training and administration, adopting future management systems will be much more effective.

- **Time savings:** By having only one management review.

- **A holistic approach to managing business risks:** By ensuring that all consequences of any action are taken into account, including how they affect each other and their associated risks.

- **Reduced duplication and bureaucracy:** By having one set of processes ensures the requirements of the specific standards are coordinated, workloads streamlined and disparate systems avoided.

- **Less conflict between systems:** By avoiding separate ‘empires’ for the likes of quality and environment, responsibilities are made clear from the outset.

- **Improved communication, both internal and external:** By having one set of objectives, a team approach culture can thrive and improve communication.

- **Enhanced business focus:** By having one system linked to the strategic objectives of the business contributes to the overall continual improvement of the organization.

- **Improved staff morale and motivation:** By involving and linking roles and responsibilities to objectives, it makes change and new initiatives easier to implement and makes for a more dynamic and successful company.

- **Optimized internal and external audits:** By minimizing the number of audits required and maximizing the number of people involved.

3 Quality Management Standard

3.1 Introduction

In supplying products or services there are fundamental parameters which determine their saleability. They are price, quality and delivery. Customers require products and services of a given quality to be delivered by or be available by a given time and to be of a price which reflects value for money. These are needs of customers. An organization can survive only if it creates and retains satisfied customers and this will only be achieved if it offers for sale products or services which respond to customer needs and expectations. While price is a function of cost, profit margin and market forces, and delivery a function of the organization's efficiency and effectiveness, quality is determined by the extent to which a product or service successfully serves the purpose of the user during usage (not just at the point of sale). Price and delivery are both transient features whereas the impact of quality is sustained long after the attraction or the pain of price and delivery has subsided. [4]

The future economical evolution stands in narrow relationship with a speed up increase of the quality in the production field. The quality of the products influences the continuity and the rhythm of the production, production costs, the production extent, the job productivity and the efficiency of these products at their application or their use in diverse manner. A high product quality adds to satisfy the needs of the population increasing constantly, stabilizing international cooperation and to enlarge as well as to increase the export ability of the products. [5]

First of all the extraction of high-quality information is a task of the measurement technology. High product quality can be achieved only there, where the measurement technology is integrated into the production event maximally strongly. On the other hand, continuously new orders are made through increasing quality onto the capability of the measurement technology. From that quality protection and measurement technology are in the enterprise event combined with each other much closely.

The general experiences both in the industrial practice and in the everyday life show a general trend towards higher expectations concerning the quality of products and services.

3.2 Terms and Aspects of Quality Management

3.2.1 Quality

Quality is the totality of characteristics of an entity that bear on its ability to satisfy stated and implied needs. In a contractual environment, or in a regulated environment needs are specified, whereas in other environments, implied needs should be identified and defined.

In many instances, needs can change with time; this implies periodic review of requirements for quality. Needs are usually translated into characteristics with specified criteria. Needs may include, for example, aspects of performance, usability, dependability (availability, reliability, maintainability), safety, environment, economics and aesthetics.

[4] refer to Hoyle, 2006, p. 8
[5] refer to Osana, Durakbasa, 2004, p. 9

The term "quality" is not used as a single term to express a degree of excellence in a comparative sense, nor should it be used in a quantitative sense for technical evaluations. To express these meanings, a qualifying adjective should be used. For example, use can be made of the following terms:

- "relative quality" where entities are ranked on a relative basis in the degree of excellence or comparative sense (not to be confused with grade),
- "quality level" in a quantitative sense (as used in acceptance sampling) and "quality measure" where precise technical evaluations are carried out.

The achievement of satisfactory quality involves all stages of the "quality circle" or life-cycle of the product as a whole. The contributions to quality of these various stages are sometimes identified separately for emphasis; for example, quality due to definitions of needs, quality due to product design, quality due to conformance, quality due to product support throughout its lifetime.[6]

In same references, quality is referred to as "fitness for use" or "fitness for purpose" or "customer satisfaction" or "conformance to the requirements". These represent only certain facets of quality, as defined above. These are just few meanings; however, the meaning used in the context of ISO 9000 is the one concerned with the totality of characteristics that satisfied needs but in the 2000 version this has changed. Quality in ISO 9000:2000 is defined as the degree to which a set of inherent characteristics fulfils the requirements. The former definition focused on an entity that was described as a product or service but with this new definition, the implication is that quality is relative to what something should be and what it is. It may be a product, service, decision, document, information or any output from a process. In describing an output, we express it in terms of its characteristics. To comment on the quality of anything we need a measure of its characteristics and a basis for comparison.
By combining the definition of the terms quality and requirement in ISO 9000:2000, quality can be expressed as the degree to which a set of inherent characteristics fulfils a need or expectation that is stated, generally implied or obligatory.

This concept of “degree” is illustrated in Figure 3-1. The diagram expresses three truths:
- Needs, requirements and expectations are constantly changing
- Performance needs to be constantly changing to keep pace with the needs
- Quality is the difference between the standard required and the standard reached.

This means that when we talk of anything using the word quality it simply implies that we are referring to the extent or degree to which a requirement is met. It also means that all the principles, methodologies, tools and techniques in the field of quality management serve one purpose, that of enabling organizations to close the gap between the standard required and the standard reached.

Therefore environmental, safety, security and health problems are in fact quality problems because an expectation or a requirement has not been met. Even if it had there would be no problem. Having made the comparison it can be still assessed whether the output is “fitness for us”. In this sense the output may be of poor quality but remain fit for use. The specification is often an imperfect definition of what a customer needs; because some needs can be difficult to express clearly and it doesn’t mean that by not conforming, the product or service is unfit for use. It is also possible that a product that conforms to requirements may be totally useless. It all depends on whose requirements are being met.[7]

[6] refer to Osana, Durakbasa, 2004, p. 15
[7] refer to Hoyle, 2006, p. 9

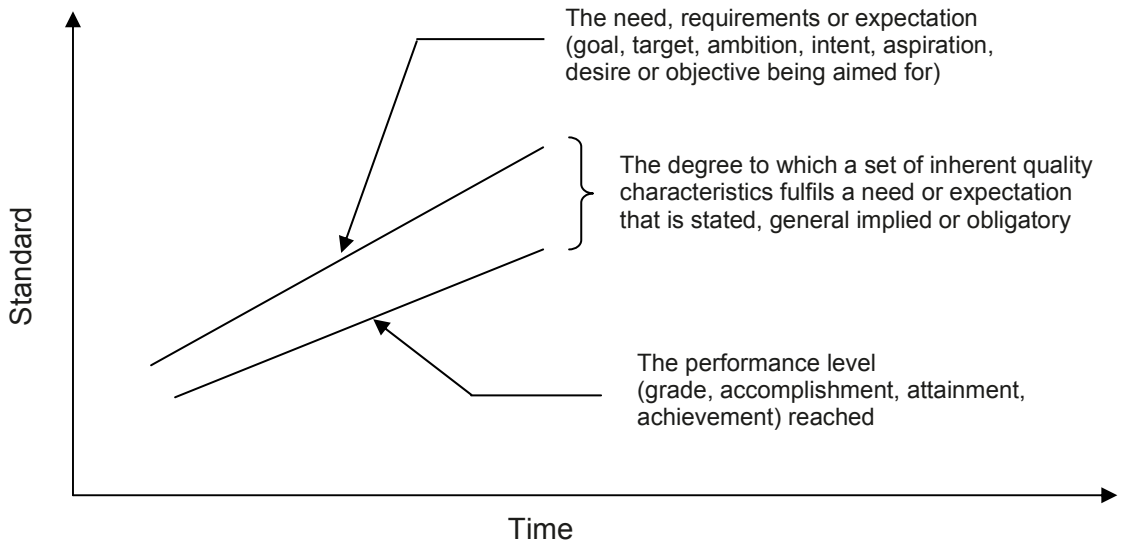

Figure 3-1: The meaning of quality[8]

3.2.2 Quality Characteristics

Any feature or characteristic of a product or service that is needed to satisfy customer needs or achieve fitness for use is a quality characteristic. When dealing with products the characteristics are almost always technical characteristics, whereas service quality characteristics have a human dimension. Some typical quality characteristics are given below.[9]

- **Product characteristics:**

Accessibility
Emittance
Flammability
Vulnerability
Functionality
Availability
Storability
Operability
Portability
Disposability
Strength
Odour
Toxicity
Reliability
Safety
Flexibility
Size
Interchangeability
Adaptability
Taste
Testability
Producibility
Transportability
Reparability
Weight
Security
Maintainability
Appearance
Cleanliness
Consumption
Traceability
Durability

- **Service quality characteristics:**

Accessibility
Accuracy
Responsiveness
Reliability
Competence
Credibility
Dependability
Comfort
Promptness
Flexibility
Honesty
Efficiency
Effectiveness
Courtesy
Security

[8] refer to Hoyle, 2006, p. 9
[9] refer to Ibid., p. 19

These are the characteristics that need to be specified and their achievement controlled, assured, improved, managed and demonstrated. These are the characteristics that form the subject matter of the product requirements referred to in ISO 9000. When the value of these characteristics is quantified or qualified they are termed product requirements.

3.2.3 Quality Parameters

Differences in design can be denoted by grade or class but can also be the result of poor attention to customer needs. It is not enough to produce products that conform to the specifications or supply services that meet management's requirements. Quality is a composite of three parameters: [10]

- **Quality of design** is the extent to which the design reflects a product or service that satisfies customer needs and expectations. All the necessary characteristics should be designed into the product or service at the outset.

- **Quality of conformance** is the extent to which the product or service conforms to the design standard. The design has to be faithfully reproduced in the product or service.

- **Quality of use** is the extent by which the user is able to secure continuity of use from the product or service. Products need to have a low cost of ownership, be safe and reliable, maintainable in use and easy to use.

Products or services that do not possess the right features and characteristics either by design or by construction are products of poor quality. Those that fail to give customer satisfaction by being uneconomic to use are also products of poor quality, regardless of their conformance to specifications. Often people might claim that a product is of good quality but of poor design, or that a product is of good quality but it has a high maintenance cost. These notions result from a misunderstanding because product quality is always a composite of the quality of design, conformance and use.

3.2.4 Dimensions of Quality

In addition to quality parameters there are three dimensions of quality which extend the perception beyond the concepts of quality parameters:[11]

- **The business quality dimension**: This is the extent to which the business serves the needs of all interested parties and is the outward facing view of the organization. The interested parties are not only interested in the quality of particular products and services but judge organizations by their potential to create wealth, the continuity of operations, the sustainability of supply, care of the environment, and adherence to health, safety and legal regulations. Changes in business strategy, direction or policies might yield improvement in business quality.

- **The product quality dimension**: This is the extent to which the products and services provided meet the needs of specific customers. Enhancement to product features to satisfy more customers might yield improvement in product quality.

[10] refer to Hoyle, 2006, p. 21
[11] refer to Hoyle, 2005, p. 17

- **The organization quality dimension**: This is the extent to which the organization maximizes its efficiency and effectiveness and is the inward facing view of the organization. Efficiency is linked with productivity which itself is linked with the motivation of personnel and the capability and utilization of resources. Effectiveness is linked with the utilization of knowledge focusing on the right things to do. Seeking best practice might yield improvement in organizational quality. This directly affects all aspects of quality.

3.2.5 Quality Policy

Quality policy is the overall intentions and directions of an organization with regard to quality, as formally expressed by top management. The quality policy forms one element of the corporate policy and is authorized by top management

3.2.6 Quality Control

Quality control comprises the operational techniques and activities that are used to fulfill requirements for quality. Quality control deals with assurance and failure testing in design and production of products or services, to meet or exceed customer requirements.

Quality control involves operational techniques and activities aimed both at monitoring a process and at eliminating causes of unsatisfactory performance at all stages of the quality loop in order to achieve economic effectiveness.

3.2.7 Quality Assurance

Quality Assurance comprises all the planned and systematic activities implemented within the quality system, and demonstrated as needed, to provide adequate confidence that an entity will fulfill requirements for quality.[12] Two key principles characterize quality assurance: "fit for purpose" (the product should be suitable for the intended purpose) and "right first time" (mistakes should be eliminated). Quality assurance includes regulation of the quality of raw materials, assemblies, products and components; services related to production; and management, production and inspection processes.

There are both internal and external purposes for quality assurance:

- **Internal Quality Assurance**: Within an organization, quality assurance provides confidence to the management,
- **External Quality Assurance**: In contractual or other situations, quality assurance provides confidence to the customers or others.

[12] refer to Osana, Durakbasa, 2004, p. 17

3.2.8 Quality Management

Quality management is all activities of the overall management function that determine the quality policy, objectives and responsibilities, and implement them by means such as quality planning, quality control, quality assurance and quality improvement within the quality system. Quality management is the responsibility of all levels of management but must be led by the top management. Its implementation involves all members of the organization.

Quality management can be considered to have three main components: quality control, quality assurance and quality improvement. Quality management is focused not only on product quality, but also the means to achieve it. Quality management therefore uses quality assurance and control of processes as well as products to achieve more consistent quality.

3.2.8.1 Basic Instruments for Quality Management

Preventive quality assurance helps to stop arising failures. Elementary but effective assisting devices are the so-called "Seven Tools of Quality", which include Pareto chart, check sheet, control chart, cause-and-effect diagram, flowchart, scatter diagram, and histogram. They are easy to learn and to handle and are used to analyze the solution of existing problems. The following two methods (Quality Function Deployment (QFD) and Failure Mode and Effect Analysis (FMEA) are extremely progressive tools in the preventive quality assurance and essential components of each QM system. These tools have been widely used in most quality management organizations, and a number of extensions and improvements to them have been proposed and adopted.

3.2.8.1.1 The Deming Cycle

Deming Cycle is basic instrument for each organization. The Deming Cycle (see Figure 3-2) is a standard base to improve any methodology, and it is composed of four stages:

- Plan,
- Do,
- Study,
- Act.

The third stage - Study - was formerly called “Check” and the Deming Cycle was known as the "PDCA Cycle". Deming made the change in 1990 as "Study" is more appropriate. With only a "Check" one might miss something.

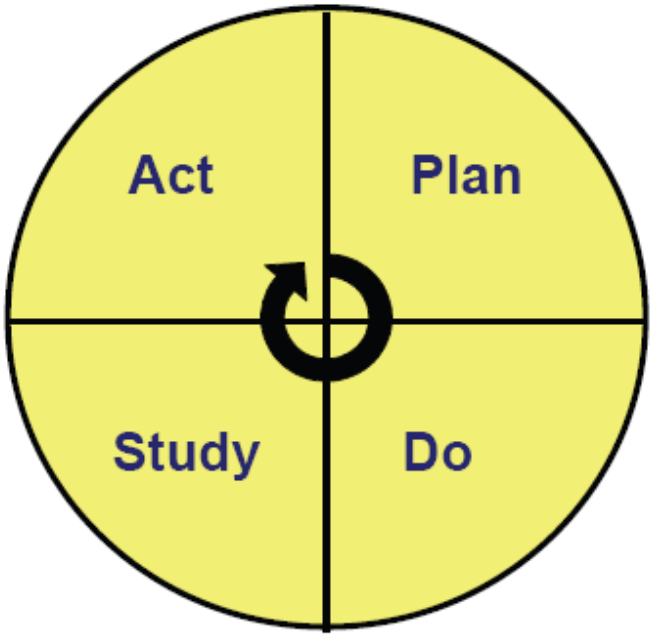

Figure 3-2: Deming Cycle[13]

- Plan: studying the current situation, gathering data, planning for improvement, understanding the problem through developing solution steps in the previous process.
- Do: implementation of the plan on a trial basis in a laboratory, pilot production process or with a small group of customers.
- Study: determine if the trial plan is working currently and if any further problems or opportunities are found.
- Act: implementation of the final plan to ensure that the improvements will be standardized and practiced continuously. This lead back to the beginning for further diagnosis and improvement.

The Deming Cycle is focused on continuous improvement.

3.2.8.1.2 Flow charts

A flowchart is a common type of chart that represents an algorithm or process showing the steps as boxes of various kinds, and their order by connecting these with arrows. Flowcharts are used in analyzing, designing, documenting or managing a process or program in various fields. [14]Flow charts are used to realize separate classes of data with different origin. To realize causes of problems, measurable data must be collected and treated. The main part of an effective collection of data to analyze the main problem is the planning of this collection. An intelligent sampling plan is to develop to get indicates to the causes of problems.

[13] refer to Osana, Durakbasa, 2004, p. 90
[14] refer to http://en.wikipedia.org/wiki/Flowchart (10.05.2009)

3.2.8.1.3 Check Sheet

Check sheets are used for methodical logging of the problem situation by concrete data. They serve to visual the frequency of single sorts of defects or measured values in definite intervals and for satisfaction the failure to the determined categories of failure by the flow chart.

3.2.8.1.4 Histogram

A histogram sorts data to the frequency of their occurrence (i.e. time) and visualize the measured values of a process. The distribution of the measured values (i.e. normal-distribution) respectively the distribution of the measured values in relation to the tolerances can be realized.

3.2.8.1.5 Pareto Diagram

Pareto analysis is based on the premise that 80% of problems are due to 20% of the possible causes. These 20% are the "vital few" problems a process improvement focuses on. This effect, known as the 80:20 rule, can be observed in action so often that it seems to be almost a universal truth. As several economists have pointed out, at the turn of the century the bulk of the country's wealth was in the hands of a small number of people. The purpose is to highlight the most important among a (typically large) set of factors. In quality control, the Pareto chart often represents the most common sources of defects, the highest occurring type of defect, or the most frequent reasons for customer complaints, etc.[15]

The Pareto diagram is a simple way of rank ordering the causes of problems by their contribution. Usually the cumulative contribution is plot as a line plot on the same scale. A common use of Pareto diagrams is to organize data and help focus action on the primary causes of the problem. After the quality improvement action has been taken, the same types of data are collected to compare the results with previous data.[16]

3.2.8.1.6 Cause-and-Effect Diagram

Cause-and-effect diagrams (also called fishbone diagrams or Ishikawa diagrams) are diagrams that show the causes of a certain event. A common use of the Ishikawa diagram is in product design, to identify potential factors causing an overall effect.
The three basic uses of the diagram are:

- dispersion analysis,
- production process classification,
- cause enumeration.

The Cause-and-Effect diagram seems to be very effective at collecting and ordering ideas generated in a session where people are trying to list the possible causes of drop-out, rework, etc.[17]

[15] refer to http://en.wikipedia.org/wiki/Pareto_chart (11.05.2009)
[16] refer to Osana, Durakbasa, 2004, p. 93
[17] refer to Ibid., p. 94

3.2.8.1.7 Scatter Diagrams

The scatter diagram is used to deduce regularities and relations from the basic data to prove unclarities about potential causes of a problem by experiments. The scatter diagram is very helpful if both, the influence quantities and the describable quantities of the problem are measurable. It is a X-Y diagram, with the influence quantity on the abscise and the quantity of the problem on the ordinate.

Data patterns may be positive, negative, or display no relationship. A positive relationship is indicated by an ellipse of points that slopes upward demonstrating that an increase in the cause variable also increases the effect variable. A negative relationship is indicated by an ellipse of points that slopes downward demonstrating that an increase in the cause variable results in a decrease in the effect variable. A diagram with a cluster of points such that it is difficult or impossible to determine whether the trend is upward sloping or downward sloping indicates that there is no relationship between the two variables. Data patterns, whether in a positive or negative direction, should also be interpreted for strength by examining the "tightness" of the clustered points. The more the points are clustered to look like a straight line the stronger the relationship.[18]

3.2.8.1.8 Control Chart

A control chart is a statistical tool used to distinguish between variation in a process resulting from common causes and variation resulting from special causes.[19] It presents a graphic display of process stability or instability over time. If the chart indicates that the process is currently under control then it can be used with confidence to predict the future performance of the process. If the chart indicates that the process being monitored is not in control, the pattern it reveals can help determine the source of variation to be eliminated to bring the process back into control. A control chart is a specific kind of run chart that allows significant change to be differentiated from the natural variability of the process.
This is a key to effective process control and improvement. On a practical level the control chart can be seen as part of an objective disciplined approach that facilitates the decision as to whether process performance warrants attention or not.

3.2.9 Quality Management System

Quality Management System (QMS) comprises the organizational structure, procedures, processes and resources needed to implement quality management. The quality system typically applies to, and interacts with, all activities pertinent to the quality of a product.

The quality management system should be as comprehensive as needed to meet the quality objectives. The quality system of an organization is designed primarily to meet the internal managerial needs of the organization. It is broader than the requirements of a particular customer, who evaluates only the relevant part of the quality system.

For contractual or mandatory quality assessment purposes, demonstration of the implementation of the identified quality system elements may be required. A quality management system is not a random collection of procedures, tasks or documents.

[18] refer to Ibid., p. 95
[19] refer to http://www.balancedscorecard.org/Portals/0/PDF/control.pdf (15.05.2009)

Quality management systems need to be designed. All the components need to fit together, the inputs and outputs need to be connected, sensors need to feed information to processes which cause changes in performance and all parts need to work together to achieve a common purpose. [20]

Only a properly implemented quality management system (QMS) within an organization and across its supply chain can provide protection from short-term actions that do not serve long-term goals. For many firms, obtaining acceptable levels of quality comes with the registration of a QMS for itself and its suppliers.

As the quality management system is the means by which the organization achieves its objectives, it follows that the scope of the system (what it covers) is every function and activity of the organization that contributes to these objectives. This should leave no function or activity outside the system. The system must also include suppliers because the organization depends on its suppliers to achieve its objectives. The chain of processes from the customer interface and back again includes the suppliers. Only a properly implemented quality management system (QMS) within an organization and across its supply chain can provide protection from short-term actions that do not serve long-term goals. For many firms, obtaining acceptable levels of quality comes with the registration of a QMS for itself and its suppliers. [21]

The adoption of a quality management system should be a strategic decision of an organization. The design and implementation of an organization's quality management system is influenced by:

- its business environment, changes in that environment, or risks associated with that environment,
- its varying needs,
- its particular objectives,
- the products it provides,
- the processes it employs,
- its size and organizational structure.

3.2.10 Total Quality Management

Total Quality Management (TQM) is a business management strategy aimed at embedding awareness of quality in all organizational processes. If modern companies are considered, there exist several major areas of special concern:

- Quality was too often entered downstream, that is, at final assembly, rather than in the design and development stages.
- Customer needs and satisfaction were not well understood.
- Quality was not an important issue until it became a problem.
- Management seemed willing to sacrifice quality when costs or scheduling conflicted.
- Operators were not sufficiently trained in their jobs and in quality issues.
- Quality problems were observed with vendors.
- Quality costs were determined to be high.

[20] refer to Hoyle, 2006, p. 59
[21] refer to Sroufe, Curkovic, 2007

People, technology, information, and management are involved in these issues. A company can respond to them with a comprehensive and integrated quality strategy. In every organization, effective quality management must be a total, companywide effort that is aimed at the avoidance of problems through the planning and engineering of products, processes, and methods, the identification of problems that inevitably will arise, correction of this problems, and continuous improvement of quality performance.[22]

3.2.10.1 Principles of TQM

The principles of Total Quality Management are summarized in the following:

- Business success can only be achieved by understanding and fulfilling the needs of customers.
- Leadership in quality is the responsibility of top management.
- Statistical reasoning with factual data is the basis for problem solving and continuous improvement.
- All functions at all levels of an organization must focus on continuous improvement to achieve corporate goals.
- Problem solving and process improvements are best performed by multifunctional work teams.
- Continuous learning, training, and education are the responsibility of everyone in the organization.[23]

TQM implies that quality is not solely a control, or technical, issue, but that quality must be addressed from the perspective of strategic management. Strategic planning involves the long-range determination of business policy and usually includes product and market planning, financial planning, and facility and equipment planning. Each of these strategic planning areas has a bearing on quality; in fact, quality is perhaps the most important issue in strategic planning. A strategic orientation toward quality will generate growth, provide a competitive advantage, and contribute to a firm's profitability.

3.3 ISO 9000 Standards

3.3.1 History and Evolution of ISO 9000 Standards

The concept of quality as it is thought of it now first emerged out of the Industrial Revolution. Previously goods had been made from start to finish by the same person or team of people, with handcrafting and tweaking the product to meet 'quality criteria'. Mass production brought huge teams of people together to work on specific stages of production where one person would not necessarily complete a product from start to finish. In the late 1800s pioneers such as Frederick Winslow Taylor and Henry Ford recognized the limitations of the methods being used in mass production at the time and the subsequent varying quality of output. Taylor established Quality Departments to oversee the quality of production and rectifying of errors, and Ford emphasized standardization of design and component standards to ensure a standard product was produced. Management of quality was the responsibility of the Quality department and was implemented by Inspection of product output to 'catch' defects.[24]

[22] refer to Osana, Durakbasa, 2004, p. 51
[23] refer to Ibid., p. 52
[24] refer to http://en.wikipedia.org/wiki/Quality_management_system (18.05.2009)

Formal quality systems did not appear until the early 1950s. During World War II, there were quality problems in many British industries such as munitions, where bombs were exploding in factories during assembly. The solution adopted to address these quality problems required factories to document their manufacturing procedures and to prove by record-keeping that the procedures were being followed.[25] Quality control, as an element of quality management, emerged as a function in industry after the Second World War and the principles were codified by Joseph M. Juran in his Quality Control Handbook of 1951. In 1959 the first national standard, Mil Std 9858 on quality program requirements, was issued by the US Department of Defense. This Standard formed the foundation of all quality system standards that followed.[26] In 1979, the British Standards Institute introduced a new set of standards aimed at promoting quality of goods and services provided by United Kingdom industries.[27] The standard was BS 5750, and it was known as a management standard because it specified not what to manufacture, but how the manufacturing process was to be managed.

In 1987, the International Organization for Standardization released the ISO 9000 quality standard series, which was the direct equivalent of BS 5750. The International Organization for Standardization (ISO) is an international-standard-setting body composed of representatives from various national standards organizations. Founded on 23 February 1947, the organization promulgates worldwide proprietary industrial and commercial standards. It is headquartered in Geneva, Switzerland. ISO is a network of the national standards institutes of 161 countries, one member per country.[28]

The original ISO quality standards from 1987 revised in a limited manner in 1994 underwent a major revision in 2000, and the most recent version ISO 9001:2008 was published on 15 November 2008.

3.3.1.1 ISO 9000:1987 Version

ISO 9000:1987 had the same structure as the British Standard BS 5750, with three models for quality management systems, the selection of which was based on the scope of activities of the organization:[29]

- **ISO 9001:1987** Model for quality assurance in design, development, production, installation, and servicing was for companies and organizations whose activities included the creation of new products.

- **ISO 9002:1987** Model for quality assurance in production, installation, and servicing had basically the same material as ISO 9001 but without covering the creation of new products.

- **ISO 9003:1987** Model for quality assurance in final inspection and test covered only the final inspection of finished product, with no concern for how the product was produced.

ISO 9000:1987 was also influenced by existing U.S. and other Defense Standards (MIL SPECS), and so was well-suited to manufacturing. The emphasis tended to be placed on conformance with procedures rather than the overall process of management—which was likely the actual intent.

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[25] refer to http://www.kcg.com.sg/iso-9000-history-and-evolution.aspx (29.05.2009)
[26] refer to Hoyle, 2006, p. 115
[27] refer to Sroufe, Curkovic, 2007
[28] refer to www.iso.org
[29] refer to http://www.kcg.com.sg/iso-9000-history-and-evolution.aspx (20.05.2009)

3.3.1.2 Year 1994 Revision

ISO 9000:1994 emphasized quality assurance via preventive actions, instead of just checking final product, and continued to require evidence of compliance with documented procedures. As with the first edition, the down-side was that companies tended to implement its requirements by creating shelf-loads of procedure manuals, and becoming burdened with an ISO bureaucracy. In some companies, adapting and improving processes could actually be impeded by the quality system.

3.3.1.3 Year 2000 Revision

ISO 9001:2000 combines the three standards 9001, 9002, and 9003 into one, called 9001. In most cases, an organization claiming to be "ISO 9000 registered" is referring to ISO 9001.[30] Design and development procedures are required only if a company engages in the creation of new products. The 2000 version sought to make a radical change in thinking by placing the concept of process management front and centre ("Process management" was the monitoring and optimizing of a company's tasks and activities, instead of just inspecting the final product). The Year 2000 version also demands involvement by upper executives, in order to integrate quality into the business system and avoid delegation of quality functions to junior administrators. Another goal is to improve effectiveness via process performance metrics — numerical measurement of the effectiveness of tasks and activities. Expectations of continual process improvement and tracking customer satisfaction were made explicit.[31]

3.3.1.4 Year 2008 Revision

The new ISO 9001:2008 was published on 15 November 2008. ISO 9001:2008 uses the same numbering system as ISO 9001:2000 to organize the standard. As a result, the new ISO 9001:2008 standard looks very much like the old standard. No new requirements have been added. ISO 9001:2008 only introduces clarifications to the existing requirements of ISO 9001:2000 and some changes intended to improve consistency with ISO 14001:2004.

3.3.2 ISO 9000 Series of Standards

ISO9000 is an international quality certification that defines minimum requirements for a company's Quality Management System (QMS). ISO 9000 has evolved into a standard designed to assist organizations in achieving 'quality' whilst helping to assure customers that quality will be achieved. Whatever definition it is chose to use for quality, and there are many, it is essential that customers are happy with the product/service being supplied. ISO 9000 is intended to assist that aim by helping to ensure that the product/service is right - for both the organization itself and its customers.

The ISO 9000 quality management systems (QMS) standards are not specific to products or services, but apply to the processes that create them. The standards are generic in nature so that they can be used by both manufacturing and service industries.

A company's QMS comprises the organization's policies, procedures and other internal requirements that ensure customer requirements are met with consistency resulting in customer satisfaction.

To receive an ISO 9000 certification a company must put the required QMS processes and controls in place, monitor performance of its processes and demonstrate continual

[30] refer to http://en.wikipedia.org/wiki/ISO_9000 (20.05.2009)
[31] refer to Ibid.

improvement. Most companies hire an experienced consulting firm to assist with these preparations. Once the QMS is in place, a registrar (or certification body) is hired to audit the company's compliance with ISO9000 requirements. If discrepancies are found during the audit, they must be corrected before the ISO9000 certificate is issued. The ISO9000 certification must be maintained through regular audits (bi-annual or annual) conducted by the selected registrar.[32]

ISO 9000 includes the following standards:[33]

- **ISO 9000:2005, Quality Management Systems – Fundamentals and Vocabulary** covers the basics of what quality management systems are and also contains the core language of the ISO 9000 series of standards. A guidance document, not used for certification purposes, but important reference document to understand terms and vocabulary related to quality management systems.

- **ISO 9001:2008 Quality Management Systems – Requirements** is intended for use in any organization regardless of size, type or product (including service). It provides a number of requirements which an organization needs to fulfill if it is to achieve customer satisfaction through consistent products and services which meet customer expectations. It includes a requirement for the continual (i.e. planned) improvement of the Quality Management System, for which ISO 9004:2000 provides many hints. ISO 9001 specifies requirements for a quality management system that can be used for internal application by organizations, for certification, or for contractual purposes. It focuses on the effectiveness of the quality management system in meeting customer requirements.

- **ISO 9004:2000 Quality Management Systems – Guidelines for Performance improvements** covers continual improvement. This gives you advice on what you could do to enhance a mature system. This standard very specifically states that it is not intended as a guide to implementation. ISO 9004 gives guidance on a wider range of objectives of a quality management system than does ISO 9001, particularly for the continual improvement of an organizations overall performance and efficiency, as well as its effectiveness. ISO 9004 is recommended as a guide for organizations whose top management wishes to move beyond the requirements of ISO 9001, in pursuit of continual improvement of performance. However, it is not intended for certification or for contractual purposes.

ISO 9001 and ISO 9004 are quality management system standards which have been designed to complement each other, but can also be used independently. Each of the standards has a different purpose, intent, scope and applicability as indicated in Table 3-1.

[32] refer to http://www.9000world.com (21.05.2009)
[33] refer to http://www.iso9001help.co.uk/ISO9000_Keys_to_Success.pdf (21.05.2009)

Attribute	*ISO 9000 family*	*ISO 9000*	*ISO 9001*	*ISO 9004*
Purpose	To assist organizations operate effective quality management systems	To facilitate common understanding of the concepts and language used in the family of standards	To provide and equitable basis for assessing the capability of organizations to meet customer and applicable regulatory requirements	To assist organizations to satisfy the needs and expectations of all interested parties
Intent	To facilitate mutual understanding in national and international trade and help organizations achieve sustained success	To be used in conjunction with ISO 9001 and ISO 9004	To be used for contractual and certification purposes	To assist organizations purpose continual improvement. It is not intended as a guide to meeting the requirements of ISO 9001
Scope	The management of quality	Defines the principles and fundamental concepts and terms used in the ISO 9000 family	Defines the requirements of a quality management system, the purpose of which is to enable organizations to continually satisfy their customers	Provides guidelines for improving the performance of organizations and enabling them to satisfy all interested parties
Applicability	Applies to all organizations regardless of size or complexity	Applies to all terms used in the ISO 9000 family	Applies where an organization needs to demonstrate its ability to provide products and services that meet customer and regulatory requirements and aims to enhance customer satisfaction	Applies to organizations seeking guidance on developing quality management systems and improving their performance
Facts and figures	3 Standards	81 Definitions	8 Sections, 51 Clauses, 250+ Requirements	8 Sections, 64 Clauses, No requirements

Table 3-1: Overview of the ISO 9000 family of standard [34]

[34] refer to Hoyle, 2006, p.4

There are many more standards in the ISO 9001 series many of them not even carrying "ISO 900x" numbers. For example, some standards in the 10,000 range are considered part of the 9000 group: ISO 10007:1995 discusses Configuration management, which for most organizations is just one element of a complete management system. ISO notes: "The emphasis on certification tends to overshadow the fact that there is an entire family of ISO 9000 standards. Organizations stand to obtain the greatest value when the standards in the new core series are used in an integrated manner, both with each other and with the other standards making up the ISO 9000 family as a whole".[35]

The tremendous impact of ISO 9001 and ISO 14001 on organizational practices and on trade has stimulated the development of other ISO standards and deliverables that adapt the generic management system to specific sectors or aspects This is partly to ensure that their versions of ISO 9000 have their specific requirements, but also to try and ensure that more appropriately trained and experienced auditors are sent to assess them. The most common specific standards are summarized below, that are generated from ISO standards:

- **ISO 14001:2004 – Environmental management systems – Requirements with guidance for use:** specifies requirements for an environmental management system to enable an organization to develop and implement a policy and objectives which take into account legal requirements and other requirements to which the organization subscribes, and information about significant environmental aspects. It applies to those environmental aspects that the organization identifies as those which it can control and those which it can influence. It does not itself state specific environmental performance criteria. This standard is going to be explained in details in the next chapter.

- **TickIT** guidelines are an interpretation of ISO 9000 produced by the UK Board of Trade to suit the processes of the information technology industry, especially software development.

- **ISO/TS 16949:2009 – Quality management systems – Particular requirements for the application of ISO 9001:2008 for automotive production and relevant service part organizations**: ISO/TS 16949:2009, in conjunction with ISO 9001:2008, defines the quality management system requirements for the design and development, production and, when relevant, installation and service of automotive-related products. Standard is applicable to sites of the organization where customer-specified parts, for production and/or service, are manufactured. ISO/TS 16949:2009 can be applied throughout the automotive supply chain. This standard is an interpretation agreed upon by major automotive manufacturers (American and European manufacturers)

- **AS9001** is the Aerospace Basic Quality System Standard, an interpretation developed by major aerospace manufacturers. Those major manufacturers include AlliedSignal, Allison Engine, Boeing, General Electric Aircraft Engines, Lockheed-Martin, McDonnell Douglas, Northrop Grumman, Pratt & Whitney, Rockwell-Collins, Sikorsky Aircraft, and Sundstrand.

- **PS 9000** is an application of the standard for Pharmaceutical Packaging Materials. The Pharmaceutical Quality Group (PQG) of the Institute of Quality Assurance (IQA) has developed PS 9000:2001. It aims to provide a widely accepted baseline GMP framework of best practice within the pharmaceutical packaging supply industry. It applies ISO 9001: 2000 to pharmaceutical printed and contact packaging materials.

[35] refer to www.iso.org (25.05.2009)

- **TL 9000** is the Telecom Quality Management and Measurement System Standard, an interpretation developed by the telecom consortium, QuEST Forum. The current version is 4.0 and unlike ISO 9001 or the above sector standards, TL 9000 includes standardized product measurements that can be benchmarked. In 1998 QuEST Forum developed the TL 9000 Quality Management System to meet the supply chain quality requirements of the worldwide telecommunications industry.

- **ISO 13485:2003 – Medical devices – Quality management systems – Requirements for regulatory purposes**: is the medical industry's equivalent of ISO 9001:2000. Whereas the standards it replaces were interpretations of how to apply ISO 9001 and ISO 9002 to medical devices, ISO 13485:2003 is a stand-alone standard. Compliance with ISO 13485 does not necessarily mean compliance with ISO 9001:2000.

- **ISO 29001 Petroleum, petrochemical and natural gas industries – Sector-specific quality management systems – Requirements for product and service supply organizations**: is quality management system requirements for the design, development, production, installation and service of products for the petroleum, petrochemical and natural gas industries.

- **ISO 22000:2005 Food safety management systems – Requirements for any organization in the food chain**: ISO 22000:2005 specifies requirements for a food safety management system where an organization in the food chain needs to demonstrate its ability to control food safety hazards in order to ensure that food is safe at the time of human consumption.

- **ISO/IEC 27001:2005** – **Information technology – Security techniques – Information security management systems**: ISO/IEC 27001:2005 covers all types of organizations. Standard specifies the requirements for establishing, implementing, operating, monitoring, reviewing, maintaining and improving a documented Information Security Management System within the context of the organization's overall business risks. It specifies requirements for the implementation of security controls customized to the needs of individual organizations or parts thereof.

- **ISO 30000:2009 – Ships and marine technology – Ship recycling management systems – Specifications for management systems for safe and environmentally sound ship recycling facilities**: specifies requirements for a management system to enable a ship recycling facility to develop and implement procedures, policies and objectives in order to be able to undertake safe and environmentally sound ship recycling operations in accordance with national and international standards.

- **ISO 28000:2007 – Specification for security management systems for the supply chain**: specifies the requirements for a security management system, including those aspects critical to security assurance of the supply chain. Security management is linked to many other aspects of business management. Aspects include all activities controlled or influenced by organizations that impact on supply chain security. These other aspects should be considered directly, where and when they have an impact on security management, including transporting these goods along the supply chain.

3.3.3 Why was ISO 9000 created?

The standards were created to facilitate mutual understanding of quality management system requirements in national and international trade. The associated certification schemes (which are not a requirement of any of the standards in the ISO 9000 family) were launched to reduce costs of customer-sponsored audits performed to verify the capability of their suppliers. The schemes were born out of a reticence of customers to trade with organizations that had no credentials in the market place.

The standard (ISO 9001) was primarily intended for situations where customers and suppliers were in a contractual relationship. It was not intended for use where there were no contractual relationships. It was therefore surprising that schools, hospitals, local authorities and many other organizations not having a contractual relationship with their “customer” would seek ISO 9000 certification. However, the 1994 version has been applied in non-contractual situations with the result that organizations created overcomplicated systems with far more documentation than they needed. In non-contractual situations there is usually no need to demonstrate potential capability. Customers normally purchase on the basis of recommendation or prior knowledge. Even in contractual situations, demonstration of capability is often only necessary when the customer cannot verify the quality of the products or services after delivery. The customer may not have any way of knowing that the product or service meets the agreed requirements until it is put into service by which time it is costly in time, resource and reputation to make corrections. In cases where the customer has the capability to verify conformity, the time and effort required is an added burden and its elimination helps reduce costs to the end user.

It is clear that customers need confidence in the quality of products supplied and would require some evidence that addressed this need. ISO 9000 was a neat solution to this problem as it embodied most of the requirements customers needed to obtain an assurance of quality. Any additional requirements could be put into the contract. Standardization in this case improved efficiency in getting orders out. However, in the mad rush to use ISO 9000, the buyers in the purchasing departments overlooked a vital step.[36]

3.3.4 Benefits of Implementing ISO 9000

In the early 1990s, companies seemed to be jumping on the certification bandwagon without seriously considering the rationale for doing so. Often they did so because competitors or "everybody else" is getting registered. Today companies seriously look at the reasons and benefits of implementing QMS.[37]

Organizations that implement an ISO 9000 compliant QMS usually realize important benefits, including a more organized operating environment, a greater number of customers and a higher level of satisfaction among those customers. Whether an organization is planning a QMS in response to direct market requirements or want to increase the productivity of the organization, the following benefits will be experienced: [38]

[36] refer to Hoyle, 2006, p. 109
[37] refer to http://www.school-for-champions.com/iso9000/reasons.htm. (25.05.2009)
[38] refer to Dawson, 2005

- **Process Improvements:** As the organization implements a QMS, the organization has the opportunity to improve its processes. It will be outlined the current process, added the requirements of the standard and then optimized the process with input from the process users. After achieving certification, continual process improvements will be likely seen. A recent survey of 100 registered firms reported the average improvement in operating margin at 5% of sales. These firms also reported faster turnaround times, and a reduction in scrap and overtime.

- **Increased Quality Awareness:** During implementation, quality awareness will increase, since all staff must be trained on ISO 9000. Staff will be required to take "ownership" of processes that they are involved in developing and improving. The QMS will also have built-in systems to report on key quality indicators, which will significantly reduce the reoccurrence of problems. This helps develop a strong quality culture, where the staff recognizes problems such as systems or process issues and works on fixing them, rather than placing blame with an individual. The result is increased confidence in workmanship and a more confident staff.

- **Increased Efficiency:** Companies that go through the ISO 9001 Quality Management Standards certification process have given a lot of thought to their processes and how to maximize quality and efficiency. Once certified for QMS, the processes are established and guidelines in place for anyone to follow easily, making training, transitions, and trouble-shooting easier.[39]

- **Consistency in Operations:** With ISO 9000 certification, operations will run more smoothly, as the QMS promotes consistency in how work is performed and recorded. This helps new employees learn processes more quickly and reduces misunderstandings with customers. If a problem does occur, it is traced to its root cause and fixed, saving the organization from "re-correcting" it every time it happens.

- **Customer Satisfaction:** The first and most common motivation is when a company's prime customer demands such certification of its suppliers. Companies want to make sure they get parts that fulfill their specifications and that they get what they are paying for.

  Client confidence is gained because of the universal acceptance of the ISO standards. Customer satisfaction is ensured because of the benefits of ISO 9001:2008 QMS to company efficiency, consistency and dedication to quality service. Customers will benefit by receiving the products /services that are: conforming to the requirements, dependable and reliable, available when needed and maintainable.

- **Market Advantages:** ISO 9000 certification is becoming a requirement to do business in many markets. A recent survey of ISO 9000 certified companies shows that 41% were asked to achieve certification by a client. Considering that it can take 6 months or longer for some organizations to achieve certification, already having a compliant QMS in place can be a distinct advantage. Many European companies have agreed only to deal with ISO 9000 registered suppliers to assure quality parts and services.

- **Increased Revenue:** Studies have shown that ISO QMS certified companies experience increased productivity and improved financial performance, compared to uncertified companies. [40]

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[39] refer to http://biotech.about.com/od/isocertification/tp/ISOQMS.htm (26.05.2009)
[40] refer to Ibid.

- **International Recognition:** The International Organization for Standardization (ISO) is recognized worldwide as the authority on quality management.

- **Employee Satisfaction:** Defined roles and responsibilities, accountability of management, established training systems and a clear picture of how their roles affect quality and the overall success of the company, all contribute to more satisfied and motivated staff. Employees will benefit from: better working conditions, increased job satisfaction, improved morale and improved stability of employment.

- **Documentation:** The ISO QMS standard requires documentation of all processes and any changes, errors and discrepancies. This ensures consistency throughout production and accountability of all staff. This also guarantees traceable records are available in case of non-compliant products or raw materials.

- **Factual Approach to Decision Making:** The ISO 9001:2008 QMS standard sets out clear instructions for audits and process reviews that facilitate information gathering and decision making based on the data.

- **Improved Supplier Relationships:** Mutually beneficial supplier relationships are one of the key attractions to ISO certification. Following the processes for documentation and testing ensure quality raw materials go into your production system. The process also requires thorough evaluation of new suppliers before a change is made and/or consistency with respect to how and where orders are placed. Suppliers and partners will benefit from: stability, growth, partnership and mutual understanding.

3.3.5 Quality Management Principles

This section introduces the eight quality management principles on which the quality management system standards of the ISO 9000:2000 and ISO 9000:2008 series are based. These principles can be used by senior management as a framework to guide their organizations towards improved performance. The principles are derived from the collective experience and knowledge of the international experts who participate in ISO Technical Committee ISO/TC 176, Quality management and quality assurance, which is responsible for developing and maintaining the ISO 9000 standards. [41]

The eight quality management principles are defined in ISO 9000:2005, Quality management systems Fundamentals and vocabulary, and in ISO 9004:2000, Quality management systems Guidelines for performance improvements. The standardized descriptions of the principles are given as they appear in ISO 9000:2005 and ISO 9004:2000. In addition, it provides examples of the benefits derived from their use and of actions that managers typically take in applying the principles to improve their organizations' performance. Figure 3-3 illustrates the eight quality management principles and relationships with each other.

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

[41] refer to www.iso.org

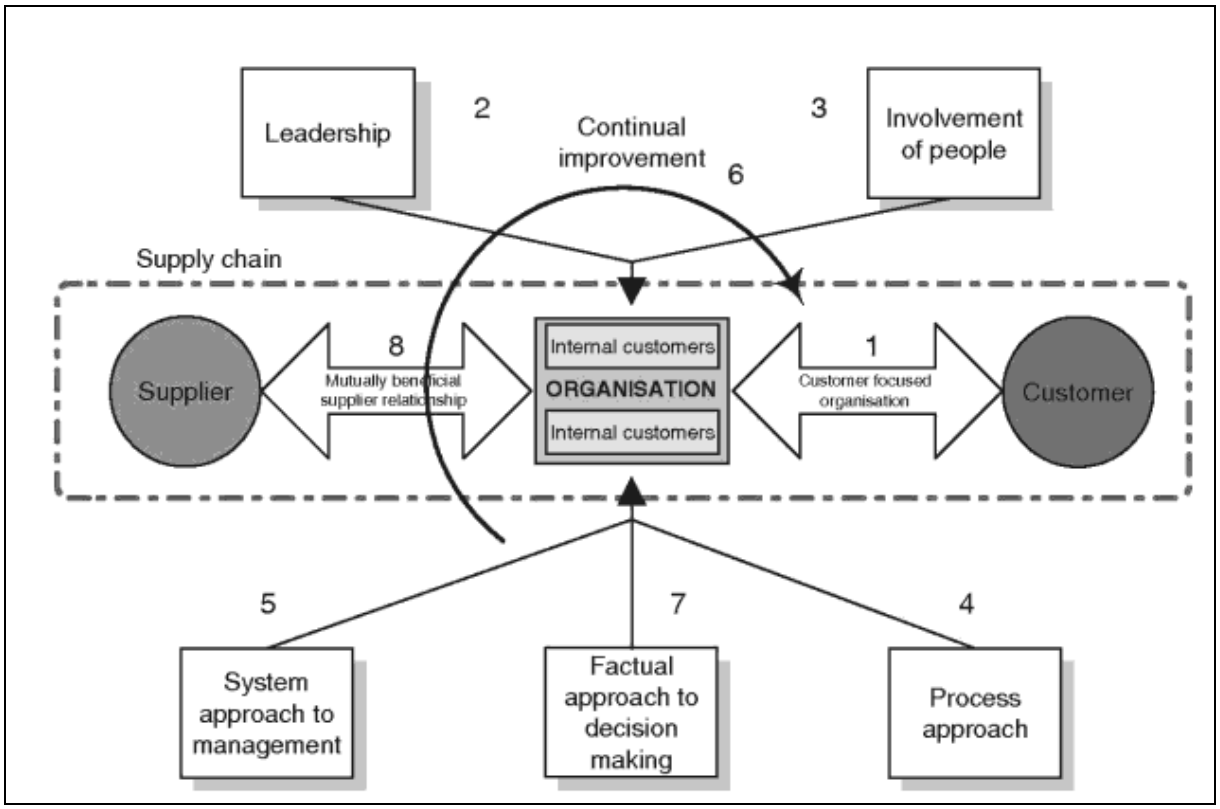

Figure 3-3: The eight quality management principles of ISO 9001:2008 [42]

3.3.5.1 Principle 1: Customer Focus

Organizations depend on their customers and therefore should understand current and future customer needs, should meet customer requirements and strive to exceed customer expectations.

The customer focus principle is reflected in ISO 9001 through the requirements addressing:[43]

- Communication with the customer (Clause 7.2.3)
- Communication of customer requirement through the organization (Clause 5.5.2)
- Care for customer property (Clause 7.5.4)
- The determination of customer needs and expectations (Clauses 5.2 and 7.2.1)
- Establishing the capability of satisfying customer requirements (Clause 7.2.2)
- Appointment of a management representative (Clause 5.5.2)
- Management commitment (Clause 5.1)
- Measuring customer satisfaction (Clause 8.2.1)
- Establishing the quality policy and quality objectives (Clauses 5.3 and 5.4.1)
- Continual improvement (Clause 8.1)

[42] refer to Tricker, p.36
[43] refer to Hoyle, 2006, p. 27

Key benefits:

- Increased revenue and market share obtained through flexible and fast responses to market opportunities.
- Increased effectiveness in the use of the organization's resources to enhance customer satisfaction.
- Improved customer loyalty leading to repeat business.

Applying the principle of customer focus typically leads to:

- Researching and understanding customer needs and expectations.
- Ensuring that the objectives of the organization are linked to customer needs and expectations.
- Communicating customer needs and expectations throughout the organization.
- Measuring customer satisfaction and acting on the results.
- Systematically managing customer relationships.
- Ensuring a balanced approach between satisfying customers and other interested parties (such as owners, employees, suppliers, financiers, local communities and society as a whole)

3.3.5.2 Principle 2: Leadership

Leaders establish unity of purpose and direction of the organization. They should create and maintain the internal environment in which people can become fully involved in achieving the organization's objectives.

The leadership principle is reflected in ISO 9001 through the requirements addressing:[44]

-
- The setting of objectives and policies (Clauses 5.3 and 5.4.1)
- Demonstrating commitment to meeting customer as well as statutory
- requirements (Clause 5.1)
- Planning of a system that will meet requirements and achieve objectives (Clause 5.4.1)
- Defining and communicating responsibility and authority (Clause 5.5.1)
- Setting up communication processes (Clause 5.5.3)
- Creating an effective work environment (Clause 6.4)
- Equipping people with the necessary competence to achieve the objectives (Clause 6.2.2)

Key benefits:

- People will understand and be motivated towards the organization's goals and objectives.
- Activities are evaluated, aligned and implemented in a unified way.
- Miscommunication between levels of an organization will be minimized.

[44] refer to Hoyle, 2006, p.28

Applying the principle of leadership typically leads to:

- Considering the needs of all interested parties including customers, owners, employees, suppliers, financiers, local communities and society as a whole.
- Establishing a clear vision of the organization's future.
- Setting challenging goals and targets.
- Creating and sustaining shared values, fairness and ethical role models at all levels of the organization.
- Establishing trust and eliminating fear.
- Providing people with the required resources, training and freedom to act with responsibility and accountability.
- Inspiring, encouraging and recognizing people's contributions.

3.3.5.3 Principle 3: Involvement of People

People at all levels are the essence of an organization and their full involvement enables their abilities to be used for the organization's benefit.

The involvement of people principle is reflected in ISO 9001 through the requirements addressing:[45]

- Setting up appropriate communication processes (Clause 5.5.3)
- Including functional representatives in design reviews (Clause 7.3.4)
- Defining objectives, responsibilities and authority (Clause 5.5.1)
- Creating an environment in which people are motivated (Clause 6.4)
- Involving people in how they contribute to achieving quality objectives (5.4.1)

Key benefits:

- Motivated, committed and involved people within the organization.
- Innovation and creativity in furthering the organization's objectives.
- People being accountable for their own performance.
- People eager to participate in and contribute to continual improvement.

Applying the principle of involvement of people typically leads to:

- People understanding the importance of their contribution and role in the organization.
- People identifying constraints to their performance.
- People accepting ownership of problems and their responsibility for solving them.
- People evaluating their performance against their personal goals and objectives.
- People actively seeking opportunities to enhance their competence, knowledge and experience.
- People freely sharing knowledge and experience.
- People openly discussing problems and issues.

[45] refer to Hoyle, 2006, p.29

3.3.5.4 Principle 4: Process Approach

A desired result is achieved more efficiently when activities and related resources are managed as a process.

The process approach principle is reflected in ISO 9001 through the requirements addressing:[46]

- The identity of processes (Clause 4.1a)
- Defining process objectives (Clause 5.4.1)
- Providing the infrastructure, information and resources for processes to function (Clause 6.1)
- Defining the activities required to deliver the process outputs (Clauses 4.1c, 7.3, 7.4, 7.5, 8.1)
- Communicating the process descriptions (Clauses 4.2 and 5.5.3)
- Determining and eliminating potential non-conformity (Clause 8.5.3)
- Measuring and monitoring processes (Clauses 4.1e and 8.2.3)
- Reviewing the processes for continuing adequacy, suitability and effectiveness (Clause 5.6.1)
- Diagnosing the cause of variation (Clause 8.5.2)
- Taking action to restore the status quo (Clauses 4.1f and 8.5.2)

Key benefits:

- Lower costs and shorter cycle times through effective use of resources.
- Improved, consistent and predictable results.
- Focused and prioritized improvement opportunities.

Applying the principle of process approach typically leads to:

- Systematically defining the activities necessary to obtain a desired result.
- Establishing clear responsibility and accountability for managing key activities.
- Analyzing and measuring of the capability of key activities.
- Identifying the interfaces of key activities within and between the functions of the organization.
- Focusing on the factors such as resources, methods, and materials that will improve key activities of the organization.
- Evaluating risks, consequences and impacts of activities on customers, suppliers and other interested parties.

[46] refer to Hoyle, 2006, p.30

3.3.5.5 Principle 5: System Approach to Management

Identifying, understanding and managing interrelated processes as a system contribute to the organization's effectiveness and efficiency in achieving its objectives.

The system approach principle is reflected in ISO 9001 through the requirements addressing:[47]

- Defining the system objectives (Clause 5.4.2)
- Establishing, implementing and maintaining the management system as a set of processes (Clause 4.1a)
- Describing the system (Clause 4.2.2)
- Continual improvement (8.1)
- Interconnection, interrelation and sequence of processes (Clause 4.1b)
- Maintaining the integrity of the system (Clause 5.4.2)
- Establishing measurement processes (Clause 8.1)

Key benefits:

- Integration and alignment of the processes that will best achieve the desired results.
- Ability to focus effort on the key processes.
- Providing confidence to interested parties as to the consistency, effectiveness and efficiency of the organization.

Applying the principle of system approach to management typically leads to:

- Structuring a system to achieve the organization's objectives in the most effective and efficient way.
- Understanding the interdependencies between the processes of the system.
- Structured approaches that harmonize and integrate processes.
- Providing a better understanding of the roles and responsibilities necessary for achieving common objectives and thereby reducing cross-functional barriers.
- Understanding organizational capabilities and establishing resource constraints prior to action.
- Targeting and defining how specific activities within a system should operate.
- Continually improving the system through measurement and evaluation.

3.3.5.6 Principle 6: Continual Improvement

Continual improvement of the organization's overall performance should be a permanent objective of the organization.
The continual improvement principle is reflected in ISO 9001 through the requirements addressing: [48]

- Commitment to continual improvement (Clause 5.1)
- A policy on continual improvement (Clause 5.3)
- Improvement processes (Clauses 4.1f and 8.1)
- Identifying improvements (Clauses 4.1f and 8.5.1)
- Determining and providing resources to undertake continual improvement (Clause 6.1)
- Reviewing documents and processes for opportunities for improvement (Clauses 5.6, 8.4 and 8.5.1)

[47] refer to Hoyle, 2006, p.31
[48] refer to Ibid., p. 32

Key benefits:

- Performance advantage through improved organizational capabilities.
- Alignment of improvement activities at all levels to an organization's strategic intent.
- Flexibility to react quickly to opportunities.

Applying the principle of continual improvement typically leads to:

- Employing a consistent organization-wide approach to continual improvement of the organization's performance.
- Providing people with training in the methods and tools of continual improvement.
- Making continual improvement of products, processes and systems an objective for every individual in the organization.
- Establishing goals to guide, and measures to track, continual improvement.
- Recognizing and acknowledging improvements.

3.3.5.7 Principle 7: Factual Approach to Decision Making

Effective decisions are based on the analysis of data and information.

The factual approach principle is reflected in ISO 9001 through the requirements addressing:[49]

- Establishing measurable and consistent objectives (Clause 5.4.1)
- Reviews, measurements and monitoring to obtain facts (Clauses 4.1e, 5.6, 7.3.4, 8.1 and 8.2.3)
- Control of measuring devices (Clause 7.6)
- Analysis to obtain facts from information
- Records for documenting the facts (Clauses 4.2.1 and 4.2.4)
- Validating processes (Clause 7.5.2)
- Establishing the capability of processes (Clause 8.2.3)
- Calibrating measurement systems (Clause 7.6)

Key benefits:

- Informed decisions.
- An increased ability to demonstrate the effectiveness of past decisions through reference to factual records.
- Increased ability to review, challenge and change opinions and decisions.

Applying the principle of factual approach to decision making typically leads to:

- Ensuring that data and information are sufficiently accurate and reliable.
- Making data accessible to those who need it.
- Analyzing data and information using valid methods.
- Making decisions and taking action based on factual analysis, balanced with experience and intuition.

[49] refer to Hoyle, 2006, p.33

3.3.5.8 Principle 8: Mutually Beneficial Supplier Relationships

An organization and its suppliers are interdependent and a mutually beneficial relationship enhances the ability of both to create value.

The mutually beneficial supplier relationships principle is reflected in ISO 9001 through the requirements addressing:[50]

- Establishing processes for supplier selection (Clause 7.4.1)
- Analyzing supplier data (Clause 8.4)
- Establishing supplier improvement programmes (Clause 8.1)

Key benefits:

- Increased ability to create value for both parties.
- Flexibility and speed of joint responses to changing market or customer needs and expectations.
- Optimization of costs and resources.

Applying the principles of mutually beneficial supplier relationships typically leads to:

- Establishing relationships that balance short-term gains with long-term considerations.
- Pooling of expertise and resources with partners.
- Identifying and selecting key suppliers.
- Clear and open communication.
- Sharing information and future plans.
- Establishing joint development and improvement activities.
- Inspiring, encouraging and recognizing improvements and achievements by suppliers.

3.3.6 Elements of ISO 9001

ISO 9001 is written by a committee (TC 176) and is designed for use in any type of organization. ISO 9001 is the only part of the ISO 9000 family against which an organization can become certified.

ISO 9001 contains all of the requirements which an organization must address within their Quality Management System (QMS) if they wish to be certified against the Standard. The majority of these requirements would be identified by many organizations as 'common sense' topics which they would want to address in order to run their business well e.g. sales, design, purchasing, training, calibration of test equipment, control of records.

This International Standard promotes the adoption of a process approach when developing, implementing and improving the effectiveness of a quality management system, to enhance customer satisfaction by meeting customer requirements.

For an organization to function effectively, it has to determine and manage numerous linked activities. An activity or set of activities using resources, and managed in order to enable the transformation of inputs into outputs, can be considered a process. Often the output from one process directly forms the input to the next. The application of a system of processes within an organization, together with the identification and interactions of these processes, and their management to produce the desired outcome, can be referred to as the “process approach”.

[50] refer to Hoyle, 2006, p.34

An advantage of the process approach is the ongoing control that it provides over the linkage between the individual processes within the system of processes, as well as over their combination and interaction. When used within a quality management system, such an approach emphasizes the importance of:

a) Understanding and meeting requirements,
b) The need to consider processes in terms of added value,
c) Obtaining results of process performance and effectiveness, and
d) Continual improvement of processes based on objective measurement.

The model of a process-based quality management system is shown in Figure 3-4. This illustration shows that customers play a significant role in defining requirements as inputs. Monitoring of customer satisfaction requires the evaluation of information relating to customer perception as to whether the organization has met the customer requirements. The model shown in Figure 3-4 covers all the requirements of this International Standard, but does not show processes at a detailed level.

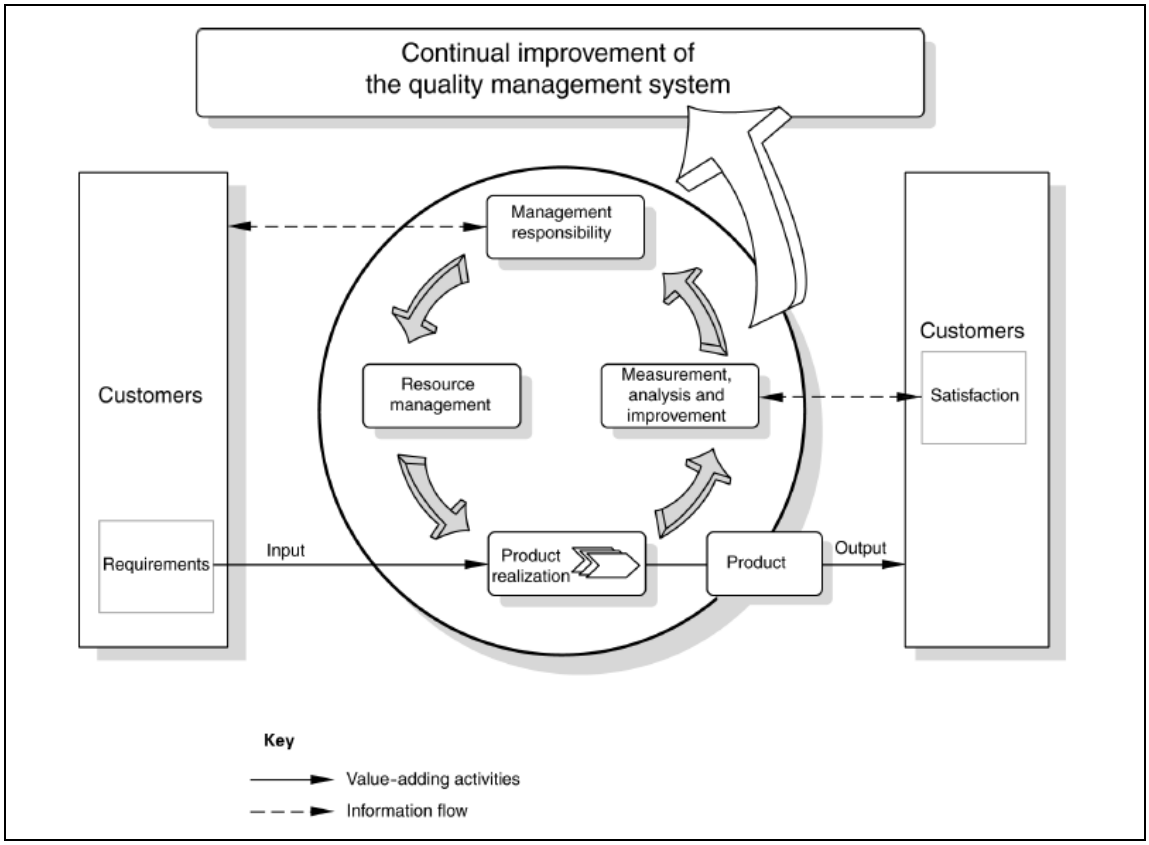

Figure 3-4: Model of a process-based quality management system[51]

[51] refer to ISO 9001:2008

In addition, the methodology known as “Plan-Do-Check-Act” (PDCA) can be applied to all processes. PDCA can be briefly described as follows:

— Plan: establish the objectives and processes necessary to deliver results in accordance with customer requirements and the organization's policies.

— Do: implement the processes.

— Check: monitor and measure processes and product against policies, objectives and requirements for the product and report the results.

— Act: take actions to continually improve process performance.

The standard contains eight sections: (1) Scope; (2) References; (3) Terms and definitions; (4) Quality management system; (5) Management responsibility; (6) Resource management; (7) Product realization; (8) Measurement, analysis and improvement.

It is sections 4, 5, 6, 7 and 8 which contain the requirements themselves and organizations wishing to be certified against ISO 9001 will need to demonstrate that they have addressed all of these requirements.

There are over 250 individual requirements in ISO 9001 that can be condensed into five key statements. The organization shall:

- determine the needs and expectations of customers,
- establish policies, objectives and a work environment necessary to motivate people to satisfy these needs,
- design, resource and manage a system of inter-related processes to implement the policy and attain the objectives,
- measure and analyse the effectiveness of each process in fulfilling its objectives and
- pursue the continual improvement of the system from an objective evaluation of its performance.

3.3.6.1 Quality management System (Section 4)

General requirements (Section 4.1)

The organization shall establish, document, implement and maintain a quality management system and continually improve its effectiveness in accordance with the requirements of this International Standard and determine how it will fulfill these requirements. The organization shall determine the processes, the interaction of these processes, monitor, measure and analyse these processes, ensure the availability of resources and information necessary to support the operation and monitoring of these processes.

Documentation requirements (Section 4.2)

Paragraph 4.2.1 – General: The quality management system documentation shall include documented statements of a quality policy and quality objectives, a quality manual, documented procedures and records required by this International Standard, documents, including records, determined by the organization to be necessary to ensure the effective planning, operation and control of its processes.

The extent of the quality management system documentation can differ from one organization to another due to the size of the organization and type of activities, the complexity of processes and their interactions, and the competence of personnel.

Paragraph 4.2.2 – Quality manual requires that the organization shall establish and maintain a quality manual that includes the scope of the quality management system, the documented procedures established for the quality management system, a description of the interaction between the processes of the quality management system.
Paragraph 4.2.3 – Control of documents requires that documents required by the quality management system shall be controlled. A documented procedure shall be established to define the controls needed to approve documents for adequacy prior to issue, to review and update as necessary and re-approve documents, to ensure that changes and the current revision status of documents are identified, to ensure that relevant versions of applicable documents are available at points of use, to ensure that documents remain legible and readily identifiable, to ensure that documents of external origin determined by the organization to be necessary for the planning and operation of the quality management system are identified and their distribution controlled, and to prevent the unintended use of obsolete documents, and to apply suitable identification to them if they are retained for any purpose.
Paragraph 4.2.4 – Control of records
Records established to provide evidence of conformity to requirements and of the effective operation of the quality management system shall be controlled.
The organization shall establish a documented procedure to define the controls needed for the identification, storage, protection, retrieval, retention and disposition of records.

3.3.6.2 Management responsibility (Section 5)

Management commitment (Section 5.1)
Top management shall provide evidence of its commitment to the development and implementation of the quality management system and continually improve its effectiveness by communicating to the organization the importance of meeting customer as well as statutory and regulatory requirements, establishing the quality policy, ensuring that quality objectives are established, conducting management reviews, and ensuring the availability of resources.

Customer focus (Section 5.2)
Top management shall ensure that customer requirements are determined and are met with the aim of enhancing customer satisfaction.

Quality policy (Section 5.3)
Top management shall ensure that the quality policy; is appropriate to the purpose of the organization, includes a commitment to comply with requirements and continually improve the effectiveness of the quality management system, provides a framework for establishing and reviewing quality objectives, is communicated and understood within the organization, and is reviewed for continuing suitability.

Planning (Section 5.4)
Paragraph 5.4.1 – Quality objectives requires that Top management shall ensure that quality objectives, including those needed to meet requirements for product, are established at relevant functions and levels within the organization. The quality objectives shall be measurable and consistent with the quality policy.
Paragraph 5.4.2 – Quality management system planning requires that top management shall ensure that the planning of the quality management system is carried out in order to meet the requirements, as well as the quality objectives, the integrity of the quality management system is maintained when changes to the quality management system are planned and implemented.

Responsibility, authority and communication (Section 5.5)
Paragraph 5.5.1 – Responsibility and authority requires that top management shall ensure that responsibilities and authorities are defined and communicated within the organization.
Paragraph 5.5.2 – Management representative requires that top management shall appoint a member of the organization's management who, irrespective of other responsibilities, shall have responsibility and authority that includes; ensuring that processes needed for the quality management system are established, implemented and maintained, reporting to top management on the performance of the quality management system and any need for improvement, and ensuring the promotion of awareness of customer requirements throughout the organization.
Paragraph 5.5.3 – Internal communication requires that top management shall ensure that appropriate communication processes are established within the organization and that communication takes place regarding the effectiveness of the quality management system.

Management review (Section 5.6)
Paragraph 5.6.1 – General requires that top management shall review the organization's quality management system, at planned intervals, to ensure its continuing suitability, adequacy and effectiveness. This review shall include assessing opportunities for improvement and the need for changes to the quality management system, including the quality policy and quality objectives.
Paragraph 5.6.2 – Review input requires that the input to management review shall include information on; results of audits, customer feedback, process performance and product conformity, status of preventive and corrective actions, follow-up actions from previous management reviews, changes that could affect the quality management system, and recommendations for improvement.
Paragraph 5.6.3 – Review output requires that the output from the management review shall include any decisions and actions related to; improvement of the effectiveness of the quality management system and its processes, improvement of product related to customer requirements, and resource needs.

3.3.6.3 Resource management (Section 6)

Provision of resources (Section 6.1)
The organization shall determine and provide the resources needed to implement and maintain the quality management system and continually improve its effectiveness, and to enhance customer satisfaction by meeting customer requirements.

Human resources (Section 6.2)
Paragraph 6.2.1 – General
Personnel performing work affecting conformity to product requirements shall be competent on the basis of appropriate education, training, skills and experience.
Paragraph 6.2.2 – Competence, training and awareness requires that the organization shall determine the necessary competence for personnel performing work affecting conformity to product requirements, where applicable, provide training or take other actions to achieve the necessary competence, evaluate the effectiveness of the actions taken, ensure that its personnel are aware of the relevance and importance of their activities and how they contribute to the achievement of the quality objectives, and maintain appropriate records of education, training, skills and experience.

Infrastructure (Section 6.3)
The organization shall determine, provide and maintain the infrastructure needed to achieve conformity to product requirements

Work environment (Section 6.4)
The organization shall determine and manage the work environment needed to achieve conformity to product requirements. The term “work environment” relates to those conditions under which work is performed including physical, environmental and other factors (such as noise, temperature, humidity, lighting or weather).

3.3.6.4 Product realization (Section 7)

Planning of product realization (Section 7.1)
The organization shall plan and develop the processes needed for product realization. Planning of product realization shall be consistent with the requirements of the other processes of the quality management system. In planning product realization, the organization shall determine the following, as appropriate: quality objectives and requirements for the product, the need to establish processes and documents, and to provide resources specific to the product; required verification, validation, monitoring, measurement, inspection and test activities specific to the product and the criteria for product acceptance, and records needed to provide evidence that the realization processes and resulting product meet requirements.
A document specifying the processes of the quality management system (including the product realization processes) and the resources to be applied to a specific product, project or contract can be referred to as a quality plan.

Customer-related processes (Section 7.2)
Paragraph 7.2.1 – Determination of requirements related to the product requires that the organization shall determine requirements specified by the customer, including the requirements for delivery and post-delivery activities, requirements not stated by the customer but necessary for specified or intended use, where known, statutory and regulatory requirements applicable to the product and any additional requirements considered necessary by the organization.
Paragraph 7.2.2 – Review of requirements related to the product requires that the organization shall review the requirements related to the product. This review shall be conducted prior to the organization's commitment to supply a product to the customer and shall ensure that product requirements are defined, contract or order requirements differing from those previously expressed are resolved, and the organization has the ability to meet the defined requirements.
Records of the results of the review and actions arising from the review shall be maintained
Paragraph 7.2.3 – Customer communication requires that the organization shall determine and implement effective arrangements for communicating with customers in relation to; product information, enquiries, contracts or order handling, including amendments, customer feedback, including customer complaints.

Design and development (Section 7.3)
Paragraph 7.3.1 – Design and development planning requires that the organization shall plan and control the design and development of product. During the design and development planning, the organization shall determine the design and development stages, the review, verification and validation that are appropriate to each design and development stage, and the responsibilities and authorities for design and development.
The organization shall manage the interfaces between different groups involved in design and development to ensure effective communication and clear assignment of responsibility.
Planning output shall be updated, as appropriate, as the design and development progresses.

Paragraph 7.3.2 – Design and development inputs requires that inputs relating to product requirements shall be determined and records maintained. The inputs shall be reviewed for adequacy.
Paragraph 7.3.3 – Design and development outputs requires that the outputs of design and development shall be in a form suitable for verification against the design and development input and shall be approved prior to release.
Paragraph 7.3.4 – Design and development review requires that at suitable stages, systematic reviews of design and development shall be performed in accordance with planned arrangements to evaluate the ability of the results of design and development to meet requirements, to identify any problems and propose necessary actions.
Paragraph 7.3.5 –Design and development verification requires that verification shall be performed in accordance with planned arrangements to ensure that the design and development outputs have met the design and development input requirements. Records of the results of the verification and any necessary actions shall be maintained.
Paragraph 7.3.6 –Design and development validation requires that design and development validation shall be performed in accordance with planned arrangements to ensure that the resulting product is capable of meeting the requirements for the specified application or intended use, where known. Records of the results of validation and any necessary actions shall be maintained
Paragraph 7.3.7 – Control of design and development changes requires that design and development changes shall be identified and records maintained. The changes shall be reviewed, verified and validated, as appropriate, and approved before implementation. The review of design and development changes shall include evaluation of the effect of the changes on constituent parts and product already delivered. Records of the results of the review of changes and any necessary actions shall be maintained

Purchasing (Section 7.4)
Paragraph 7.4.1 – Purchasing process requires that the organization shall ensure that purchased product conforms to specified purchase requirements. The type and extent of control applied to the supplier and the purchased product shall be dependent upon the effect of the purchased product on subsequent product realization or the final product.
The organization shall evaluate and select suppliers based on their ability to supply product in accordance with the organization's requirements. Criteria for selection, evaluation and re-evaluation shall be established. Records of the results of evaluations and any necessary actions arising from the evaluation shall be maintained.
Paragraph 7.4.2 – Purchasing information requires that purchasing information shall describe the product to be purchased, including, requirements for approval of product, procedures, processes and equipment, requirements for qualification of personnel, and quality management system requirements. The organization shall ensure the adequacy of specified purchase requirements prior to their communication to the supplier.
Paragraph 7.4.3 – Verification of purchased product requires that the organization shall establish and implement the inspection or other activities necessary for ensuring that purchased product meets specified purchase requirements.
Where the organization or its customer intends to perform verification at the supplier's premises, the organization shall state the intended verification arrangements and method of product release in the purchasing information.

Production and service provision (Section 7.5)
Paragraph 7.5.1 – Control of production and service provision requires that the organization shall plan and carry out production and service provision under controlled conditions.
Paragraph 7.5.2 – Validation of processes for production and service provision requires that the organization shall validate any processes for production and service provision where the resulting output cannot be verified by subsequent monitoring or measurement and, as a consequence, deficiencies become apparent only after the product

is in use or the service has been delivered. Validation shall demonstrate the ability of these processes to achieve planned results.
Paragraph 7.5.3 – Identification and traceability requires that where appropriate, the organization shall identify the product by suitable means throughout product realization.
The organization shall identify the product status with respect to monitoring and measurement requirements throughout product realization.
Paragraph 7.5.4 – Customer property requires that the organization shall exercise care with customer property while it is under the organization's control or being used by the organization. The organization shall identify, verify, protect and safeguard customer property provided for use or incorporation into the product. Customer property can include intellectual property and personal data.
Paragraph 7.5.5 – Preservation of product requires that the organization shall preserve the product during internal processing and delivery to the intended destination in order to maintain conformity to requirements.

Control of monitoring and measuring equipment (Section 7.6)
The organization shall determine the monitoring and measurement to be undertaken and the monitoring and measuring equipment needed to provide evidence of conformity of product to determined requirements. The organization shall establish processes to ensure that monitoring and measurement can be carried out and are carried out in a manner that is consistent with the monitoring and measurement requirements.
The organization shall assess and record the validity of the previous measuring results when the equipment is found not to conform to requirements. The organization shall take appropriate action on the equipment and any product affected. Records of the results of calibration and verification shall be maintained (see 4.2.4).

3.3.6.5 Measurement, analysis and improvement (Section 8)

General (Section 8.1)
The organization shall plan and implement the monitoring, measurement, analysis and improvement processes needed to demonstrate conformity to product requirements, to ensure conformity of the quality management system, to continually improve the effectiveness of the quality management system.

Monitoring and measurement (Section 8.2)
Paragraph 8.2.1 – Customer satisfaction requires that the organization shall monitor information relating to customer perception as to whether the organization has met customer requirements. The methods for obtaining and using this information shall be determined.
Monitoring customer perception can include obtaining input from sources such as customer satisfaction surveys, customer data on delivered product quality, user opinion surveys, lost business analysis, compliments, warranty claims, dealer reports.
Paragraph 8.2.2 – Internal audit requires that the organization shall conduct internal audits at planned intervals to determine whether the quality management system conforms to the planned arrangements to the requirements of this International Standard and to the quality management system requirements established by the organization, and is effectively implemented and maintained.
An audit programme shall be planned, taking into consideration the status and importance of the processes and areas to be audited, as well as the results of previous audits. The audit criteria, scope, frequency and methods shall be defined. This selection of auditors and conduct of audits shall ensure objectivity and impartiality of the audit process.
A documented procedure shall be established to define the responsibilities and requirements for planning and conducting audits, establishing records and reporting results.
Paragraph 8.2.3 – Monitoring and measurement of processes requires that the organization shall apply suitable methods for monitoring and, where applicable,

measurement of the quality management system processes. When planned results are not achieved, correction and corrective action shall be taken, as appropriate.
Paragraph 8.2.4 – Monitoring and measurement of product requires that the organization shall monitor and measure the characteristics of the product to verify that product requirements have been met. This shall be carried out at appropriate stages of the product realization process in accordance with the planned arrangements. Evidence of conformity with the acceptance criteria shall be maintained.
Records shall indicate the person(s) authorizing release of product for delivery to the customer.

Control of nonconforming product (Section 8.3)
The organization shall ensure that product which does not conform to product requirements is identified and controlled to prevent its unintended use or delivery. A documented procedure shall be established to define the controls and related responsibilities and authorities for dealing with nonconforming product.
Where applicable, the organization shall deal with nonconforming product by one or more of the following ways: by taking action to eliminate the detected nonconformity, by authorizing its use, release or acceptance under concession by a relevant authority and, where applicable, by the customer, by taking action to preclude its original intended use or application, and by taking action appropriate to the effects, or potential effects, of the nonconformity when nonconforming product is detected after delivery or use has started.
When nonconforming product is corrected it shall be subject to re-verification to demonstrate conformity to the requirements.

Analysis of data (Section 8.4)
The organization shall determine, collect and analyse appropriate data to demonstrate the suitability and effectiveness of the quality management system and to evaluate where continual improvement of the effectiveness of the quality management system can be made. This shall include data generated as a result of monitoring and measurement and from other relevant sources. The analysis of data shall provide information relating to; customer satisfaction, conformity to product requirements, characteristics and trends of processes and products, including opportunities for preventive action and suppliers.

Improvement (Section 8.5)
Paragraph 8.5.1 – Continual improvement requires that the organization shall continually improve the effectiveness of the quality management system through the use of the quality policy, quality objectives, audit results, analysis of data, corrective and preventive actions and management review.
Paragraph 8.5.2 – Corrective action requires that the organization shall take action to eliminate the causes of nonconformities in order to prevent recurrence. Corrective actions shall be appropriate to the effects of the nonconformities encountered.
Paragraph 8.5.3 – Preventive action requires that the organization shall determine action to eliminate the causes of potential nonconformities in order to prevent their occurrence. Preventive actions shall be appropriate to the effects of the potential problems.

4 Environmental Management Standard

4.1 Introduction

The environment has become a critical issue in business today. In the 1960s and 1970s businesses typically considered environmental compliance to be a "fringe" issue which elicited little discussion at executive levels. Since then, several highly visible environmental disasters (e.g., Exxon Valdez[52], Three Mile Island) have demonstrated the importance of having a comprehensive environmental strategy in place. [53]

Organizations of all kinds are increasingly concerned with achieving and demonstrating sound environmental performance by controlling the impacts of their activities, products and services on the environment, consistent with their environmental policy and objectives. They do so in the context of increasingly stringent legislation, the development of economic policies and other measures that foster environmental protection, and increased concern expressed by interested parties about environmental matters and sustainable development.

There is now a considerable amount of public concern about the health of the environment in almost all developed countries of the world. As a consequence, the adoption by companies of procedures that minimize damage to the environment is becoming an important ingredient in their success, and is almost as important as the quality of the goods and services that they provide. Any actions of companies that lead to environmental pollution or damage, whether intended or not, cause widespread public anger that may lead to a boycott of the company's products or services, or even more direct action that interferes with its operations. In addition to this, environmental protection legislation is becoming increasingly stringent in most countries, and pollution incidents will, at best, lead to financial penalties and, at worst, result in orders to suspend operations until the cause of pollution is rectified. Thus, the implementation of an environmental management system (EMS) that minimizes damage to the environment through a company's operations is becoming almost mandatory if the consequences of causing environmental damage are to be avoided. Environmental management system (EMS) is one of the most important tools available for the purpose of making the organizations more environmentally proactive and efficient.

'ISO 14000' is a global term for a set of standards, developed by the International Organization for Standardization (ISO), that have been written in response to this need for environmental protection systems, in the same way that ISO 9000 standards were written to satisfy the need for quality assurance systems to control the goods produced and services supplied by companies. This series of standards are designed to cover the whole area of environmental issues for organizations in the global marketplace.

Within the ISO 14000 series of standards, the fundamental standard that prescribes good practice in environmental management is ISO 14001. ISO 14001 specifies the various requirements that have to be satisfied in setting up an effective EMS, such that the risks of pollution incidents and other forms of environmental damage through the operations and activities of a company are minimized. International Standards covering environmental management are intended to provide organizations with the elements of an effective environmental management system (EMS) that can be integrated with other management requirements and help organizations achieve environmental and economic goals.

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[52] Exxon Valdez was the original name of an oil tanker owned by the former Exxon Shipping Company, a division of the former Exxon Corporation. The ship gained infamy after the March 24, 1989 oil spill in which the tanker hits Prince William Sound's Bligh Reef and spilled an estimated minimum 10.8 million US gallons (40.9 million liters) of crude oil. This has been recorded as one of the largest spills in United States history and one of the largest ecological disasters. (http://en.wikipedia.org/wiki/Exxon_Valdez)

[53] refer to Walton, Steve, Handfield, Robert, Melnyk, Steven, 1998

Apart from the need to satisfy the stringent environmental control legislation that exists in most developed countries, the image of a company is damaged if pollution incidents occur, particularly if these are identified by environmental pressure groups, and this can have a severe impact on the marketability of products and services provided by the company. Conversely, ISO 14001 certification can have a very positive impact on a company's business, in view of the widespread public interest that now exists in environmental protection.

4.2 Organizations Responses to Businesses and Environmental Trends

Organizations respond to the environmental management requirements in many different ways. These responses can basically be grouped as reactive approaches or proactive approaches. [54]

The level of inter-organizational relationship or collaboration determines the extent to which an organization can improve its environmental management performance and therefore become either a reactive or a proactive organization. Also, the more engaged the parties in the supply chain are the bigger is the range and quality of environmental performance outcomes; organizations that are closely collaborating can make the most from a proactive approach to environmental management. [55]

4.2.1 Reactive and Proactive responses

Companies with reactive responses tend to use end of pipe solution intending to comply with regulations and avoid penalties by the government because of public and customers' pressure while those with proactive responses believe that environmental management is a part of the company's quality and sustainability management.[56]. The reactive organizations focus mostly on their internal functions and their responses vary from resistant adaptation (to avoid penalties and public pressure), through receptive adjustment of the current processes, to constructive responses which are more efficiency based but with secondary environmental advantages; [57] Some of the environmental management techniques used by reactive response organization involve:

- Reduction of pollutants emitted into the air instead of pollutant produced,
- Inclusion of basic environmental clauses into purchasing contracts to seek compliance to regulations,
- Use of established international environmental standards like ISO 14001.

Proactive organizations are more innovative and their strategies are specialized to tackle environment challenges. These organizations normally look beyond their current processes and beyond their internal functions. [58] By integrating other members in the supply chain they increase the range and quality of environment management outcomes.[59] Some of the techniques used by organization using proactive strategies involve the closed loop supply chain, Total Quality Environment Management in planning and operations, and Product Life Cycle Cost Analysis. Total Quality Environment Management is applied for both products (Specific design, characteristics, and functionality) and for processes (Production, distribution, and use).

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[54] refer to Humphreys, 2003
[55] refer to Simpson, 2008
[56] refer to Ibid.
[57] refer to Walton,1998
[58] refer to Walton,1998
[59] refer to Humphreys, 2003

4.3 Environmental Management Systems

The Earth's resources began to run out and the balance of nature was disturbed in the nineteenth century in Europe with mechanization – the Industrial Revolution. This was a period when inventiveness and innovation was at its height, and the resultant mechanization of manufacturing processes began to have negative impacts upon the environment. Prior to this period, any negative environmental impacts tended to be localized due to lack of mechanization. Immense changes to society began to occur and, consequently, vast amounts of nonrenewable resources were consumed to support this industrialized society with little thought as to the longer-term effects on the health of the population or the quality of the environment. [60]

To enforce an environmental management system there are historical triggers and drivers, fuelled by the interest of a host of stakeholders all seeking to reach the same goal – reconciling the demands of a modern technological society with the available resources of the planet. Such an understanding can only improve any organization's ability to manage for the environment.

An Environmental Management System (EMS) is a structured framework for businesses and organizations to manage their environmental impacts. National and international EMS certification schemes emerged in the early 1990s and have since developed closely through to increasingly standardized and complimentary approaches.[61]

Many companies have adopted environmental policies and carried out environmental audits or reviews in response to legislative pressures, green marketing opportunities, increased public pressure, ethical concerns and the commitment of local and central government. However, companies still be faced with a problem of finding a systematic way of implementing commitments to environmental management within their existing organizational structure.

Environmental management system (EMS) refers to the management of an organization's environmental programs in a comprehensive, systematic, planned and documented manner. It includes the organizational structure, planning and resources for developing, implementing and maintaining policy for environmental protection.

An Environmental Management System (EMS):

- Serves as a tool to improve environmental performance,
- Provides a systematic way of managing an organization's environmental affairs,
- Is the aspect of the organization's overall management structure that addresses immediate and long-term impacts of its products, services and processes on the environment,
- Gives order and consistency for organizations to address environmental concerns through the allocation of resources, assignment of responsibility and ongoing evaluation of practices, procedures and processes,
- Focuses on continual improvement of the system.

[60] refer to Hoyle, 2006, p. XII
[61] refer to www.iema.net/ems (01.06.2009)

An EMS is a systematic, continuous cycle for improving environmental performance. This cycle consists of four primary components: planning, doing, checking, and acting. The "Plan-Do-Check-Act" cycle illustrated below is repeated continually (Figure 4-1), which facilitates continual improvement of environmental performance. The diagram shows the process of first developing an environmental policy, planning the EMS, and then implementing it. The process also includes checking the system and acting on it. The model is continuous because an EMS is a process of continual improvement in which an organization is constantly reviewing and revising the system.

Figure 4-1: PDCA Continuous Improvement Cycle[62]

4.3.1 Reasons for Developing an Environmental Management System

The benefits to the firm arising from advanced environmental management practice can include: cost reduction, quality improvement; early adoption of new regulations; and better human resource management practice.[63]

These important benefits are listed below:

- **Cost Savings:** Successful environmental management will evaluate all opportunities for cost savings, the most common benefits derive from a review of resource/ energy utilization and its efficiency, forcing full consideration of alternative energy sources and their cost effectiveness. The other primary element will be minimization of waste and result and cost of disposal.

- **Corporate Image:** Since the people, i.e. the companies′ customers, have become increasingly aware of the need to protect the environment, they use their power to recklessly punish corporations that do not live up to their expectations. The ability to demonstrate a responsible environmental attitude can dramatically improve the image of the corporation fostering better relations with the company's stake holders. Even more importantly, adverse publicity about the organizations environmental performance is always highly damaging.

[62] refer to http://www.lm.doe.gov/ems/model.htm
[63] refer to Theyel, 2000, p. 249

For example, UPS claims to be especially proud to belong to Fortune magazine′s most admired companies in the transportation industry because of their special attention to environmental responsibility, which the company claims to have resulted in a significant positive effect on corporate reputation.[64]

- **Customer Requirements:** Many companies have addressed the management system for customer requirements related to quality and ISO 9000. The range and diversity of customer needs and expectations is constantly growing with many customers increasing preference for use of suppliers and sub-contractors who can demonstrate that they are good environmental citizens. No customer would want to risk a tarnished reputation (or non-compliance to legislation) from the poor environmental performance of their suppliers and sub-contractors. The safest option for the customer is to use suppliers and sub-contractors who can demonstrate their positive environmental performance.

- **Legislation:** The scope and severity of environmental legislation is ever increasing. A management system that ensures recognition of the requirements and compliance with them will ensure that fines are avoided and staff are not imprisoned in addition to avoidance of the publicity that inevitably follows an environmental prosecution.

- **Improved Overall Performance and Efficiency:** With an effective EMS, the company's overall performance and efficiency increase by using inputs more efficiently, eliminating the need for hazardous, hard-to-handle materials and eliminating unneeded activities.[65]

- **Investment:** The investors are increasingly moving to green portfolio's, and it is interesting that the financial performance of these portfolios has been good in comparison to more traditional investment. In seeking additional investment for the organization it is sensible to ensure the widest scope and this is only aided by a demonstrably sound environmental performance.

- **Insurance:** Insurance companies are fully aware of the risk to their policies from poor environmental performance of the insured. Companies with a sound and effective environmental management system are able to demonstrate that they pose less risk to the insurance company and create a negotiating tool for lower premiums. Some insurance companies now require an environmental audit of the company prior to agreeing cover. With an effective environmental management system insurance risk is reduced.

- **Marketing Opportunities:** All companies seeking growth obviously want their product and services attractive to a widest possible market. Poor environmental performance will encourage many potential customers to decide not to buy from the company; good environmental performance will ensure continuation of the widest possible market. A company can gain or retain market share via a green corporate image.

[64] refer to Eskew, 1999, p. 510
[65] refer to Nettesheim, 2002

4.4 ISO 14000

4.4.1 ISO 14000 – Evolution from Previous Environmental Standards

One of the consequences of the environmental issues and concerns was a large number of requests to standard-writing bodies to produce a standard for managing the environmental impacts of an organization. As a result, the British Standards Institute (BSI), a world-respected standards body, in conjunction with many other committees and interested parties, developed and produced BS 7750:1992, the world's first environmental standard.[66] At the same time that BSI began work on BS 7750, the European Commission was setting out its proposal for an eco-audit scheme and it was from this proposal that EMAS (Eco-Management and Audit Scheme) eventually emerged in 1993. Other similar national standards were in existence in various countries and world-wide demand for accredited certification to an international standard began to grow.

The ISO 14000 series emerged primarily as a result of the Uruguay round of the GATT negotiations and the Rio Summit on the Environment held in 1992. While GATT concentrates on the need to reduce non-tariff barriers to trade, the Rio Summit generated a commitment to protection of the environment across the world. The environmental field has seen a steady growth of national and regional standards. The British Standards Institution has BS 7750, the Canadian Standards Association has environmental management, auditing, eco-labeling and other standards, the European Union has all of these plus the eco-management and audit regulations, and many other countries (e.g. USA, Germany and Japan) have introduced eco-labeling programs. [67]

After the rapid acceptance of ISO 9000, and the increase of environmental standards around the world, ISO assessed the need for international environmental management standards. They formed the Strategic Advisory Group on the Environment (SAGE) in 1991, to consider whether such standards could serve to:

- Promote a common approach to environmental management similar to quality management;
- Enhance organizations' ability to attain and measure improvements in environmental performance;
- Facilitate trade and remove trade barriers.

In 1992, SAGE's recommendations created a new committee, TC 207 (Technical Committee), for international environmental management standards. The committee and its sub-committees include representatives from industry, standards organizations, government and environmental organizations from many countries. The new series of ISO 14000 standards are designed to cover:

- environmental management systems,
- environmental auditing,
- environmental performance evaluation,
- environmental labeling,
- life-cycle assessment,
- environmental aspects in product standards.

[66] refer to Whitelaw, 2004, p. XV
[67] refer to /www.quality.co.uk/iso14000.htm (05.06.2009)

Thus ISO 14001 was first published in 1996 with a swift uptake by organizations world-wide. It is the first such series of standards that allows organizations from around the world to pursue environmental efforts and measure performance according to internationally accepted criteria. The most recent version of ISO 14001 was released in 2004.

4.4.2 Other ISO 14000 Standards

ISO 14000 is not a standard in itself but rather the descriptor for a series of standards that have environmental management as the theme.[68] The ISO 14000 family addresses various aspects of environmental management. The very first two standards, ISO 14001:2004 and ISO 14004:2004 deal with environmental management systems (EMS). ISO 14001:2004 provides the requirements for an EMS and ISO 14004:2004 gives general EMS guidelines. ISO 14001 is a system requirement standard. Companies do not register to ISO 14000 as series. Companies only register to the requirements standard ISO 14001. The other standards and guidelines in the family address specific environmental aspects, including: labeling, performance evaluation, life cycle analysis, communication and auditing. Some of the other standards are listed below:

ISO 14001 (2004): Environmental Management Systems: Requirements with Guidance for Use – ISO 14001:2004 specifies requirements for an environmental management system to enable an organization to develop and implement a policy and objectives which take into account legal requirements and other requirements to which the organization subscribes, and information about significant environmental aspects. It applies to those environmental aspects that the organization identifies as those which it can control and those which it can influence.

ISO 14004 (2004): Environmental Management Systems: General Guidelines on Principles, Systems and Supporting Techniques – ISO 14004:2004 provides guidance on the establishment, implementation, maintenance and improvement of an environmental management system and its coordination with other management systems. The guidelines in ISO 14004:2004 are applicable to any organization, regardless of its size, type, location or level of maturity. While the guidelines in ISO 14004:2004 are consistent with the ISO 14001:2004 environmental management system model, they are not intended to provide interpretations of the requirements of ISO 14001:2004.

ISO 19011 (2002): Guidelines for Quality and/or Environmental Management Systems Auditing – ISO 19011:2002 provides guidance on the principles of auditing, managing audit programmes, conducting quality management system audits and environmental management system audits, as well as guidance on the competence of quality and environmental management system auditors. It is applicable to all organizations needing to conduct internal or external audits of quality and/or environmental management systems or to manage an audit programme. The application of ISO 19011 to other types of audits is possible in principle provided that special consideration is paid to identifying the competence needed by the audit team members in such cases.

ISO 14015 (2001): Environmental Management: Environmental Assessment of Sites and Organizations (EASO) – This standard gives guidance on the conduct of an environmental assessment of a site or organization. The usual circumstances in which such an assessment is carried out is when a company is considering purchasing another company, to ensure that the purchase would not involve it in large costs in rectifying nonconformance of the site with good environmental management principles, or with present or likely future environmental legislation. Like ISO 14001, it is applicable to a wide range of companies of all types, in all industries and of all sizes.

[68] refer to Morris, 2004, p. 8

ISO 14020 (2000): Environmental Labels and Declarations: General principles – This International Standard establishes guiding principles for the development and use of environmental labels and declarations. It is intended that other applicable standards in the ISO 14020 series be used in conjunction with this International Standard. This International Standard is not intended for use as a specification for certification and registration purposes.

ISO 14021 (1999): Environmental Labels and Declarations: Self-declared Environmental Claims (Type II Environmental Labelling) – This sets common standards for the use of particular environmental labels and symbols. It specifies the requirements that must be satisfied for the application of various labels such as “degradable” and “recyclable”.

ISO 14024 (1999): Environmental Labels and Declarations: Type I Environmental Labels: Principles and Procedures – This extends ISO 14020 by providing a framework for issuing licenses to permit the use of particular environmental labels on products, and to assess the continued compliance of the products at regular intervals.

ISO 14025 (2006): Environmental Labels and Declarations: Type III Environmental Declarations: Principles and procedures – This standard establishes the principles and specifies the procedures for developing Type III environmental declaration programmes and Type III environmental declarations. It specifically establishes the use of the ISO 14040 series of standards in the development of Type III environmental declaration programmes and Type III environmental declarations. ISO 14025:2006 establishes principles for the use of environmental information, in addition to those given in ISO 14020:2000. Type III environmental declarations as described in ISO 14025:2006 are primarily intended for use in business-to-business communication, but their use in business-to-consumer communication under certain conditions is not precluded.

ISO 14031 (1999): Environmental Management: Environmental Performance Evaluation Guidelines – This is provided as a management tool to help companies to assess whether its environmental performance is meeting the targets set. The document is particularly useful to companies that have not implemented a formal EMS, since it includes guidance on identifying the environmental impact of operations and setting targets for reduction in environmental damage.

ISO 14032 (1999): Environmental Management: Examples of Environmental Performance Evaluation – This document provides 17 case studies across a wide range of industries, showing how ISO 14031 has been implemented.

ISO 14040 (2006): Environmental Management: Life Cycle Assessment: Principles and Framework – ISO 14040:2006 describes the principles and framework for life cycle assessment (LCA) including: definition of the goal and scope of the LCA, the life cycle inventory analysis (LCI) phase, the life cycle impact assessment (LCIA) phase, the life cycle interpretation phase, reporting and critical review of the LCA, limitations of the LCA, the relationship between the LCA phases, and conditions for use of value choices and optional elements. ISO 14040:2006 covers life cycle assessment (LCA) studies and life cycle inventory (LCI) studies. It does not describe the LCA technique in detail, nor does it specify methodologies for the individual phases of the LCA. The intended application of LCA or LCI results is considered during definition of the goal and scope, but the application itself is outside the scope of this International Standard.

ISO 14041 (1998): Environmental Management: Life Cycle Assessment: Goal and Scope Definition and Inventory Analysis – This extends ISO 14040 by providing further guidance on defining the goals of life-cycle assessment and collecting data to assess environmental performance against the indicators set.

ISO 14042 (2000): Environmental Management: Life Cycle Assessment: Life Cycle Impact Assessment – This provides guidance on how the performance indicator data defined according to ISO 14041 should be used to assess the environmental impact of a product and identify opportunities to improve the product to reduce its environmental impact.

ISO 14043 (2000): Environmental Management: Life Cycle Assessment: Life Cycle Interpretation – This provides guidance on how the impact assessments made according to ISO 14042 should be summarized, interpreted and discussed with respect to the environmental goals set according to ISO 14041.

ISO 14044:2006: Environmental Management: Life Cycle Assessment: Requirements and Guidelines – This specifies requirements and provides guidelines for life cycle assessment (LCA) including: definition of the goal and scope of the LCA, the life cycle inventory analysis (LCI) phase, the life cycle impact assessment (LCIA) phase, the life cycle interpretation phase, reporting and critical review of the LCA, limitations of the LCA, relationship between the LCA phases, and conditions for use of value choices and optional elements.

ISO/TR 14047:2003: Environmental Management: Life Cycle Impact Assessment: Examples of Application of ISO 14042 – This provides examples to illustrate current practice in carrying out a life cycle impact assessment in accordance with ISO 14042. These are only examples of the total possible "ways" to satisfy the provisions of ISO 14042. They reflect the key elements of the life cycle impact assessment (LCIA) phase of the LCA.

ISO/TS 14048 (2002): Environmental Management: Life Cycle Assessment: Data Documentation Format – This Technical Specification provides the requirements and a structure for a data documentation format, to be used for transparent and unambiguous documentation and exchange of Life Cycle Assessment (LCA) and Life Cycle Inventory (LCI) data, thus permitting consistent documentation of data, reporting of data collection, data calculation and data quality, by specifying and structuring relevant information.

ISO 14049 (2000): Environmental Management: Life Cycle Assessment: Examples of Application of ISO14041 to Goal and Scope Definition and Inventory Analysis – This provides a number of examples indicating how the various requirements of ISO 14041 might be implemented.

ISO 14050 (2009): Environmental Management Vocabulary – This defines terms of fundamental concepts related to environmental management, published in the ISO 14000 series of International Standards.

ISO/TR 14062 (2002): Environmental Management: Integrating Environmental Aspects into Product Design and Development – This describes concepts and current practices relating to the integration of environmental aspects into product design and development. ISO/TR 14062:2002 is applicable to the development of sector-specific documents. It is not applicable as a specification for certification and registration purposes.

ISO 14063 (2006): Environmental Management: Environmental Communication: Guidelines and Examples – This gives guidance to an organization on general principles, policy, strategy and activities relating to both internal and external environmental communication. It utilizes proven and well-established approaches for communication, adapted to the specific conditions that exist in environmental communication. It is applicable to all organizations regardless of their size, type, location, structure, activities, products and services, and whether or not they have an environmental management system in place.

ISO 14064-1(2006): Greenhouse Gases: Part 1: Specification with Guidance at the Organization Level for Quantification and Reporting of Greenhouse Gas Emissions and Removals – This specifies principles and requirements at the organization level for quantification and reporting of greenhouse gas (GHG) emissions and removals. It includes requirements for the design, development, management, reporting and verification of an organization's GHG inventory.

ISO 14064-2 (2006): Greenhouse Gases: Part 2: Specification with Guidance at the Project Level for Quantification, Monitoring and Reporting of Greenhouse Gas Emission Reductions or Removal Enhancements – This specifies principles and requirements and provides guidance at the project level for quantification, monitoring and reporting of activities intended to cause greenhouse gas (GHG) emission reductions or removal enhancements. It includes requirements for planning a GHG project, identifying and selecting GHG sources, sinks and reservoirs relevant to the project and baseline scenario, monitoring, quantifying, documenting and reporting GHG project performance and managing data quality.

ISO 14064-3 (2006): Greenhouse Gases: Part 3: Specification with Guidance for the Validation and Verification of Greenhouse Gas Assertions – This specifies principles and requirements and provides guidance for those conducting or managing the validation and/or verification of greenhouse gas (GHG) assertions. ISO 14064-3:2006 specifies requirements for selecting GHG validators/verifiers, establishing the level of assurance, objectives, criteria and scope, determining the validation/verification approach, assessing GHG data, information, information systems and controls, evaluating GHG assertions and preparing validation/verification statements.

4.4.3 Key elements of ISO 14001

Many organizations have undertaken environmental “reviews” or “audits” to assess their environmental performance. On their own, however, these “reviews” and “audits” may not be sufficient to provide an organization with the assurance that its performance not only meets, but will continue to meet, its legal and policy requirements. To be effective, they need to be conducted within a structured management system that is integrated within the organization.

ISO 14001 Standard does not specify levels of environmental performance. If it specified levels of environmental performance, they would have to be specific to each business activity and this would require a specific EMS standard for each business. ISO 14001 specifies requirements for an environmental management system to enable an organization to develop and implement a policy and objectives which take into account legal requirements and information about significant environmental aspects. It is intended to apply to all types and sizes of organization and to accommodate diverse geographical, cultural and social conditions. The underlying philosophy is that whatever the organization's activity, the requirements of an effective EMS are the same. This has the effect of establishing a common reference for communicating about environmental management issues between organizations and their customers, regulators, the public and other stakeholders.

An EMS meeting the requirements of ISO 14001 is a management tool enabling an organization of any size or type to:[69]

- identify and control the environmental impact of its activities, products or services,
- improve its environmental performance continually,
- implement a systematic approach to setting environmental objectives and targets, to achieving these and to demonstrating that they have been achieved.

[69] refer to www.iso.org

The basis of the approach is shown in Figure 4-2. The success of the system depends on commitment from all levels and functions of the organization, and especially from top management. A system of this kind enables an organization to develop an environmental policy, establish objectives and processes to achieve the policy commitments, take action as needed to improve its performance and demonstrate the conformity of the system to the requirements of this International Standard. The overall aim of this International Standard is to support environmental protection and prevention of pollution in balance with socio-economic needs. It should be noted that many of the requirements can be addressed concurrently or revisited at any time.

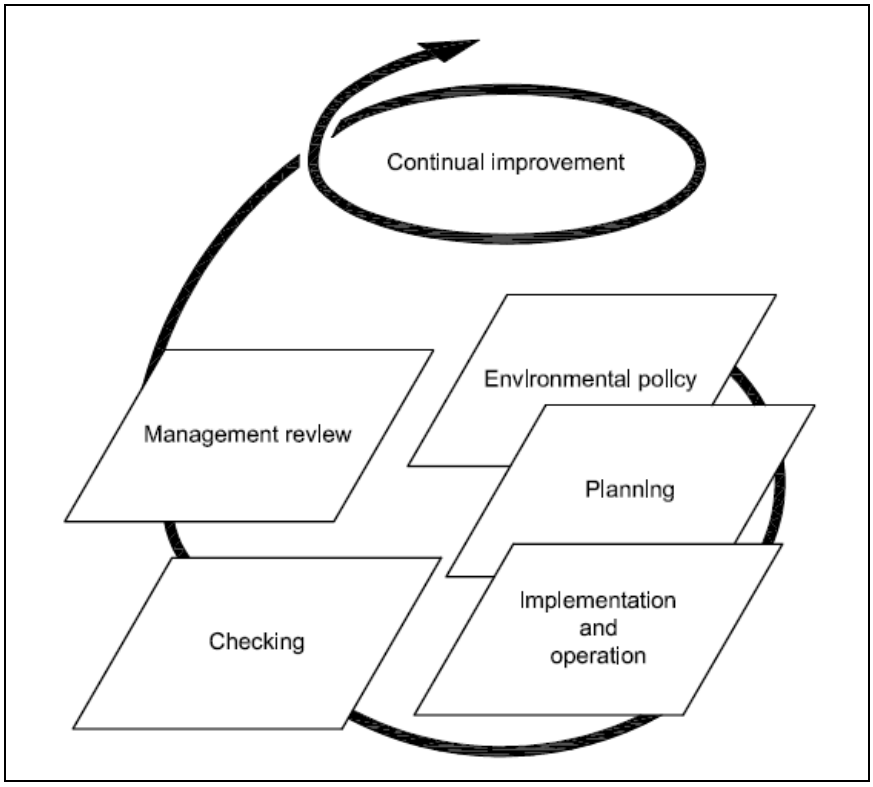

Figure 4-2: Environmental management system model for ISO 14001[70]

This International Standard is based on the methodology known as Plan-Do-Check-Act (PDCA). PDCA can be briefly described as follows.

— Plan: establish the objectives and processes necessary to deliver results in accordance with the organization's environmental policy

— Do: implement the processes

— Check: monitor and measure processes against environmental policy, objectives, targets, legal and other requirements, and report the results

— Act: take actions to continually improve performance of the environmental management system

[70] refer to ISO 14001:2004

The standard contains four sections: (1) Scope; (2) Normative References; (3) Definitions; and (4) Environmental Management System Requirements. Section 4, which contains five subsections, these are the main elements of the standard:

4.1 General Requirements
4.2 Environmental Policy
4.3 Planning
4.4 Implementation and Operation
4.5 Checking and Corrective Actions
4.6 Management Review

4.4.3.1 General requirements (Section 4.1)

The organization shall establish, document, implement, maintain and continually improve an environmental management system in accordance with the requirements of this International Standard and determine how it will fulfill these requirements. The organization shall define and document the scope of its environmental management system.

4.4.3.2 Environmental Policy (Section 4.2)

Top management of the company to define an environmental policy that is consistent with the scope of the EMS and appropriate to the organization. This environmental policy must include a commitment to continual improvement, prevention of pollution and compliance with legal requirements. The policy must provide a framework for setting and reviewing environmental objectives and targets. The environmental policy must be documented, communicated to all persons working for or on behalf of the organization and made available to the public.

4.4.3.3 Planning (Section 4.3)

Paragraph 4.3.1 – Environmental aspects requires that the company establish and maintain procedures to identify environmental aspects and determine those which may have significant environmental impacts. Environmental aspects are activities, products or services of the company which can interact with the environment (e.g. potential for accidental spillage, air exhaust emissions). Environmental impacts are environmental changes resulting from an organization's aspects (e.g. contamination of soil or water from an accidental spill, air pollution). These aspects must be addressed within the EMS.
Paragraph 4.3.2 – Legal and other requirements requires that the company establish and maintain a procedure to identify and provide access to the legal and other environmental requirements applicable to the company's activities, products and services. The identified legal requirements must be addressed as an integral part of the EMS.
Paragraph 4.3.3 – Objectives, targets and programme(s) requires that the company establish and maintain documented environmental objectives and targets. These need to be specific, measurable and consistent with the company's environmental policy. Environmental management programs must be established to accomplish these objectives and targets and include designation of responsibilities, means and time-frames for completion.

4.4.3.4 Implementation and Operation (Section 4.4)

Paragraph 4.4.1 – Resources, roles, responsibility and authority requires that roles, responsibilities and authorities for environmental management system be defined. Top management of the company must appoint a specific environmental management representative who will report on the performance of the environmental management system and make recommendations for improvements.

Management is also required to ensure the availability of the resources essential to the implementation, maintenance and improvement of the environmental management system.
Paragraph 4.4.2 – Competence, training and awareness requires that the company identify competency requirements and training needs and institute a program to make those working for the company aware of the environmental policy, environmental aspects and impacts, and employee's individual roles and responsibilities for the EMS. Training records must be maintained.
Paragraph 4.4.3 – Communication requires that the company establish and maintain procedures for both internal and external communication regarding environmental issues.
Paragraph 4.4.4 – Documentation requires that the company describe the main elements of its environmental management system and provide direction to related documentation. Documentation to ensure the effective planning, operation and control of processes related to significant environmental aspects is also required.
Paragraph 4.4.5 – Control of documents requires that the company establish and maintain procedures to control the creation, review, approval, modification, storage, availability and destruction of its EMS documentation including documents of external origin.
Paragraph 4.4.6 – Operational control requires that the company identify its operations and activities with significant environmental aspects. The company is required to establish and maintain documented procedures outlining how these activities will be conducted and stipulating operating criteria (control limits). Procedures must be established to communicate applicable requirements to suppliers and contractors.
Paragraph 4.4.7 – Emergency preparedness and response requires that the company establish and maintain emergency preparedness and response procedures. These procedures are to be reviewed and revised when necessary and periodically tested where practicable.

4.4.3.5 Checking (Section 4.5)

Paragraph 4.5.1 – Monitoring and measurement requires that the company establish procedures for monitoring and measuring the key characteristics of its operations and activities which may impact the environment. Records are to be kept which track the company's performance in relation to its environmental objectives and targets. Any environmental monitoring equipment must be calibrated and maintained in accordance with established procedures. Calibration records must be retained.
Paragraph 4.5.2 – Evaluation of compliance requires that the company establish and maintain a procedure for periodically evaluating compliance with environmental laws and other legal requirements. Records must be kept of this compliance evaluation.
Paragraph 4.5.3 – Nonconformity, corrective action and preventive action requires that the company establish and maintain procedures for taking corrective and preventative action to deal with actual and potential nonconformities.
Paragraph 4.5.4 – Control of records requires that the company establish and maintain procedures for the identification, storage, protection, retrieval, retention and disposal of environmental records. Environmental records must be maintained to demonstrate conformity with the EMS.

Paragraph 4.5.5 – Internal audit requires that the company establish and maintain an internal EMS audit program to determine whether the company's environmental management system conforms to ISO 14001.

4.4.3.6 Management Review (Section 4.6)

Top management of the company reviews the environmental management system to ensure its continued suitability, adequacy and effectiveness. This management review must be documented and must address the need for changes to the EMS and assess opportunities for improvement.

5 Role of Suppliers and Purchasing Decisions in Integrated Management Systems

5.1 Role of Suppliers and Purchasing Decisions in Quality Management Systems

5.1.1 Introduction

The transaction between the customer and the supplier is often a complex one. There may be a supply chain from original producer through to the end user. At each transaction within this supply chain, the receiving party needs to be satisfied. It is not sufficient to simply satisfy the first receiver of the product or service. All parties in the supply chain need to be satisfied before the organization can claim to have supplied a quality product. Once the product leaves its premises control may be loosed and therefore cannot be held accountable for any damage that may become the product, but the inherent characteristics are organization's responsibility.

In an increasing global market, many organizations are faced with the bulk of the cost in a product being added down or up the supply chain with less and less being added by themselves. More and more activities are being outsourced putting a greater burden on the purchasing and staff to manage suppliers and commercial staff to manage customers. The integrity of the supply chain depends upon each party honoring their commitments and this depends upon each supplier having processes that have the capability to deliver quality product on time. Once products begin to flow along the supply chain any disruptions due to either poor quality or late delivery cause costs to rise further along the chain that are irrecoverable. The end customer will only pay for product that meets requirements therefore if buffer stocks have to be held and staff paid waiting time as a result of supply chain unreliability, these costs have to be borne by the producers. Process capability and product and service quality along the supply chain become the most vital factors in delivering outputs that satisfy the end customer requirement. [71]

Most manufacturing enterprises are organized as networks of manufacturing and distribution sites that procure raw materials, transform them into intermediate and finished products, and distribute the finished products to customers.[72] Supply chain management (SCM) administers these networks. The short-term objective of SCM is primarily to increase productivity and reduce the entire inventory and the total cycle time, while the long-term objective is to increase customer satisfaction, market share, and profits for all organizations in the supply chain: suppliers, manufacturers, distribution centers (DCs), and customers [2]. To accomplish these objectives, tight coordination among the organizations in supply chains is needed

As the complexity of products has increased, so has the need for quality. Quality is an important feature that enables firms to sustain their competitive advantage and maintain growth levels. The quality of firm's product depends not only on its quality but also on the supplier's quality.[73] Purchasing agents have assumed the added responsibility of quality assurance.

[71] refer to Hoyle 2006, p. 13
[72] refer to Lee, Billington, 1992, p.65
[73] refer to Garfamy, 2003

Supplier quality has a large and direct impact on the quality positioning of organizations. The growing attention to this area of quality management reflects an understanding that a firm's quality performance (output) can only be as good as the quality performance of its suppliers (input).[74] This suggests an increasing tendency towards supplier development by organizations as supplier quality integration is found to be a critical dimension of quality excellence. Many organizations achieved success because of their tenacious zeal in enforcing strict quality standards on their suppliers.

This indicates that one of the competencies essential to the supply chain is an effective purchasing function.[75] Purchasing is not a purely tactical exercise anymore, instead it is now recognized as a strategic function, because external suppliers now exert a major influence on a company's success or failure.[76]

5.1.2 Criteria of Supplier Selection and Evaluation

In today's highly competitive and interrelated manufacturing environment, the effective selection of suppliers is very important to the success of a manufacturing firm.[77] Companies in order to attain the goals of low costs, consistent high quality, flexibility and quick response have increasingly considered better supplier selection approaches. Increased concern for supplier selection is probably due to the fact that supplier selection may be the single most important phase of the purchasing process. As the strategy of supplier integration becomes more widespread, methods and criteria of their selection assumes a more critical dimension. According to Fiorito[78] ,"[i]n making a purchasing decision the buyer is confronted with the dual factors of uncertainty and the consequence of action. These combine to create a degree of risk".

Traditionally, the role of purchasing agent has been one of getting the product at the lowest cost. Potential suppliers were evaluated in terms of their ability to provide the following:

- The desired quality defined as the suitability of product or service of use as intended
- The total number of products required, including the schedule by which the product or service is required
- Tangible and intangible services that are benefits over and above quality and price
- Price, which is a measure of value [79]

Purchasing managers need to evaluate periodically supplier performance in order to retain those suppliers who meet their requirements in terms of several performance criteria. As with any decision process, supplier selection decision involves two basic tasks: evaluation and selection. The evaluation element typically consists of identifying the attributes, criteria, or factors relevant to the decision and then measuring or rating each supplier by considering each of the relevant factors. When a supplier selection decision needs to be made, the buyer generally establishes a set of evaluation criteria that can be used to compare potential sources. Purchasing managers use all available attributes when evaluating supplier performance. Further, in making their choices the purchasing managers must necessarily make trade-offs among different levels of these attributes.[80]

[74] refer to Forker, 1999
[75] refer to Tracey, Tan, 2001
[76] refer to Goffin, Szwejczewki, New, 1997
[77] refer to Weber, Current, Desai, 2000
[78] refer to Fiorito, 1990
[79] refer to Bossert, 1994, p. 3
[80] refer to Braglia, 2000

The involvement of a large number of closely interrelated decisions regarding financing, negotiations, distribution, procurements and product quality assurance at the source implies the significance and long-lasting impact of supplier selection on sourcing. The supplier performance considerably impacts on the efficiency and effectiveness of the buying firm and is of vital importance. Therefore, it is plausible that effectual selection and evaluation of suppliers and promoting their involvement in critical supply chain activities will result in improved firm performance via enhanced customer satisfaction.

Since the supplier selection process encompasses different functions (such as purchasing, quality, production, etc) within the company, it is a multi-objective problem, encompassing many tangible and intangible factors in a hierarchical manner.[81]. Supplier selection process is inherently multi-objective in nature, because typically more than one criterion (e.g. price, quality, delivery performance) needs to be considered and evaluate in selecting suppliers and monitoring their performance.[82] Figure 5-1 illustrates the identification of the supplier selection criteria.

The basic criteria typically utilized for this purpose are pricing structure, delivery, product quality, and service. The effect of the sourcing decision on the competitiveness is not limited to cost control alone, but also influences the performance of the conversion system, along the other competitive dimensions of quality, dependability, flexibility and innovation.[83]

Six attributes frequently used as performance criteria for suppliers are identified and used in a study by Mummalaneni et al.[84] These attributes are: on-time delivery, quality, price/costs targets, professionalism, responsiveness to customer needs and long-term relationships with the purchasing company.

In industrial buying research, explicit criteria such as quality, service, delivery and price have been found to dominate supplier selection.[85] Implicit criteria such as reputation and location have also been found to be important but their relative importance is the subject of debate.

Tracey and Tan (2001) show that selecting and evaluating suppliers grounded in the criteria of quality, delivery reliability and product performance enhances the four dimensions of customer satisfaction (price, quality, variety and delivery) and firm performance.[86] The findings of previous researches indicate that the importance of supplier selection factors does vary based on the type of purchase and product and there is no common list of criteria used across supplier selection studies.

[81] refer to Karpak, Kasuganti, Kumcu, 1999
[82] refer to Talluri, S., Sarkis, J., 2002
[83] refer to Hayes, Wheelwright, Clark, 1988
[84] refer to Mummalaneni, Dubas, Chao, 1996
[85] refer to Bhutta, Huq, 2002
[86] refer to Tracey, Tan, 2001

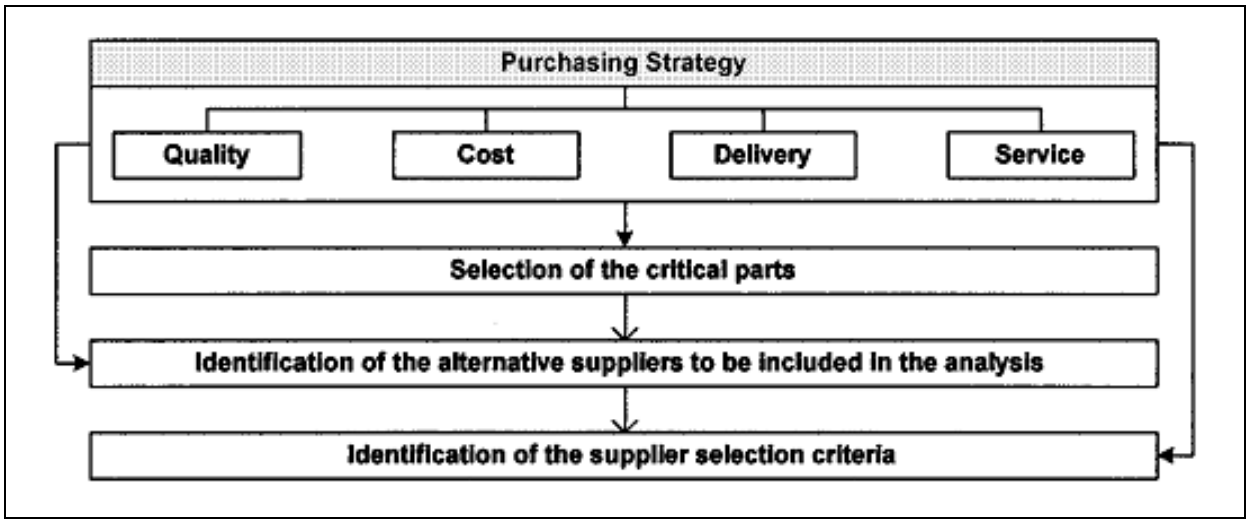

Figure 5-1: Identification of the supplier selection criteria[87]

According to the previous researches regarding to supplier selection and evaluation decision, the insight gained into the perceived importance of different supplier attributes are controversial. As an example, Wilson found that price tends to be less important in the current practices of supplier selection criteria. Quality and service considerations tend to dominate price and delivery criteria.[88] Verma and Pullman, on the other hand, point out that although managers say that quality is the most important attribute for a supplier, their actual supplier choice is based largely on cost and delivery performance.[89] Furthermore, the importance placed on the different attributes was found to vary largely in accordance with the differing cultural aspects of a society.

To conclude, the supplier selection and evaluation process should not only consider price, but also a wide range of factors such as quality, organization and culture with a view to decision making by the whole supplier capability in a long-term and strategic way. With the help of previous researches, quality is one of the most important criterion related to supplier selection and evaluation.

In the following sections supplier selection and evaluation decisions with related purchasing decisions are highlighted in compliance with quality and environmental management systems.

[87] refer to Eon, Sungdo, Sheung-Kown, p. 2001
[88] refer to Wilson, 1994
[89] refer to Verma, Pullman, 1998

5.1.3 ISO 9000 as Supplier Selection and Evaluation Criterion

Supplier selection studies in the industrial marketing literature have demonstrated that buyers consider specific criteria in their evaluation of suppliers as explained in previous section.

The ISO 9000 series standards define the minimum requirements a supplier must meet to assure its customer that they are receiving high-quality products. This has had a major impact on companies around the world. Through the ISO standards, suppliers can now be evaluated consistently and uniformly. [90]
It is perceived customers requiring ISO registration of suppliers as part of a larger quality assurance (QA) effort. QA includes the regulation of the quality of raw materials, assemblies, products, and components; services related to production; and management, production, and inspection processes. The main goal of QA is to ensure that products fulfill or exceed customer expectations. One approach to QA is through the development of a formal QMS, and for many firms this has meant ISO 9000 registration.

Customers need confidence that their suppliers can meet their quality, cost and delivery requirements and have a choice as to how they acquire this confidence.
They can select their suppliers:[91]

(a) Purely on the basis of past performance, reputation or recommendation
(b) By assessing the capability of potential suppliers themselves
(c) On the basis of an assessment of capability performed by a third party

Most customers select their suppliers using option (a) or (b) but there will be cases where these options are not appropriate either because there is no evidence for using option (a) or resources are not available to use option (b) or its not economic. It is for these situations that a certification scheme was developed. Organizations submit to a third party audit that is performed by an accredited certification body independent of both customer and supplier. An audit is performed against the requirements of ISO 9001 and if no nonconformities are found, a certificate is awarded. This certificate provides evidence that the organization has the capability to meet customer and regulatory requirements relating to the supply of certain specified goods and services. Customers are now able to acquire the confidence they require simply by establishing whether a supplier holds an ISO 9001 certificate covering the type of products and services they are seeking. ISO 9000 registration has become an important element when companies make their selection of suppliers. The standards help in determining capable suppliers with effective quality assurance systems.

Previous studies have shown that the criteria of importance to buyers are expected to vary by the type of product being purchased [92] and also by the presence of quality programs within the business.[93] Both quality programs in general and ISO 9000 in particular have been suggested as criteria for supplier selection and evaluations. [94] Such programs demand the existence of a quality infrastructure which should ensure the consistency of products and services. For many firms, obtaining acceptable levels of quality comes with the registration of a QMS for itself and its suppliers.

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[90] refer to Adedeji, 1995, p.22
[91] refer to Hoyle, 2006, p. 2
[92] refer to Dickson, 1966, Dempsey, 1978
[93] refer to Weber, Current, Benton, 1991
[94] refer to Bossert, 1998

Purchasing and materials managers are increasingly concerned with ISO 9000 registration, both as a prerequisite for participation in global markets and in supplier selection. The ISO 9000 guidelines link certification requirements to quality-related corporate issues and can be used as a screening tool for companies when assessing the conformity of a supplier's process. Also Governments encouraged organizations to use ISO 9000 alongside product standards in their purchasing strategy so as to raise the standard of quality in national and international trade.[95]

In recent years most organizations have begun to develop detailed quality assurance procedures for dealing with suppliers of critical materials. The benefits in this arise from the fact that the more information the organization has about the history of the purchased material, the less inspection it has to be done and the more confidence in the quality of the material. The amount of testing it is carried out should be based on the degree of uncertainty about the quality[96]

Organizations want to make sure they have a more stable supply chain can use supplier assessment programs that include ISO registration to help ensure good quality suppliers. One of the easiest ways for an organization to do this is through working with suppliers that have obtained an industry standard for quality systems, namely, ISO 9001. Having ISO 9000 certification could become the advantage that registered suppliers have over their non-registered counterparts in response to the trend for large businesses to reduce their supplier bases.

The standards help reduce buyers' quality costs through confidence and assurance in suppliers' quality practices. Compliance with an ISO 9000 standard provides a means for contractual agreement between the buyer and the supplier. Companies that are certified and registered as meeting the ISO standards will be perceived as viable suppliers to their customers. Those that are not will be perceived as providing less desirable products and services.[97]

ISO 9000 certification provides to the supplier other benefits in the form of quality awareness, entry into global markets, improved perception of quality, etc.[98]

ISO 9000 does not require purchasers to impose ISO 9000 on their suppliers. What it does require is for purchasers to determine the controls necessary to ensure whether purchased product met their requirements. But the easy way of meeting this requirement was to impose ISO 9000 for their suppliers.[99]

Making the decision to develop and certify a QMS becomes more difficult if customers are from different industries, as there are many industry-specific standards derived from ISO 9000. These included QS 9000 for the automotive industry. In 1995, a joint venture between Ford, General Motors, and Chrysler published QS 9000, which was derived from the 1994 version of ISO 9000.[100] In 2000, ISO 9000 was rewritten and became the foundation for ISO/ TS 16949, which is replacing QS 9000. The International Automotive Task Force (IATF), which consists of an international group of vehicle manufacturers and trade associations, developed TS 16949 in conjunction with ISO 9000:2000. To impose ISO certification is commonly being used in the automotive industry where 2nd, 3rd, or 4th tier suppliers are being coerced into getting ISO/TS 16949 certification. GM and Ford insisted that all suppliers should make the transition from QS 9000 to ISO/TS 16949 by the end of 2006. Daimler Chrysler called for the transition in 2004.

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[95] refer to Department of Trade and Industry, 1982
[96] refer to Seaver, 2001, p.55
[97] refer to Adedeji, 1995, p. 21
[98] refer to Stevenson, Barnes, 2001
[99] refer to Hoyle, 2006, p. 94
[100] refer to Kartha, 2004

Over 6000 Tier 1 and Tier 2 suppliers worldwide have already achieved ISO/ TS 16949 registration. U.S. firms lead the way, followed by firms in Germany, France, Spain, Italy, China, Brazil, and India.[101]

Other industry-specific standards derived from ISO 9000 include AS 9000 for the aerospace industry, PS 9000 for pharmaceutical packaging materials, TL 9000 for the telecommunications industry, and TE 9000 for the tooling and equipment industry. Suppliers to these specific industries are required to have specific registration. Typically, the OEMs across these different industries require that all their facilities be registered. However, they also require their first-tier suppliers to obtain registration, and they place pressure on their suppliers to likewise require the same from their suppliers. For example, the ISO/TS 16949 requirement for supplier development states that an organization's suppliers must be third-party registered to ISO 9000:2000 at a minimum.[102] The end result is that the entire supply chain is impacted by these ISO-related registrations.

Even without buyer pressure for certification, suppliers may seek certification to communicate about underlying quality attributes. If buyers are unable to tell apart high quality suppliers from low quality ones, they may shift demand to substitute products or else pay an average premium to all suppliers. Consequently, if certification with a management standard allows an organization to communicate about its unobserved quality attributes, a certified organization may be able to gain an advantage vis-à-vis its non-certified competitors.

Evidence suggests that ISO 9000 may meet the requirements for a market signal. Because certification with ISO 9000 demands compliance with a wide range of quality system requirements, meeting these requirements should, on average, be less costly for high quality organizations.[103] This is because they need to undertake fewer adjustments and are more likely to be certified with the first visit of the auditor.[104]

A supplier's quality is often a function of intangible organizational characteristics that cannot be observed through direct examination of products or services. For example, numerous intangible internal attributes caused disastrous tire quality problems at the Bridgestone-Firestone plant in Decatur, IL. Failures in internal systems for product design, production, labor management, and buyer communications all contributed to the problem.[105] Because these attributes were internal to the supplier, buyers could not detect these problems through inspection of the eventual product.

For certification with ISO 9000 to provide information about differences in organizational quality, the standard needs to be indicative of intangible attributes that are linked to supplier quality. Indeed, Wenmoth and Dobbin[106] find that certification with ISO 9000 is facilitated by leadership qualities from top management teams, a commitment of management to ongoing improvements, employee training, intra firm communication systems, as well as existing management systems and best practices. King and Lenox[107] find that ISO 9000 certification is linked to lean production practices and that it reflects general organizational differences in the use and management of technology, material, and labor. Thus, to the extent that certification with ISO 9000 reveals information about intangible supplier differences, it should provide a greater return in industries with higher levels of R&D and advertising intensity.

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[101] refer to Davis, 2004
[102] refer to Willem, 2004.
[103] refer to Darnall, Edwards, 2004
[104] refer to Hutchins,1997
[105] refer to O'Rourke, 2001
[106] refer to Wenmoth, Dobbin, 1994
[107] refer to King, Lenox, 2001

5.1.4 Purchasing in Compliance with ISO 9001:2008

Most organizations need to purchase items in order to conduct their business. Some purchases may be incorporated into products supplied to customers or simply passed onto customers without any further processing. Other purchases may contribute to the processes that supply product or deliver services to customers and there are perhaps some purchases that have little or no effect on the product or service supplied to customers but they may affect other interested parties. It is therefore inconceivable that this Clause could be excluded in an organization that was considering certification to ISO 9001.[108]

The term “purchasing” involves the payment of money or an equivalent but the requirements still apply if items are obtained without any payment being made, at least by the organization which is to use the item. A more suitable term would be “procurement”, which does not have to involve payment. Although the principles are common sense, the detail requirements of the standard would be too onerous to apply to everything you acquire in connection with the business; so it is needed a means of classifying purchases so as to apply controls on the basis of their risk to the quality of the products and service supplied to the customers.[109]

Purchasing section includes following subsections in ISO 9001:2008: [110]

7.4 Purchasing

- **7.4.1 Purchasing process**

The organization shall ensure that purchased product conforms to specified purchase requirements. The type and extent of control applied to the supplier and the purchased product shall be dependent upon the effect of the purchased product on subsequent product realization or the final product.
The organization shall evaluate and select suppliers based on their ability to supply product in accordance with the organization's requirements. Criteria for selection, evaluation and re-evaluation shall be established. Records of the results of evaluations and any necessary actions arising from the evaluation shall be maintained.

- **7.4.2 Purchasing information**

Purchasing information shall describe the product to be purchased, including, where appropriate,
a) requirements for approval of product, procedures, processes and equipment,
b) requirements for qualification of personnel, and
c) quality management system requirements.
The organization shall ensure the adequacy of specified purchase requirements prior to their communication to the supplier.

- **7.4.3 Verification of purchased product**

The organization shall establish and implement the inspection or other activities necessary for ensuring that purchased product meets specified purchase requirements.
Where the organization or its customer intends to perform verification at the supplier's premises, the organization shall state the intended verification arrangements and method of product release in the purchasing information.

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[108] refer to Hoyle, 2006, p. 123
[109] refer to Hoyle, 2005, p. 307
[110] refer to ISO 9001

5.1.4.1 Purchasing Process (Section 7.4.1)

5.1.4.1.1 Ensuring purchased product conforms to specified requirements (7.4.1)

The standard requires the organization to ensure that purchased product conforms to specified purchase requirements.

ISO 9000 defines a supplier as an organization or person that provides a product and in ISO 9000 a product can be services, hardware, software or processed materials. A supplier may therefore be a producer, distributor, retailer, vendor, contractor, subcontractor or service providers. Purchased product is any product or service that is purchased rather than freely given or otherwise acquired and applies to any product or service that affect compliance with customer requirements. Specified purchase requirements are those requirements that are specified by the customer, the organization or by statutes and regulations that apply to purchased product. This would include any requirements limiting the conditions or the source of supply.

This requirement responds to the Factual Approach Principle.

All organizations have suppliers of one form or another in order to provide products and services to their customers. Some of the directly or indirectly impact the product being supplied to the organization's customers and others may have no impact at all such as office supplies. [111]

How can this be implemented?
Once the make or buy decision has been made, control of any purchasing activity follows a common series of activities, which are illustrated in Figure 5-2. There are four key processes in the procurement cycle for which the procedures should be prepared:

- The specification process, which starts once the need has been identified and ends with a request to purchase.
- The evaluation process, which starts with the request to purchase and ends with the placement of the order or contract.
- The surveillance process, which starts with placement of order or contract and ends upon delivery of supplies.
- The acceptance process, which starts with delivery of supplies and ends with entry of supplies onto the inventory and/or payment of invoice.

Although the goods inwards or goods receiving function including receipt inspection is considered part of purchasing, as it is the final stage in the purchasing process.
Where the purchasing process is relatively simple, one procedure may suffice but where the process varies separate procedures may be needed so as to avoid all purchases, regardless of value and risk, going through the same process. It is likely that the organization will have one purchasing system for supplies irrespective of whether it is used for deliverable or non-deliverable products. It would therefore make sense to distinguish between the procedures used for deliverable supplies and those for purely internal usage.

The standard does not define what the specified requirements are in this case. Elsewhere in the standard the term seems to relate to customer requirements but when purchasing the company may well not be passing on customer requirements to its supplier. In cases other than when truly subcontracting work, the organization will in all probability be driving its own requirements.

[111] refer to Hoyle, 2005, p. 451

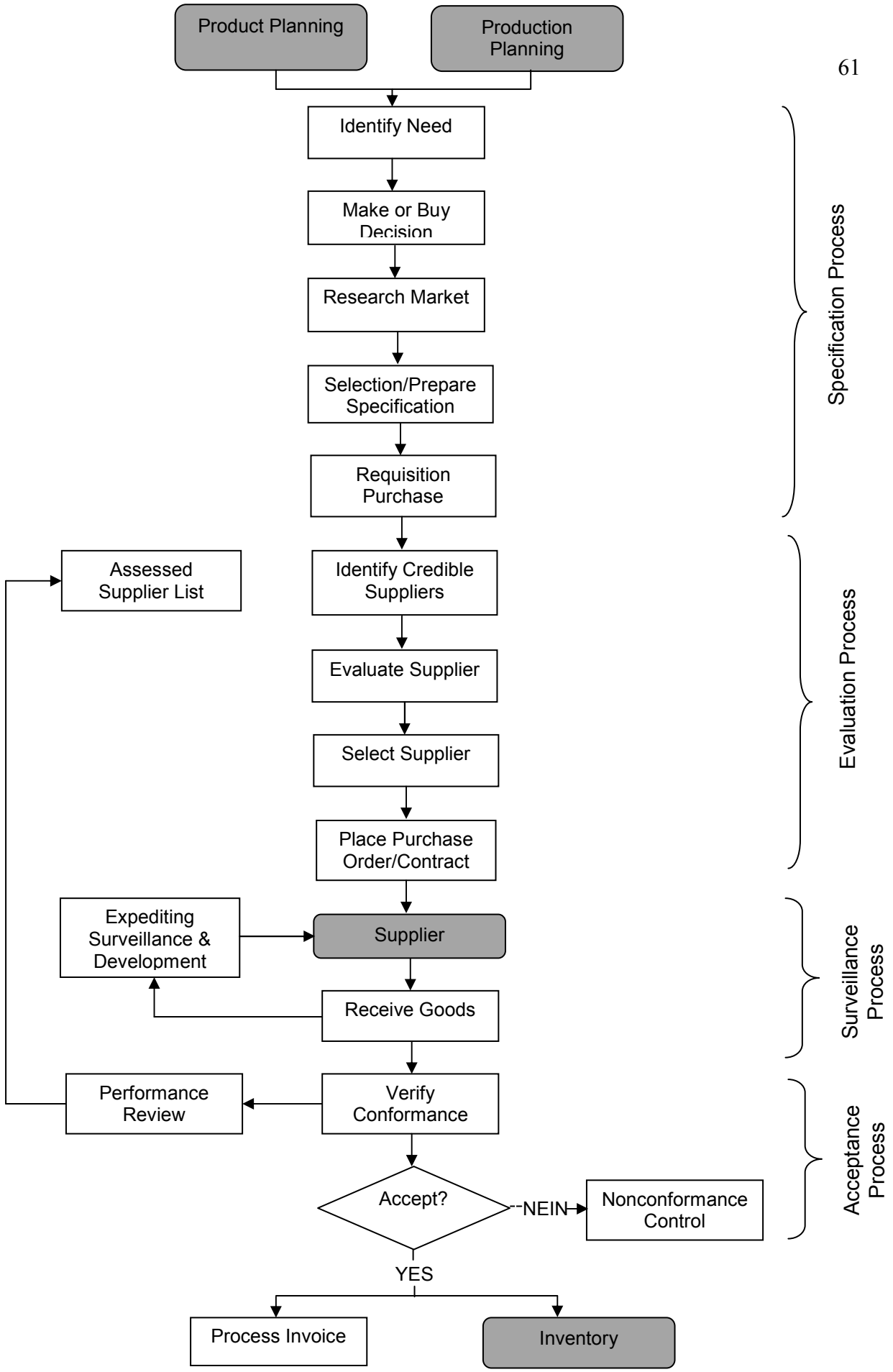

Figure 5-2: Procurement process flow[112]

[112] refer to Hoyle, 2006, p. 446

5.1.4.1.2 Control of suppliers (7.4.1)

The standard requires the type and extent of control applied to the supplier and the purchased product to be dependent on the effect of the purchased product on subsequent product realization or the final product.

The requirement contains two separate requirements: one applying to the product and the other applying to the supplier.

Regarding to the product, the type of control refers to whether the controls should act before, during or after receipt of product. The extent of control refers to whether it is remote or on the supplier's premises and whether product is accepted on the basis of supplier data or is to be evaluated before authorizing delivery.
Regarding the supplier the type of control refers to whether or not to qualify the supplier and the extend of control refers to the degree to which the organization is involved with the supplier in managing the purchase.

Purchased product can have varying degrees of impact on the processes and products of the organization ranging from no impact to critical impact. A product with a critical impact would warrant stringent control over its purchase, whereas a product with negligible or no impact may warrant no more than a simple visual check on delivery to verify receipt of the right product.

This requirement responds to the "Mutually Beneficial Supplier Relationships Principle".

As it would not be prudent to exercise no control over suppliers, it would also be counterproductive to impose rigorous controls over every supplier and purchased product. A balance has to be made on the basis of risk to the processes in which the purchased product is to be used and the final product into which the purchased product may be installed. [113]

How can this be implemented?

5.1.4.1.2.1 Selecting the degree of control

The purchaser needs some means of verifying that the supplier has met the requirements of the order and the more unusual and complex the requirements, the more control will be required. The degree of control the purchaser needs to exercise over suppliers depends on the confidence purchaser has in the ability to meet the requirements. If you have high confidence in a particular supplier you can concentrate on the areas where failure is more likely. If you have no confidence, you will need to exercise rigorous control until you gain sufficient confidence to relax the control. The fact that a supplier has gained ISO 9000 registration for the products and service you require should increase your confidence, but if you have no previous history of their performance it does not mean they will be any better than the supplier you have used for years which is not registered to ISO 9000. Your supplier control procedures need to provide the criteria for selecting the appropriate degree of control and for selecting the activities you need to perform.

The degree of control the organization needs to exercise over suppliers depends on the confidence the organization has in their ability to meet its requirements. In determining the degree of control to be exercised the organization needs to establish whether:

- The quality of the product or service can be verified by the organization on receipt using its normal inspection and test techniques. This is the least costly of methods and usually applies where achievement of the requirements is measurable by examination of the end product.

[113] refer to Hoyle, 2006, p. 447

- The quality of the product can be verified by the organization on receipt providing the organization acquires additional equipment or facilities. More costly than the previous method but may be economic if there is high utilization of the equipment.
- The quality of the product can be verified by the organization witnessing the final acceptance tests and inspections on the supplier's premises. If the organization does not possess the necessary equipment or skill to carry out product verification, this method is an economic compromise and should yield as much confidence in the product as the previous methods. However, it has to be recognized that the buyer's presence on the supplier's premises may affect the results. They may omit tests which are problematical or buyer's presence may cause them to be particularly diligent, a stance which may not be maintained when the buyer is not present.
- The verification of the product could be contracted to a third party. This can be very costly and is usually applied with highly complex products and where safety is of paramount importance.
- The quality of the product can be verified by the supplier during its design and manufacturing process. In such cases the buyer has to rely on what the contractor tells the buyer and to gain sufficient confidence the buyer can impose quality system requirements, require certain design, manufacturing, inspection and test documents to be submitted to the buyer for approval and carry out periodic audit and surveillance activities. This method is usually applied for one-off systems or small quantities when the stability of a long production run cannot be achieved to iron out problems.

In order to relate the degree of inspection to the importance of the item, purchases should be categorized as follows:

- If the subsequent discovery of nonconformity will not cause design, production, installation or operational problems of any nature, a simple identity, carton quantity and damage check may suffice.
- If the subsequent discovery of nonconformity will cause minor design, production, installation or operational problems, you should examine the features and characteristics of the item on a sampling basis
- If the subsequent discovery of nonconformity will cause major design, production, installation or operational problems then you should subject the item to a complete test to verify compliance with all prescribed requirements.

5.1.4.1.2.2 Defining supplier controls

When carrying out supplier surveillance the purchaser will need a plan which indicates what is intended to do and when purchaser intends to do it. Purchaser will also need to agree the plan with your supplier. If purchaser intends witnessing certain tests the supplier will need to give advanced warning of commencing such tests so that it may be attended.

The quality plan would be a logical place for such controls to be defined. Some companies produce a "Quality Assurance Requirement Specification" to supplement ISO 9001 and also produce a "Supplier Surveillance Plan". In most other cases the controls may be defined on the reverse side of the purchase order as standard conditions coded and selected for individual purchases. However, it should not be imposed onerous requirements on simple purchases. It should be made provision for the relevant conditions to be selected by the buyer otherwise the buyer runs the risk of suppliers ignoring requirements that might be relevant.

5.1.4.1.3 Evaluation and selection of suppliers (7.4.1)

The standard requires the organization to evaluate and select suppliers based on their ability to supply product in accordance with the organization's requirements and to establish criteria for selection, evaluation and re-evaluation.

In searching for a supplier purchaser needs to be confident that the supplier can provide the product or service it is required. This means that the decision to select a supplier should be based on knowledge about that supplier's capability to meet the requirements. The decision should be based on facts gathered as a result of an evaluation against criteria that it has been established.

This requirement is necessary because of responding to the "Mutually Beneficial Supplier Relationships Principle".

It would not be plausible to select a supplier without first verifying that it was able to meet the requirements in some way or other. Failure to check out the supplier and its products may result in late delivery of the wrong product. It may also mean that purchaser might not know immediately that the product does not meet the requirements and discover much later that it seriously impacts buyer's commitments to the customer. [114]

How can this be implemented?

5.1.4.1.3.1 Selection process

The process for selection of supplier varies depending on the nature of the products and services to be procured. The more complex is the product or service, the more complex is the process. Purchaser either purchases products and services to his specification (custom) or the supplier's (proprietary). There are grey areas where proprietary products can be tailored to suit company's needs and custom made products or services that primarily consist of proprietary products configured to suit the needs. There is no generic model, each industry seems to have developed a process to match its own needs. However, it can be treated the process as a number of stages, some of which do not apply to simple purchase as shown in Table 5-1.

At each stage the number of potential suppliers is whittled down to end with selection of what is hoped to be the most suitable that meets the requirements. With "custom" procurement this procurement cycle may be exercised several times. For instance, there may be a competition for each phase of project feasibility, project definition, development and production. Each phase may be funded by the customer. On the other hand, a supplier may be invited to tender on the basis of previously demonstrated capability but has to execute project feasibility, project definition and development of a new version of a product at its own cost. Supplier capability will differ in each phase. Some suppliers have good design capability but lack the capacity for quantity production; others have good research capability but lack development capability.

It is needed to develop a supplier evaluation and selection process and in certain cases this may result in several closely related procedures for use when certain conditions apply. It should not be tried to force every purchase through the same selection process. Having purchasing policies that require three quotations for every purchase regardless of past performance of current supplier is placing price before quality. It should be provided flexibility so that process complexity matches the risk anticipated.

[114] refer to Hoyle, 2006, p. 450

Stage	Purpose	Proprietary	Tailored	Custom
Preliminary Supplier Assessment	To select credible suppliers	✓	✓	✓
Pre-qualification of Suppliers	To select capable bidders		✓	✓
Qualification of Suppliers	To qualify capable bidders			✓
Request for Quotation (RFQ)	To obtain prices for products or services	✓	✓	
Invitation to Tender (ITT)	To establish what bidders can offer			✓
Tender or Quote Evaluation	To select a supplier	✓	✓	✓
Contract Negotiation	To agree terms and conditions	✓	✓	✓

Table 5-1: Supplier evaluation and selection stages[115]

5.1.4.1.3.2 Preliminary supplier assessment

The purpose of the preliminary supplier assessment is to select credible suppliers and do not necessarily to select a supplier for a specific purchase. The organization needs a process for gathering intelligence on potential suppliers and for eliminating unsuitable suppliers so that the buyers do not need to go through the whole process from scratch with each purchase. The first step is to establish the type of products or services it is required to support the business, then search for suppliers that claim to provide such products or services. In making the choice, it is important to look at what the supplier says it will do and what it has done in the past.

The organization will need to develop its own criteria but, typically, suitable suppliers may be suppliers that:

- Are likely to deliver what the buyer wants in the quantities it is required
- Are able to meet buyer's potential delivery requirements
- Has a system to assure the quality of supplies
- Comply with the relevant environmental regulations
- Comply with the health and safety standards of the company
- Are committed in to continuous improvement
- Can provide after sales support needed
- Are ethical
- Are financially stable

[115] refer to Hoyle, 2006, p. 451

The supplier assessment will therefore need to be in several parts:

- **Technical assessment**: This would check the products, processes or services to establish they are what the supplier claims them to be. Assessment of design and production capability may be carried out at this stage or be held until the prequalification stage when specific contracts are being considered.
- **Quality system assessment**: This would check the certification status of the quality system, verifying that any certification was properly accredited. For non-ISO 9000 registered suppliers, a quality system assessment may be carried out at this stage either to ISO 9000 or the customer's standards.
- **Financial assessment**: This would check the credit rating, insurance risk, stability etc.
- **Ethical assessment**: This would check probity, conformance with professional standards and codes.

These assessments do not need to be carried out on the supplier's premises. Much of the data needed can be accumulated from a supplier questionnaire and searches through directories and registers of companies, and you can choose to rely on assessments carried out by accredited third parties to provide the necessary level of confidence. The assessments may yield suppliers over a wide range and purchaser may find it beneficial to classify suppliers. (See Table 5-2)

Class A	**ISO 9000 certified and demonstrated capability** – this is the class of those certified suppliers with which the organization has done business for a long time and gathered historical evidence that proves their capability.
Class B	**Demonstrated capability** – this is the class of those suppliers the organization has done business with for a long time and warrant continued patronage on the basis that it is better to deal with those suppliers that is known. They may not even be contemplating ISO 9000 certification, but the organization gets a good product, a good service and no hassle.
Class C	**ISO 9000 certified and no demonstrated capability** – this is the class of those certified suppliers with whom the organization has done no business. This may appear a contradiction because ISO 9000 certification is obtained on the basis of demonstrated capability, but the organization has not established their capability to meet the requirements. These suppliers may be customer-designated suppliers.
Class D	**Capable with additional assurance** – this is the class of first-time suppliers with which the organization has not done sufficient business to put in class B and where it may be needed to impose ISO 9000 requirements or similar to gain the confidence it is required.
Class E	**Unacceptable performance that can be neutralized** – this is for those cases where the organization may be able to compensate for poor performance if they are sole suppliers of the product or service
Class F	**No demonstrated capability** – this is the class of those suppliers the organization has not used before and therefore has no historical data. It is unlikely it will be classified these but it is a category for placing those suppliers that produce the type of products that is purchased, so might become eligible when they become eligible for Class C status.
Class G	**Demonstrated unacceptable performance** – this is the class of those suppliers that they have clearly demonstrated that their products and services are unacceptable and it is uneconomic to compensate for their deficiencies.

Table 5-2: Assessment of Suppliers[116]

Caution is advised on the name it is given to this list of suppliers. All have been assessed but all may not have been visited or used. Some organizations refer to it as an “Approved Suppliers List (ASL)” or “Approved Vendor List (AVL)” or “Assessed Vendor List (AVL)” but if purchaser does not include unacceptable suppliers it cannot be called an Approved Vendor List. If data is stored electronically, the fields can be protected to prevent selection of unacceptable suppliers.

If the requirements vary from product to product, suppliers approved for one product may not be approved for others. If the procurement requirements do not vary from product to product, purchaser may well be able to maintain an AVL. Most will meet the minimum criteria for doing business with the company but may not be capable of meeting specific product or service requirements. Others purchaser will include simply because they do supply the type of product or service it is required but their credibility is too low at present to warrant preferred status.

[116] refer to Hoyle, 2005, p. 459

5.1.4.1.3.3 Pre-qualification of supplier

Pre-qualification is a process for selecting suppliers for known future work. The design will have proceeded to a stage where an outline specification of the essential parameters has been developed. Purchaser knows roughly what he wants but not in detail. Pre-qualification is undertaken to select those suppliers that can demonstrate they have the capability to meet the specific requirements on quality, quantity, price and delivery. A supplier may have the capability to meet quality, quantity and price requirements but not have the capacity available when purchaser needs the product or service. One that has the capacity may not offer the best price and one that meets the other criteria may not be able to supply product in the quantity it is required.

A list of potential bidders can be generated from the Assessed Suppliers List by searching for suppliers that match given input criteria specific to the particular procurement. However, the evidence purchaser gathered to place suppliers on ASL may now be obsolete. Their capability may have changed and therefore it is needed a sorting process for specific purchases. If candidates are selected that have not been assessed, an assessment should be carried out before proceeding any further.

When choosing a bidder, it is also required to be confident that continuity of supply can be assured. One of the benefits of ISO 9001 certification is that is should demonstrate that the supplier has the capability to supply certain types of products and services. However, it is not guarantee that the supplier has the capability to meet the organization's requirements. Using an ISO 9001 registered supplier should enable the organization to reduce supplier controls, so by using a non-ISO 9000 registered supplier the organization will need to compensate by performing more quality assurance activities, or employ a third party.

5.1.4.1.3.4 Qualification of suppliers

Of those potential bidders that are capable, some may be more capable than others. Qualification is a stage executed to compile a short list of bidders following pre-qualification. A detail specification is available at this stage and production standard models may be required to qualify the design. Some customers may require a demonstration of process capability to grant the production part approval.

During this stage of procurement, a series of meetings may be held depending on the nature of purchase. A pre-bid meeting may be held on the customer's premises to enable the customer to clarify the requirements with the bidders. A mid-bid meeting or pre-award assessment may be held on the supplier's premises at which customer's Supplier Evaluation Team carries out a capability assessment on site. This assessment may cover:

- An evaluation of product
- Audit of design and production plans to establish that, if followed, they will result in compliant product
- Audit of operations to verify that the approved plans are being followed
- Audit of processes to verify their capability
- Inspection and test of product (on or off site) to verify that it meets the specification

ISO 9000 certification is supposed to reduce the amount of supplier assessments by customers and it has in certain sectors. However, the ISO 9000 certification, whilst focused on a specific scope of registration, is often not precise enough to give confidence to customers for specific purchases.

The evaluation may qualify two or three suppliers for a specific purchase. The tendering process will yield only one winner but the other suppliers are equally suitable and should not be disqualified, as they may be needed if the chosen supplier fails to deliver.

5.1.4.1.3.5 Invitation to tender

Once the bidders have been selected, an Invitation to Tender (ITT) needs to be prepared to provide a fixed baseline against which unbiased competitive bids may be made. The technical, commercial and managerial requirements should be finalized and subject to review and approval prior to release. It is important that all functions with responsibilities in the procurement process review the tender documentation. The ITT will form the basis of any subsequent contract.
The requirements the buyer passes to the bidders need to include as appropriate:

- the tender condition, date, format, content etc.
- the terms and conditions of the subsequent contract
- a specification to the product or service that is required that transmits all of the relevant requirements of the main contract.
- a specification of the means by which the requirements are to be demonstrated
- a statement of work which is required the supplier to perform – it might be design, development, management or verification work and will include a list of required deliverables such as project plans, quality plans, production plans, drawings, test data etc.
- a specification of the requirements which will give an assurance of quality. This might be a simple reference to the appropriate ISO 9000 standard, but as this standard does not give the buyer will probably need to amplify the requirements.

In tendering phase each of the potential suppliers are in competition, so it should be observed the basic rule that what the buyer gives one must be given to all. It is at this stage that the supplier conducts the tender review defined in clause 7.2.2 of ISO 9001.[117]

5.1.4.1.3.6 Tender or quote evaluation

On the due date when the tenders should have been received, the organization should record those that have been submitted and discard any submitted after the deadline. An evaluation must be conducted to determine the winner – the supplier that can meet all the requirements (including confidence) for the lowest price. The evaluation phase should involve all the staff that was involved with the specification of requirements. It is needed developing scoring criteria so that the result is based on objective evidence of compliance.

The standard does not require that the organization only purchases from “approved suppliers”. It does require that the buyer maintains records of the results of supplier evaluations but does not prohibit the buyer from selecting suppliers that do not fully meet the purchasing requirements. There will be some suppliers that fully meet buyer’s requirements and others that provide a product with the right functions but quality, price and delivery may be less that buyer requires. If the demonstrated capability is lacking in some respects the buyer can adjust its controls to compensate for the deficiencies. In some cases buyer’s choice may be limited to a single source because no other supplier may market the needs. On other occasions the buyer may be spoilt for choice. With some proprietary products the buyer is able to select particular options so as to tailor the product or service to the requirements. It remains a proprietary product because the supplier has not changed anything for the buyer.

5.1.4.1.3.7 Contract negotiation

After selecting a “winner” the buyer needs to enter contract negotiations in order to draw up a formal subcontract. It is most important that one of the requirements are changed without the supplier being informed and given the opportunity to adjust the quotation. It is at this stage that the supplier conducts the requirement review defined in Clause 7.2.2 of ISO 9001.

[117] refer to Hoyle, 2009, 504

5.1.4.1.3.8 Satisfying regulatory requirements

The first step in meeting this requirement is to establish a process that will identify all current regulatory requirements pertaining to the part or material. It required identifying the regulations that apply in the country of manufacture and the country of sale. This may result in two different sets of requirements. For example, a part may be manufactured in Mexico and sold in California or made in UK and sold in India. In one case, the regulations on recycling materials may be tougher in the country of sale and in the other case, there may be restrictions prohibiting sale of vehicles containing materials from a particular country. It is difficult to keep track of changes in import and export regulations but using the services of a legal department or agency will ease the burden.

In order to ensure compliance with this requirement the buyer needs to impose on the suppliers through the purchase order, the relevant regulations and through examination of specifications, products and by on-site assessment, verify that these regulations are being met. It is not sufficient to merely impose the requirement on the supplier through the purchase order. It can be used the certified statements of authorized independent inspectors as proof of compliance instead of conducting the assessment itself. However, such inspections may not extend to the product being supplied and therefore a thorough examination by organization's technical staff will be needed. Once deemed compliant, it is needed to impose change controls in the contract that prohibit the supplier changing the process or the product without approval. This may not be possible when dealing with suppliers supplying product to their specification or when using offshore suppliers where the system of law enforcement cannot be relied on. In such cases, it will be needed to accurately define the product required and carry out periodic verification for continued compliance.

5.1.4.1.3.9 Criteria for periodic evaluation

For one-off purchases periodic re-evaluation would not be necessary. Where a commitment from both parties is made to supply products and services continually until terminated, some means of re-evaluation is necessary as a safeguard against deteriorating standards.
The re-evaluation may be based on supplier performance, duration of supply, quantity, risk or changes in requirements and conducted in addition to any product verification that may be carried out. Suppliers are not different than customers in that their performance varies over time. People, organizations and technologies change and may impact the quality of the service obtained from suppliers.

5.1.4.1.4 Result of supplier evaluation

The standard requires the records of evaluations and any necessary follow-up actions to be maintained.

Records of evaluations are documents containing the results of the evaluation. This is not the approved supplier list or AVL used to select suppliers but the objective evidence that was used to make the decision as to whether a supplier should be listed in such a document.

This requirement responds to the "Factual Approach Principle".

Records of supplier evaluation are necessary in order to select suppliers on the basis of facts rather than opinion. They are also necessary for comparisons between competing suppliers as a mere listing provides little information on which to judge acceptability.

How can this be implemented?
Although records of evaluations are not the same list of approved suppliers, there is a need for both. The list identifies which suppliers have been or not been evaluated and the records support the decision to include suppliers in the list of quality suppliers in different categories.

5.1.4.1.4.1 Evaluation records

Evaluation records can be classified in three groups:

- Initial evaluation for supplier selection
- Supplier performance monitoring
- Re-evaluation to confirm approval status

The initial evaluation records would include the evaluation criteria, the method used, the results obtained and the conclusions. They may also include information relevant to the supplier such as supplier history, advertising literature, catalogues and approvals. These records may not contain actions and recommendations because the evaluation may have been carried out under a competitive tender. The actions come later, when re-evaluations are performed and continued supply is decided.

It should be monitored the performance of all the suppliers and classified each of them according to prescribed guidelines. Supplier performance will be evident from audit reports, surveillance visit reports and receipt inspections carried out by the organization or the third party if one has been employed. These documents are needed to be examined for evidence that the supplier's quality system is controlling the quality of the products and services supplied. The organization can determine the effectiveness of these controls by periodic review of the supplier's performance. By collecting data on the performance of suppliers over a long period, it can be measured their effectiveness and rated on a scale from excellent to poor. In such cases it should be measured at least three characteristics; quality, delivery and service. Quality would be measured by the ratio of defective products to conforming products. Delivery would be measured by the number of days early or late and service would be measured by the responsiveness to actions requested by the organization on scale of excellent to poor. The output of these reviews should be in the form of updates to the list of assessed suppliers.

Re-evaluation records would include all the same information as the initial evaluation but in addition contain follow-up actions and recommendations, the supplier's response and evidence that any problems have been resolved.[118]

5.1.4.1.4.2 Listing suppliers

It is important that suppliers have been recorded in order not to be used to due to previously demonstrated poor performance so that the organization does not repeat the mistakes of the past. Assessing suppliers is a costly operation. The database should be made available to the purchasing authority thereby avoiding the necessity of reassessments each time you wish to place an order. The database of assessed suppliers should not only identify the name and address of the company but also provide details of the products and service that have been evaluated.
This is important because the evaluation performed to place suppliers on the list will have only covered particular products and services. Other products and services offered by the supplier may not have been acceptable.
A procedure is necessary for generating and managing the database of Assessed Suppliers adding new suppliers, changing data and reclassifying suppliers that no longer meet organization's criteria.

[118] refer to Hoyle, 2006, p. 459

5.1.4.2 Purchasing information (Section 7.4.2)

5.1.4.2.1 Describing products to be purchased

The standard requires purchasing information to describe the product to be purchased.

Purchasing information is the information that identifies the product or service to be purchased and which is used to make purchasing decisions. Not all of this information may be conveyed to the supplier. Some information may be needed by buyers to select the correct product or service required.

This requirement responds to the “Process Approach Principle”.

The supplier needs to know what the organization requires before it can satisfy the need and although the standard does not specifically require the information to be recorded; purchasing requirements need to be documented so that the previous orders have records. This can then be used when the goods and the invoice arrive to confirm that the order has been received. The absence of such a record may prevent from returning unwanted or unsatisfactory goods.

How can this be demonstrated?
The essential purchasing information must be communicated to suppliers so that they know what is required, but it is not essential to submit the purchasing documents to the suppliers. Providing purchaser has a record and can compare this with the goods received and the invoice, purchaser is protected against paying for goods it was not ordered.

5.1.4.2.1.1 Product identification

The product or service identification should be sufficiently precise as to avoid confusion with other similar products or services. The supplier may produce several versions of the same product and denote the difference by suffixes to the main part number. To ensure the buyer receives the product the buyer requires, it is needed to consult carefully the literature provided and specify the product in the same manner as specified in the literature or as otherwise advised by the supplier.

5.1.4.2.1.2 Purchasing specifications

If the buyer is procuring the products or services of a supplier to design and/or manufacture a product or design and/or deliver a service, the buyer will need specifications which detail all the features and characteristics which the product or service is to exhibit. The reference number and issue status of the specifications need to be specified in the event that they change after placement of the purchase order. This is also a safeguard against the repetition of problems with previous supplies. These specifications should also specify the means by which the requirements are to be verified so that the buyer has confidence in any certificates of compliance that are supplied.

For characteristics that are achieved using special processes it is needed to ensure that the supplier employs qualified personnel and equipment. Products required for particular applications need to be qualified for such applications and so buyer’s purchasing documents will need to specify what qualification tests are required.

5.1.4.2.1.3 Quality management system requirements

Management system requirements are only necessary inclusions in purchasing information when the quality of the product cannot be verified on receipt or when confidence in the product and the supplier is needed to permit the supplier to ship direct into stock or onto the production line. This might appear at odds with the requirement for all suppliers to be certified to ISO 9001 but this requirement applies to suppliers providing to the buyer's specification. If specifying ISO 9001 on the purchase order will not increase buyer's level of confidence then it would not be plausibel to do so.

5.1.4.2.2 Adequacy of purchasing requirements

The standard requires the organization to ensure the adequacy of specified purchase requirements prior to their communication to the supplier.

The adequacy of purchasing information is judged by the extent to which it accurately reflects the requirements of the organization for the products concerned. Communication of such requirements to the supplier can be verbal or through documentation and processed by post or electronically.

This requirement responds to the "Factual Approach Principle".

The acceptance of an order by a supplier places it under an obligation to accept product or service that meets the stated requirements. It is therefore important that such information is deemed adequate before being released to the supplier.

How can this be demonstrated?
Prior to order being placed the purchasing information should be checked to verify that it is fit for its purpose. The extent to which it is carried out this activity should be on the basis of risk and if purchaser chooses not to review and approve all purchasing information, the procedures should provide the rationale for the decision. In some cases orders are produced using a computer and transmitted to the supplier directly without any evidence that the order has been reviewed or approved. The purchase order does not have to be the only purchasing document. If purchasing data is entered onto a database, a simply code used on a purchase order can provide traceability to the approved purchasing documents.
The adequacy of the purchasing data can be controlled in four ways:

- Provide the criteria for staff to operate under self-control
- Check everything they do
- Select those orders that need to be checked on a sample basis
- Classify orders depending on risk and only review and approve those that present a certain risk

A situation where staff operates under self-control would be in the case of telephone orders where there is little documentary evidence that a transaction has taken place. There may be an entry on a computer database showing that an order has been placed with a particular supplier.

The adequacy of purchasing requirements would be ensured in such circumstances by following a number of steps:

- Provide buyers with read only access to approved purchasing data in the database
- Provide buyers with read only access to a list of approved suppliers in the database
- Provide a computer file containing details of purchasing transactions with read and write access
- Provide a procedure that defines the activities, responsibilities and authority of all staff involved in the process
- Train the buyers in the use of the database
- Route purchase requisitions only to trained buyers for processing

The above approach is suitable for processing routine orders, however, where there are non-standard conditions a more variable process needs to be developed.

5.1.4.3 Verification of purchased product (Section 7.4.3 and 7.4.3.1)

5.1.4.3.1 Ensuring purchased product meets requirements (7.4.3)

The standard requires the organization to establish and implement the inspection or other activities necessary for ensuring that purchased product meets specified purchase requirements.

Verification is one of the fundamental elements of the control loop and in this case the verification serves to ensure that the output from the purchasing process meets the purchasing requirements. Verification may be achieved by several means, inspection, test, analysis before or after product is delivered or by building confidence in the source of supply so that product may enter the organization without any physical inspection. The requirement does not state when such verification should be performed and clearly it can be before, during and after receipt of the product. The standard leaves it to the organization's discretion to choose the timing that is appropriate to its operations.

This requirement responds to the "Factual Approach Principle".

When the buyer purchases items as individuals it is a natural act to inspect what is purchased before it is used. To neglect to do this may result in the buyer forfeiting its rights to return it later if found defective or nonconforming. When the company purchases items on behalf of its employers, the buyer may not be as tenacious, so the company has to enforce its own verification policy as a way of protecting itself from the mistakes of its suppliers. Another reason for product verification is that it is often the case that characteristics are not accessible for inspection or test after subsequent processing. Characteristics that have not been verified prior to or on receipt may never be verified.[119]

How can this be demonstrated?
There are several ways of verifying that purchased product meets requirements and these were explained previously in "Selecting the degree of control". Assessments by third parties alone would not give sufficient confidence to remove all receiving inspection for deliveries from a particular supplier. It is needed to examine product as well as the system until the confidence has been gained to reduce inspection and eventually remove it.

[119] refer to Hoyle, 2006, p. 463

5.1.4.3.1.1 Timing of verification activities

If it has been verified that the product conforms to the specified requirements before it arrives the product can be received into the company and straight onto the production line. An example of this can be where acceptance tests or witnessed tests have been performed on the supplier's premises. The buyer may also have obtained sufficient confidence in the supplier that the buyer can operate a "just-in-time" arrangement, but the organization must be able to show that the organization has a continuous monitoring programme that informs the supplier's performance.

If it has not been verified that products meets requirements before it arrives, it is needed to install a "gate" through which only conforming items may pass. It is needed to register the receipt of items and then pass them to an inspection station equipped to determine conformance with the purchasing requirements. If items would normally pass into stores following inspection, as a safeguard it should also be made provision for the store-person to check that all items received have been through inspection, rejecting any that have not. By use of labels attached to items, the buyer can make this a painless routine. If some items are routed directly to the user, it is required a means of obtaining written confirmation that the items conform to the prescribed requirements so that at receipt inspection the buyer can provide evidence that:

- nothing comes into the company without being passes through inspection,
- nothing can come out of inspection without it being verified as conforming.

If the user in unable to verify that requirements have been met, it is needed to provide either evidence that it has passed the receipt inspection or has been certified by the vendor.

5.1.4.3.1.2 Receiving inspection

The verification plans should prescribe the acceptance criteria for carrying out receipt inspection. The main aspects to cover are as follows:

- Define how the receipt inspection personnel obtain current purchasing requirements
- Categorize all items that you purchase so that you can assign levels of receipt inspection based on given criteria
- For each level of inspection, define the checks that are to be carried out and the acceptance criteria to be applied
- Where dimensional and functional checks are necessary, define how the receipt inspection personnel obtain the acceptance criteria and how they are to conduct the inspections and tests
- Define the action to be taken when the product, the packaging or the documentation is found to be acceptable
- Define the action to be taken when the product, the packaging or the documentation is found to be unacceptable
- Define the records to be maintained

5.1.4.3.1.3 Evaluation of supplier's statistical data

If the supplier supplies statistical data from the manufacturing process that indicates that quality is being controlled, then an analysis of this data based on assurances it has been obtained through site evaluation can provide sufficient confidence in part quality to permit release into the organization. Where the organization has required the suppliers to send a certificate of conformity (C of C) testifying the consignment's conformity with the order, organization cannot omit all receiving checks.

Once supplier capability has been verified, the C of C allows to reduce the frequency of incoming checks but not to eliminate them. The C of C may need to be supported with test results therefore purchaser would need to impose this requirement in purchasing documents. However, it should be specified exactly what test results it is required and in what format purchaser requires them presented because purchaser could be provided with attribute data when purchaser really want variables data.

5.1.4.3.1.4 Purchased labor

This requirement poses something of a dilemma when purchasing subcontract labor because clearly it cannot be treated the same as product. Purchaser still needs to ensure, however, that the labour conforms with the requirements before deployment to the job. Such checks will include verification that the personnel provided could demonstrate competence and they are who they say they are. These checks can be made on the documentary evidence provided such as certificates, but purchaser may wish to monitor their performance because it is the effort it has been purchased not the people. Purchaser will not be able to verify whether they are entirely suitable until purchaser has evaluated their performance so it is needed to keep records of the personnel and their performance during the tenure of the contract.

5.1.4.3.1.5 Dealing with product audits on supplier's premises

Within the procedures purchaser needs to provide a means of identifying which items have been subject to inspection at the supplier's premises and the receipt inspection action to be taken depending on the level of that inspection. In one case, organization's representative on the supplier's premises may have accepted the product. In another case, organization's representative may have accepted a product from the same batch but not the batch that has been delivered. Alternatively the representative may have only performed a quality audit to gain a level of confidence. Purchaser needs to specify the inspection to be carried out in all such cases. Even if someone has performed inspection at the supplier's premises, if there is no evidence of conformance the inspections are of little value. The fact that an inspection was carried out is insufficient. There has to be a statement of what was checked, what results were obtained and a decision as to whether conformance had been achieved. Without such evidence it may be needed to repeat some of the inspections carried out on the supplier's premises.

5.1.4.3.1.6 Third party assessments or part evaluation

In cases where the organization does not have the skills or the resources to verify products on supplier sites it can be outsourced to a competent organization such as a part evaluation laboratory. This is what is known as "Third Party Assessment". Organization can use the third party to undertake specialist assessments that support to its own incoming inspection so as to give confidence that the components it is received are built under adequately controlled conditions.

5.1.4.3.2 Legitimizing verification on supplier's premises (7.4.3)

The standard requires that where the organization or its customer intends to perform verification activities at the supplier's premises, the organization is to state the intended verification arrangements and method of product release in the purchasing information.

If it is chose a verification method other than receipt inspection that involves a visit to the supplier's premises, the supplier has a right to know and the proper vehicle for doing this is through the purchasing information such as a contract or order.

This requirement responds to “the Factual Approach Principle”.

The supplier needs to know if organization or organization’s customers intend to enter its premises to verify product before shipment so that they may make the necessary arrangements and establish that the proposed methods are acceptable to them.

How can this be implemented?

5.1.4.3.2.1 Verification by the organization

The acceptance methods need to be specified at the tendering stage so that the supplier can make provision in the quotation to support any of the activities on site. When purchaser visits a supplier purchaser enters its premises only with their permission. The product remains their property until purchaser has paid for it and therefore purchaser needs to be very careful how he behaves. The contract or order is likely only to give access rights to products and areas related to the order and not to other products or areas. Purchaser cannot dictate the methods the supplier should use unless they are specified in the contract. It is the results in which purchaser should be interested not the particular practices unless he has evidence to demonstrate that the steps they are taking will affect the results.

5.1.4.3.2.2 Verification by the customer

In cases where customer requires access to the suppliers to verify the quality of supplies, it is required to transmit this requirement to the supplier in the purchasing information and obtain agreement. Where a firm’s business is wholly that of contracting to customer requirements, a Clause giving their customers certain rights will be written into their standard purchasing conditions. If this is an unusual occurrence, purchaser needs to identify the need early in the contract and ensure it is passed on to those responsible for preparing subcontracts. Purchaser may also wish to impose on the customer a requirement that purchaser is given advanced notice of any such visits so that it may be arranged an escort. Unless purchaser knows the customer’s representative very well it is unwise to allow unaccompanied visits to the suppliers.

When customers visit the suppliers or inspect product on receipt, they have the right to reserve judgement on the final acceptance of the product because it is not under their direct control and they may not be able to carry out all the test and inspections that are required to gain sufficient confidence. Customer visits are to gain confidence and not to accept product. The same rules apply to purchaser when purchaser visits the suppliers. The final decision is the one made on receipt or some time later when the product is integrated with company’s equipment and it can be tested thoroughly in its operating environment or equivalent.

5.1.4.4 Analysis of supplier data (Section 8.4d)

The standard requires analysis of data to provide information relating to suppliers.

Information relating to suppliers includes that related to their performance regarding product and service quality, delivery and cost.

This requirement responds to the "Factual Approach Principle".

Suppliers are a key contributor to the performance of an organization and therefore information on the performance of suppliers is necessary to determine the adequacy, suitability and effectiveness of the management system.[120]

Supplier Quality Surveys are one the key method for gathering information about supplier's quality performance and related data. The questionnaire requires information about products or raw materials which is outside the direct control of the supplier, meaning that the supplier has to obtain information from their own supplier base. In Appendix A "Supplier Quality Assurance Survey" is illustrated as an example, which is taken from company. [121]

How can this be implemented?
There are several aspects of the purchasing process that can be analyzed and used to reveal information about suppliers in order to determine their performance and opportunities for improvement. However, the resources allocated to the analysis need to be appropriate to the potential risks to the organization and its customers. It is therefore necessary to focus on those suppliers that indicate the greatest risk to the organization's performance.

5.1.4.4.1 Order value

One group of suppliers at risk are those that provide the highest value of products and services. High order value implies significant investment by the organization because such decisions are not taken lightly. Should the supplier fail, the organization may not be able to recover sufficiently to avoid dissatisfying its customers.

The supplier database should identify the value of orders with suppliers and from an examination of these data a Pareto analysis may reveal the proportion of suppliers that receive the highest value of orders. The performance of those in the top 20% in the order value list will obviously have more effect on the organization than the performance of the other 80% and may warrant closer attention. If it is established the effort spent on developing these suppliers as opposed to the others, it may reveal that the priorities are wrong and need adjustment.

5.1.4.4.2 Order quantity

Another group at risk are those suppliers that process the greatest number of orders. If there is a systemic fault in their processes, many deliveries may contain the same fault. It is possible that some of the high order value suppliers are the same as the high order quantity suppliers such as those supplying consumables. The performance of the top 20% in the order quantity list may affect all your products especially if the product is a raw material, fasteners, adhesives or any item that forms the basis of the products' physical nature.

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[120] refer to Hoyle, 2006, p. 599
[121] refer to http://www.modinds.com/VR_Supplier/MII%20Supplier%20Survey%20Revision%205.doc (01.07.2009)

5.1.4.4.3 Quality risk

The third group at risk comprises suppliers that supply products or services that a product failure modes analysis has shown are mission critical regardless of value or quantity. It may be only needed a few of these and their cost may be trivial, but their failure may result in immediate customer dissatisfaction. The FMEA should show the probability of failure and therefore the Pareto analysis could reveal the top 20% of products that are critical to the organization in terms of quality.

5.1.4.4.4 Delivery risk

The fourth group at risk are those suppliers that must meet delivery targets. Some items are on a long lead time with plenty of slack, others are ordered when stocks are low and others are ordered against a schedule that is designed to place product on the production line just-in-time to be used. It is the latter that are most critical although a JIT scheme does not have to be in place for delivery to be critical. The top 20% of these suppliers deserve special attention, regardless of value, quantity or product quality risk. A late delivery may have ramifications throughout the supply chain.

5.1.4.4.5 Suppliers per item

The fifth group of suppliers is not necessarily a group at risk. Many organizations insist on having more than one qualified supplier for a given item or service just in case a supplier underperforms. As Deming points out “A second source for protection in case of ill luck puts one vendor out of business temporarily or forever, is a costly policy. There is lower inventory and a lower total investment with a single supplier than with two.” [122] Purchaser does not have to be ordering from different suppliers at the same time for a second source to be a costly policy. There are the costs associated with the evaluation and approval which are double for maintaining a viable second source. An analysis of purchased items by supplier will reveal how many items are sourced from more than one supplier. Those items sourced from the most number of suppliers are therefore candidates for a supplier reduction programme.

5.1.4.4.6 Costs

Cost is also a factor but often only measured when there is a target for suppliers to reduce costs year on year. An analysis of these suppliers may reveal the top 20% that miss the target by the greatest amount. Once the top 20% have been identified in each group, further analysis should be carried out to establish how each of these suppliers performs on quality, cost and delivery, the amount of effort spent in developing these suppliers and the degree to which these suppliers respond to requests for action. A common method of assessing suppliers was to send out questionnaires that gathered data about the supplier. These add little value apart from gathering data. A measure of how many of your suppliers have ISO 9000 certification does not reveal anything of value because it does not indicate their performance. Analysis of supplier data should only be performed to obtain facts from which decisions are to be made to develop the supplier or terminate supply.

[122] refer to Deming, 1982

5.2 Role of Suppliers and Purchasing Decisions in Environmental Management System

5.2.1 Environmental Supply Chain Management Aspects

Companies are now starting to recognize the possible competitive advantages associated with environmental awareness.

It has been argued that success in addressing environmental issues may provide new opportunities for competition, and new ways to add value to core business programs [123] and others argue that inter-firm relations provide formal and informal mechanisms that promote trust, reduce risk and in turn increase innovation and profitability.

In the last ten years the awareness of the potential for synergies between environmental performance and corporate and manufacturing performance has been developing. It was traditionally accepted wisdom that investment in environmental goals was against sound business strategy and a poor allocation of firm investments
The implementation of environmentally friendly practices have a particularly large impact on supply chain management, as it includes the entire flow of materials from raw materials to the delivery of the finished product to the customer. Figure 5-3 illustrates the basic components of “Green Manufacturing Process”.

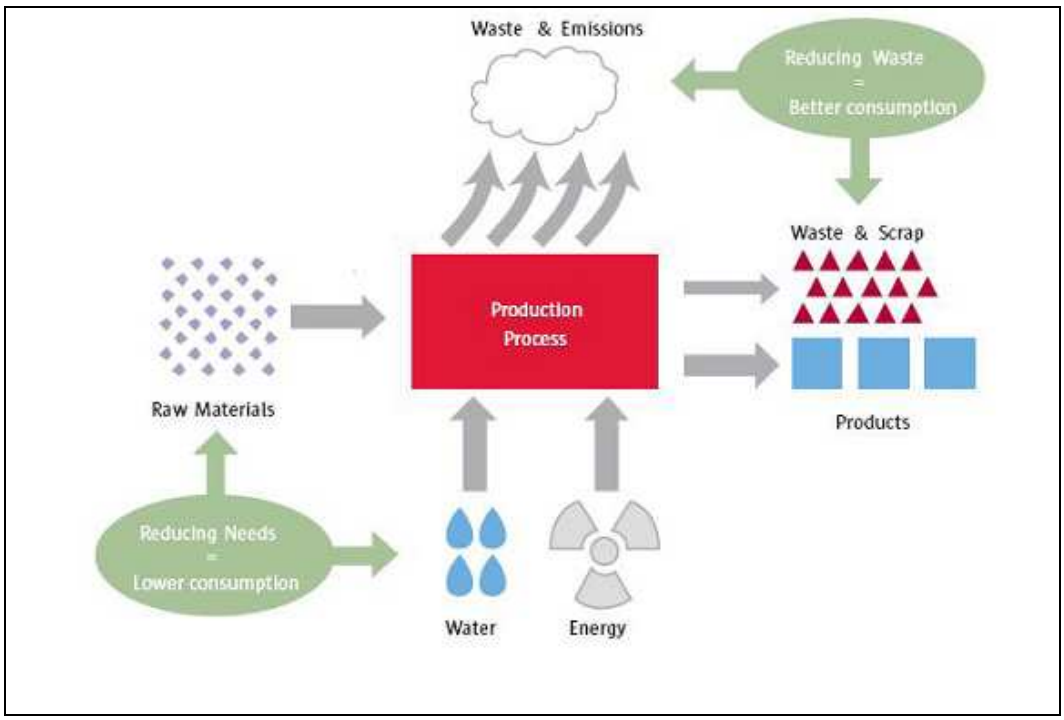

Figure 5-3: Green Manufacturing Process [124]

[123] refer to Hansmann, Kroger, 2001
[124] refer to How Mature is the Green supply chain. Supply chain Monitor, 2008

Companies are compelled to include suppliers if they want truly environmentally-friendly practices for purchasing and materials management, which is tantamount to "greening the supply chain".[125] One important task in supply chain management is cost control. The relevance of environmental aspects like waste avoidance becomes extremely visible when referring to the following interpretation of total cost:[126]

Total cost = (Labor, materials, overhead cost)-(Return from the sale of surplus materials)

Surplus material can relate to scrap, waste, obsolete or damaged stock, or surplus, obsolete, or damaged equipment. This point of view shows that environmental considerations do not necessarily only have to relate to certain government regulations, but that they instead are an important element of a firm′s objective of profit maximization.

As for the supply chain in particular, several authors agree to this interdependence of two important trends in operations management. On the one hand, firms increasingly integrate their supply chain processes in order to lower costs and add more value for the customer. On the other hand, more government regulation and a stronger public awareness require the integration of environmental aspects into a firm′s processes. Since companies must involve both suppliers and customers in order to achieve these goals, both trends are clearly not independent of each other.[127] There are various studies of more and more well-known companies that in fact as early as in the mid 90s made their first attempts to involve the supply chain to improve their environmental performance like e.g. British Telecom, Ciba Geigy, the retail company B&Q, Nissan U.K., Nortel, or Pilkington Glass.

Green supply chain management has emerged as an important archetype for companies to achieve profit and market share objectives by lowering their environmental risks and impacts and while raising their ecological efficiency. [128]

Basically, two different forms of environmental supply management can be distinguished:[129]

1. The integration of environmental criteria/standards into product and production related decisions along the whole supply process (“Greening the Supply Chain”)
2. The optimization of the environmental compatibility of purchased goods (“Product-Based Green Supply”)

Green supply refers to the way in which innovations in supply chain management and industrial purchasing may be considered in the context of the environment.[130] Environmental supply chain management consists of the purchasing function’s involvement in activities that include reduction, recycling, reuse and the substitution of materials. [131]

As the public becomes more aware of environmental issues and global warming, consumers will be asking more questions about the products they are purchasing. Companies will have to expect questions about how green their manufacturing processes and supply chain are, their carbon footprint and how they recycle.

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[125] refer to Walton, Handfield, Melnyk, 1998
[126] refer to Handfield, Robert , Nichols, Ernest,1999
[127] refer to Ibid.
[128] refer to Van Hock, Erasmus, 2000
[129] refer to Bowen, Cousins, Lamming, Faruk, 2001
[130] refer to Green, Morton, New, 1996, p. 188
[131] refer to Narasimhan and Carter, 1998, p. 6

A number of companies have shown that there is a proof of the link between improved environmental performance and financial gains. Companies have looked to their supply chain and seen areas where improvements in the way they operate can produce profits.

General Motors reduced disposal costs by $12 million by establishing a reusable container program with their suppliers. Perhaps General Motors may have been less interested in green issues if they were making record profits, but in an attempt to reduce costs in their supply chain, GM found that the cost reductions they identified complemented the company's commitment to the environment.

Companies can find cost savings by reducing the environmental impact of their business processes. By re-evaluating the company's supply chain, from purchasing, planning, and managing the use of materials to shipping and distributing final products, savings are often identified as a benefit of implementing green policies. [132]

5.2.2 Environmental Purchasing

Purchasing activities influence the quantities and types of resources consumed, and have a direct bearing on economic growth and employment. Purchasing function in relation with other functions has a greater role to play in environmental management performance of an organization. Also, the considerations taken into account in the sourcing of products and in the choice of suppliers affects the potential for abating environmental damage and making social progress in the supply chain.[133]

Ten years ago the environmental impacts of products and services flowing into organizations were neglected aspects of environmental performance. Purchasing was the poor relation of environmental activity. This situation is now being rectified. Purchasing and environmental professionals have begun to recognize the importance of the supply chain in the transition, over the long term, to a more sustainable world.[134]Purchasing is one of the main activities through which organizations can manage their environmental impacts

Materials and energy flow into organizations through their purchasing activities. The upstream impacts of these flows are diverse and, in many cases, environmentally significant. Energy purchases can directly affect the build-up of carbon-dioxide in the atmosphere; forest products can have a major impact on the world's biodiversity. Toxic materials can spread through the biosphere riding on the back of the supply chain. Beyond environmental sustainability lie the social concerns of poverty and child labour. Again, the supply chain is the point at which these concerns can be either reinforced or ameliorated.

Many organizations worldwide are making an effort to purchase products and services that are less harmful to local and global environments. Both public and private sector organizations are implementing purchasing practices that include environmental (and social) considerations — green procurement. Governments are realizing the benefits of green procurement practices such as cost savings from reduced energy consumption, resource use, and material management. They also reap more qualitative benefits such as improved image and achieving policy/program objectives.

[132] refer to http://logistics.about.com/od/greensupplychain/a/green_intro.htm (20.06.2009)
[133] refer to IEMA, CIPS, NHS, 2002, p. 4
[134] refer to Ibid., p. 1

Green Procurement is the purchasing of products or services which have a lower impact on the environment over their whole life cycle than the standard equivalent. It involves the integration of environmental issues into purchasing decisions based on price, performance and quality. This means that products or services that consume fewer natural resources should be given preference over competing products or services exerting a greater environmental impact. To prevent waste and pollution, these programs require considering environmental impacts, along with price, performance, and other traditional factors, when making purchasing decisions. [135]
The typical Green Procurement program elements are:

- Recycled content products,
- Energy efficient products and energy efficient standby power devices,
- Alternative fuel vehicles, alternative fuels, and fuel efficient vehicles
- Bio-based products,
- Non-ozone depleting substances,
- Alternative fuels and fuel efficient vehicles,
- Environmental Protection Priority Chemicals.

Leading private sector organizations have also demonstrated significant movement towards greening procurement practices. Many private firms are working to improve the environmental performance of their operations and products and green procurement has been a logical extension of this work. Private sector organizations have in the last two decades adopted green procurement practices for specific products (e.g., recycled-content office paper, renewable energy, paints, cleaners, etc.), but are also looking at the materials, substances and chemicals they purchase that go into the products and services they provide. In the private sector green procurement is seen as a means towards improving their products and operations from environmental perspective to reduce risk, total cost of ownership and improve supply chain performance. [136]

5.2.2.1 Pressures for Environmental Purchasing

Tendency of organization to integrate their supply chains in an attempt to reduce costs and be able to better serve their customers and changes in environmental requirements and public pressure on organizations have become a new trends in the business world. These trends together provide an opportunity to exceed environmental expectation of governments and customers through supply chain collaboration; these include an ability to see supply chain members' commitment to Environmental Friendly Practices.[137]

Many organizations have accepted the need to develop their environmental management capabilities. This has helped them to address a wide range of environmental issues in a formal and structured manner. The major external pressures for the implementation of environmental purchasing are listed below.

All these pressures have implications for an organization's financial position and are therefore major influences on the adoption of environmental purchasing:

[135] refer to Lacroix, p. 2
[136] refer to Ibid., p. 1
[137] refer to Walton, Handfield, Melnyk, 1998

- **Environmental Regulation and Legislation:** Much environmental legislation imposes limits or administrative controls on emissions from operational sites, such as air emissions, effluent discharges, noise and solid waste. In the last ten years, legislators have moved away from this 'command and control' approach towards the use of laws that give individual organizations more flexibility in the way they respond. Some of this recent legislation is having a direct effect on supply chains – for example:

  - The proposed Waste Electrical and Electronic Equipment Directive;
  - The proposed End-of-life Vehicles Directive.

  By directly affecting the market for products, legislation changes the context in which purchasing is carried out in public and private sector organizations. As the demands of environmental legislation increase, forward-looking organizations are taking action now to secure their futures.
  In addition, public sector purchasers in the European Union must operate within EU procurement rules. The European Commission has made it clear that there are numerous possibilities for integrating environmental considerations into public procurement.

- **Customer and Competitor Pressure:** Many corporate customers are looking for good environmental performance from suppliers and the goods or services they provide. Increasingly, customers want to know about the potential environmental impacts of products and services. Customers would not want to risk a tarnished reputation (or non-compliance to legislation) from the poor environmental performance of their suppliers and sub-contractors. Like all other forms of customer preference, this presents threats and opportunities, according to the response and that of the competitors.

- **External Benchmarks:** organizations are faced with a number of external benchmarks, for example:

  - Business in the Environment's Index of Corporate Environmental Engagement: The BiE Index, now known as the Environment Index, benchmarked companies against their peers, and against all companies that participated in the Index, on the basis of their environmental performance in key impact areas.[138]
  - Dow Jones Sustainability Index: The Dow Jones Sustainability Indexes are the first global indexes tracking the financial performance of the leading sustainability-driven companies worldwide.[139]

  For many large companies these external benchmarks have become major incentives for adopting environmental management policies and practices.

- **Investor Interest:** Investors are beginning to take account of the environmental performance of companies, with the prospect that good performance will attract investor loyalty over the long term. Companies with good environmental records are often seen as being better managed, with better control of the whole range of risks facing them.

- **Insurers:** In some cases companies with good environmental performance and an accompanying reputation find insurance more readily available and at lower premiums. Insurers in other areas are beginning to seek evidence that companies manage the environmental impacts of their operations.

[138] refer to http://www.bitc.org.uk/resources/publications/bie_index_of.html (27.06.2009)
[139] refer to http://www.sustainability-index.com (27.06.2009)

- **Community and Other Stakeholders' Concern:** The general public is increasingly concerned about the impact of corporate activity on the local and global environments. Large corporations can no longer take for granted their 'license to operate' from local communities, and many are now regarded as custodians of the environment. Also, many non-governmental organizations have grown in stature and reach to become more than just a threat to corporate image.

5.2.2.2 Benefits of Environmental Purchasing

Companies that decide to go along with environmental purchasing activities are experiencing tangible benefits. Strategic sourcing can create value through increased overall cost efficiency, enhanced reputation and market share, and reduced environmental risks and liabilities.[140]

Environmental purchasing also has a valuable role to play in the short term by: reducing corporate exposure to environmental risk, improving the security of key supplies, and driving environmental improvements along the supply chain. Whilst the benefits of environmental purchasing have to be weighed against costs and other commercial pressures, the environment cannot be ignored in modern day purchasing practice.[141]

The potential benefits of environmental purchasing are summarized below:

- Provide cost savings,
- Reduce waste and improve resource efficiency;
- Secure the supply of goods and services,
- Minimize business risks,
- Provide added value,
- Enhance corporate image,
- Create markets for new products and services,
- Competitive advantage through innovation,
- Easier compliance with environmental regulations.

While there are a number of other quantifiable benefits measured from green procurement, cost savings and risk reduction are perhaps the most universal across all types of industries and organizations. Qualitative benefits such as improved image, brand or ability to meet policy commitments is another key benefit and is of note in a business and public sector climate that is increasingly influenced by the public, nongovernmental organizations and employees that are well informed and educated around the environmental and social issues related to products and services. They often quantify direct costs savings, environmental benefits, money spent or estimate hidden or indirect savings.

5.2.2.2.1 To provide cost savings

Cost savings remains high on the list of priorities for many purchasing and supply chain professionals. The inferior quality of some early examples of so-called 'greener' products led many to believe that value for money was not achieved through 'greener' purchasing. But as quality has improved, organizations have been able to source products with better environmental characteristics using a whole-life costing approach, and have demonstrated that cost savings can be achieved.

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[140] refer to Lacroix, p. 4
[141] refer to IEMA, CIPS, NHS, 2002, p.1

By reducing supplier-generated wastes and surpluses, companies decrease handling expenses and risks associated with waste disposal.

Meanwhile, there is a growing body of evidence to suggest that an active environmental management process can bring about savings in operating costs – most notably through reducing waste. It could be argued therefore that suppliers with good environmental management could expect to be lower cost suppliers in the long run. Savings can be made by small and medium-sized companies as well as by larger enterprises.

5.2.2.2.2 To reduce waste and improve resource efficiency

Effective purchasing processes can make a significant contribution to reducing waste in an organization. This means that organizations should first ensure that they have the right purchasing structures and processes in place before tackling environmental purchasing. The role of the purchasing professional is to deliver value for money and ensure that money is not wasted. Where the amount of waste generated is large and waste management costs in an organization are high, there is likely to be substantial scope to improve purchasing practice, thereby improving environmental performance.

The aim of improving the efficiency of an organization's procurement and use of materials, energy and other inputs is central to modern purchasing management. This 'resource efficiency', or doing more with less, is also a key component of environmental management practice. Building collaborative relationships inside and outside an organization to drive resource efficiency forward is a key requirement which, when recognized, opens up opportunities for joint purchasing-environmental improvements.

5.2.2.2.3 To secure the supply of goods and services

Environmental regulations, such as the banning of certain dangerous substances, can have an impact on the security of supply of vital goods and services.
Purchasers need to be aware of potential implications for supply in time to source alternative materials or to ensure that existing suppliers can continue to meet their needs.

Suppliers may also come under pressure from customers to improve their environmental performance. Failure to make the necessary improvements may result in the loss of a particular supply contract or, at worst, the failure of the business. Business failure has ramifications for all of that business's customers. Thus environmental pressure in one part of the supply chain can affect suppliers and customers elsewhere.
Products with reduced environmental impacts can, however, present their own problems in terms of security of supply. For example, markets for products containing recycled material are still developing. Prices can fluctuate and availability might not be guaranteed at all times. These uncertainties should decrease as markets for environmentally-preferred products mature.

5.2.2.2.4 To minimize business risk

Some organizations have decided to view environmental supply chain management as a business risk. This is because the potential threats to security of supply posed by environmental issues justify such an approach.

A company can be exposed to business risks through the operations of its suppliers and contractors - for example, where contractors are in breach of environmental regulations. An additional risk to major corporations or high profile companies is that poor performance on the part of suppliers can result in unwelcome media coverage.

The increasingly global nature of business compounds the problem and adds further pressures on companies to address environmental performance in their supply chains.

Organizations need to understand the nature of the services provided to them and their associated environmental risks in order to be able to write a contract that deals effectively with them. Organizations cannot outsource their environmental responsibilities.

5.2.2.2.5 To provide added value

Purchasing has a role to play in delivering an organization's environmental and sustainable development objectives. It can add value by helping to stimulate markets for environmentally preferred goods and services, particularly through joint working and by encouraging suppliers to aim for continuous improvement across a range of issues, including the environment. The result is better quality products from better performing suppliers.

5.2.2.2.6 To enhance corporate image

Purchasers and supply chain managers can justifiably argue that corporate image is enhanced through environmental purchasing practice since it demonstrates to a wide audience that the organization is engaged with the consequences of its operations and activities. It is saying that an organization is looking beyond the 'factory gate' to the impacts of its products and services on the wider community. It is also saying that an organization is interested in these impacts over time, ultimately from 'cradle to grave', rather than only during their immediate use.

Greening its suppliers can contribute to a company's overall reputation among customers, investors, employees, and other stakeholders.

5.2.2.2.7 To create markets

Purchasers with significant buying power in particular markets can encourage suppliers to invest in new technologies, and develop new products with higher environmental specifications. They can also stimulate markets for:

- recycled products or those with a high recycled material content,
- new services delivering an equivalent function to the products they replace but at lower environmental cost.

5.2.2.2.8 Competitive advantage through innovation

Efficient production may be enhanced through suppliers' use of cleaner technologies, process innovation, and waste reduction. This is especially true when suppliers and customers work together to find new ideas.

5.2.2.3 Challenges of Environmental Purchasing

Green-procurement initiatives typically come with difficulties. Getting buy-in from suppliers often takes a concerted and persistent effort. Environmental managers may also encounter initial resistance to change from within their own company's procurement department.
Some environmentally preferable products aren't as readily available, may not meet performance specifications, or may not be cost-competitive**.** However, these products often outperform their less-green counterparts through improved efficiencies or favorable life-cycle costs.

Several challenges exist for organizations in implementing and stimulating environmental purchasing programs:

- **Estimating hidden costs and potential savings:** Total cost of ownership and life-cycle costing tools provide a means towards estimating potential benefits (e.g., reporting, material handling, and disposal), however, purchasing departments are often ill equipped to conduct such calculations. These calculations often require an in-depth knowledge of the products being procured and how they are used and disposed of.

- **Mis-informed advocacy groups:** One important challenge to green procurement as a whole is that well-intentioned environmental groups may not understand the full picture and will send conflicting messages. This can lead to frustration on the part of procurers and undermine the effort.

- **Lack of clear definitions:** Many procurement professionals and their organizations are still unaware, uncertain or struggling to define the term "environmentally preferable." This becomes particularly difficult when organizations need to balance multiple environmental attributes in their decision making.

- **Integration into management systems:** Decentralized organizations require consistent management systems to ensure consistent application of environmental initiatives. Many green procurement activities in the public sector have been bottom-up, initiated by small groups or individuals. Integrating gren procurement activities within a quality or environmental management system help ensure objectives, targets and measurement procedures are established throughout an organization.

- **Potential barriers to trade:** Globalization and international trade issues pose potential barriers to establishing procurement programs for both governments and private firms. Eco-labels have in the past, and likely in the future, will be discussed as a "barrier to trade" issue. There have been instances where ecolabeling has been designed to support certain products within specific markets. As a result, labeling organizations tend to use clear, science based, environmental criteria when establishing their programs.

- **Changing the first cost mindset:** A key challenge identified by many public and private sector organizations is changing behavior with the purchasing departments. In many instances, procurement is based on established supplier relationships, personal or brand preferences. First cost as the prime decision factor in purchasing. Many public sector organizations do not have purchasing practices that factor in total cost of ownership, or full life-cycle costs of the organization. Providing information and tools that will change these behaviors to favor environmentally preferable products will be key to overcoming the status quo.

- **Insufficient and incomparable environmental information:** There is often not enough environmental information available on certain products (e.g., Interface requires information on embodied energy of supplied materials, which most suppliers do not have). Making this information available in a manner that is relevant to procurement officers, procurement specifications and their decision-making processes is a further challenge.

5.2.2.4 Steps to Implement an Environmental Purchasing Program

5.2.2.4.1 Developing an Environmental Policy[142]

It is sensible to establish an environmental purchasing policy that provides a broad indication of how purchasing will do this. This is often developed as part of an overall environmental policy.

An environmental policy should address the organization's key impacts and be endorsed by senior management. Many business support organizations can provide assistance to companies, particularly small and medium-sized enterprises, wishing to develop a policy. In this way a policy can be established even by organizations with no environmental manager.

The environmental policy should reflect the nature of the business. For example, for a chemical company it should address the issues associated with producing chemicals, rather than focusing on the use of recycled paper or lease cars.

An environmental purchasing policy can take account of the results of any environmental reviews undertaken as part of policy development or carried out within an environmental management system. This can help to assess the significance of the indirect impacts of purchased goods and services.

Environmental purchasing can also be treated as an integral part of the corporate approach to purchasing and supply chain management.
An explicit environmental purchasing policy should convey a strong, clear message to suppliers and contractors about what the organization seeks and expects from them.

The policy itself should reflect the organization's overall environmental strategy and objectives. These objectives will vary according to the nature of the business, its supply chain relationships and the environmental pressures and opportunities affecting it. Those developing the policy need to bear in mind factors such as:

- organizational arrangements for purchasing, e.g. centralized or devolved,
- the size and buying power of the organization,
- the extent of influence of the organization in its major markets,
- public sector constraints on purchasing - where these are relevant.

The most effective approaches to environmental purchasing tend to be:

- integrated with an organization-wide environmental strategy,
- backed by senior level commitment and the allocation of responsibilities,
- well communicated throughout the organization,
- supported by clear objectives and targets,
- owned by those responsible for delivering them.

[142] refer to IEMA, CIPS, NHS, 2002, p. 16

In addition, in the more successful cases the roles of internal customers as well as purchasers are defined and understood; results are included in published reports; and savings are used to stimulate further actions.

5.2.2.4.2 Engaging with Stakeholders

Communication and dialogue with stakeholders in purchasing activities is an important part of implementing policy on the ground. Methods of communicating information on environmental purchasing within an organization can include:

- induction training for budget holders and internal customers,
- training and workshops on environmental purchasing,
- purchasing guides - these often provide information on 'green' products and services,
- newsletters - in electronic format and hard copy on new products, services and suppliers.

Organizations use a variety of methods to convey messages to the supply chain about environmental priorities. Methods are usually designed for each of the following stages in the purchasing process: specifications, invitations to tender, questionnaires, workshops, audits and visits, and contract review meetings.

Therefore, all those who are involved in purchasing decisions and who have contacts with suppliers need to be aware of, and to some degree involved in, environmental purchasing. In the course of routine dealings with suppliers, purchasers have opportunities to influence the process in a number of particularly important ways, such as:

- through the development of specifications and the environmental characteristics of the goods and services to be purchased,
- by choosing services in place of products and creating an opportunity for suppliers to offer more environmentally preferable options,
- by encouraging suppliers to invest in research and development or new production facilities in response to new environmental demands.

5.2.2.4.3 Prioritizing and Managing the Tasks

When introducing environmental purchasing, most organizations are immediately confronted with the environmental effects of a wide range of goods and services they currently buy as well as the suppliers and contractors supplying them. It can be difficult to know where to start. Those organizations with most experience in this area have found that trying to tackle every product and service and every supplier at the same time is a hugely resource-intensive task. Indeed, it is simply not an option for most organizations. A much more effective approach is to find a means of prioritizing actions. This usually means making a decision on two issues:

- which products and suppliers will be subject to most intense scrutiny, e.g products with high environmental risk,
- which products and suppliers will be examined first, e.g. business-critical products and suppliers.

For organizations starting out on this process, it is not enough to look only at high-spend products and services. Major environmental impacts can occur where expenditure is quite low. Similarly, companies cannot afford to concentrate solely on their largest suppliers, as small suppliers can have high environmental impacts. Purchasers and others involved in this process need to find an approach to prioritizing that is appropriate to their circumstances.

The types of products and services purchased and the manner in which purchasing is carried out vary widely between organizations. So too does the level of expertise within organizations. These factors are relevant to the choice of approach and include:

- the nature of the products and services purchased, such as products supplied to your own specification, finished products for office-based activities, and the services of sub-contractors,
- the organization of purchasing and whether it is centralized or devolved,
- the level of environmental expertise available in your organization.

There are a number of prioritizing approaches in environmental purchasing. Some bundle like-products together into ranges and categories and address common issues. One common feature amongst practicing companies is to identify the products and suppliers associated with the highest risk. This is defined by many organizations as a combination of the following factors:

- environmental risk, this might focus on the most energy-consuming equipment, and products containing hazardous materials,
- risk to the company's reputation or 'profile', this might focus on a waste management contractor who dumps the company's waste illegally,
- risk to security of supply, this might focus on strategically important suppliers with poor environmental performance.

Environmental purchasing can be seen as part of the process of managing business risk. In introducing environmental criteria to the process of acquiring goods and services, most organizations try to integrate the environment as closely as possible into routine business practice. It makes sense for 'the environment' to be seen as another aspect of commercial relationships with suppliers and contractors. Environmental factors can then be fully integrated into day-to-day purchasing operations.

5.2.2.4.4 Identifying the Need

In this and subsequent sections we describe the actions that can be taken by purchasers and supply chain managers at the key stages in the purchasing process. Figure 5-4 illustrates the stages in the process of acquiring goods and services at which environmental issues can be addressed.

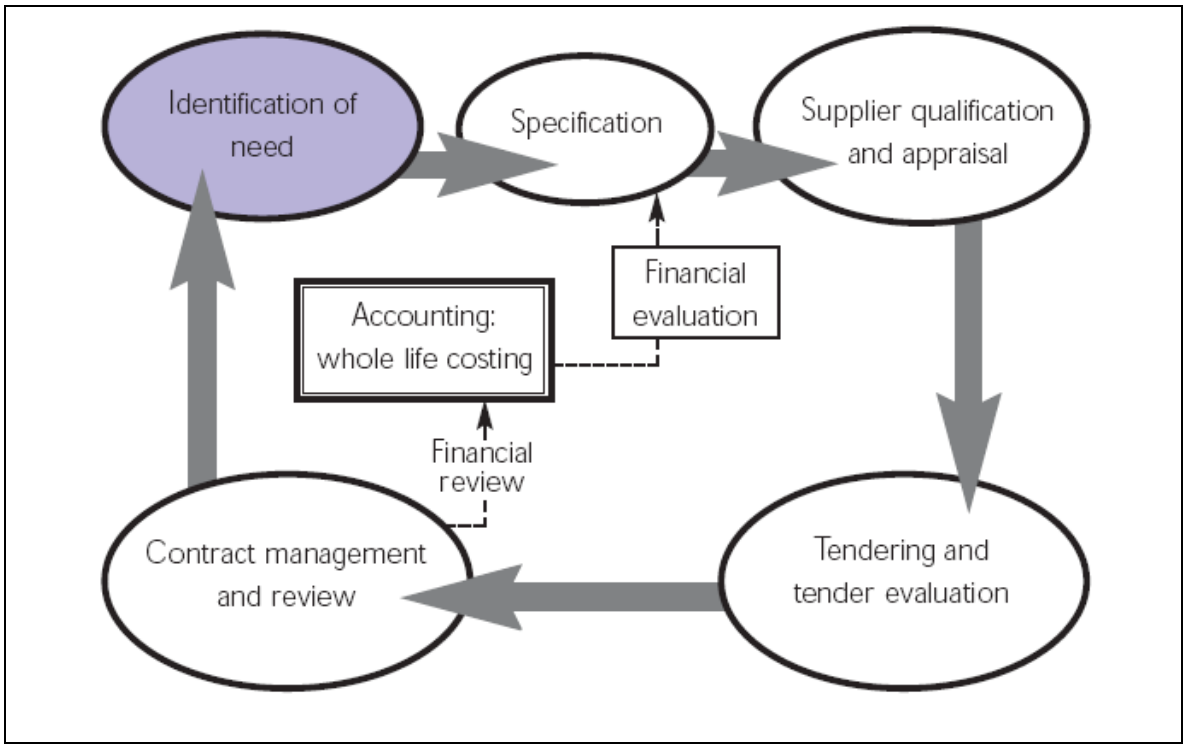

Figure 5-4: Addressing environment at key stages of the purchasing process[143]

Where purchasing and supply chain managers are involved in the very earliest stages of identifying what an organization needs to buy, they have the greatest opportunity to 'manage out' environmental impacts. At this early stage, purchasers and internal customers working together can re-examine the need for a purchase.

Effective environmental purchasing requires that 'repeat purchases' should be challenged and questioned. The more ambitious the environmental objectives to be achieved, the more this fundamental re-examination become a necessity. This approach is not radically new since good purchasing practice requires that fundamental questions are routinely asked about the value being delivered.
Purchasers and technical specifiers need to appreciate the environmental characteristics of the products and services they buy. This knowledge can be built up from a number of sources including:

- environmental expertise within the organization,
- information provided by suppliers,
- external sources of environmental information such as trade associations and government bodies.

By increasing the understanding of the environmental impacts of products and services currently purchased, purchasers and specifiers will be in a better position to assess the alternatives. This in turn helps in the development of new specifications.

[143] refer to IEMA, CIPS, NHS, 2002, p. 24

Those who might be involved in identifying need include:

- users - who can have significant knowledge of requirements, new and potential uses of products and services, and the market,
- environmental managers - who have knowledge of potential environmental impacts of products, services and alternatives, existing and forthcoming regulations and legislation,
- procurement managers - who have knowledge of products, services and the supply market, and can influence the development of new products and processes by suppliers,
- first and second tier suppliers - who can provide information on alternative products and services, and alternative means of delivering functionality.

5.2.2.4.5 Identification of the Specification

One of the most effective ways of reducing environmental impacts through purchasing is to focus on the specification of environmentally preferred goods and services. For example, by changing specifications organizations can:[144]

- manage out wastes such as packaging,
- reduce the amount of hazardous material in products,
- increase recycled material content of products.

Purchasers and those specifying goods and services can use national and international standards as an aid to environmental purchasing.

The process of introducing environmental criteria into purchasing usually involves moving away from writing technical specifications towards the development of performance or functional specifications. This means that required outcomes or functionality become the focus of the specification. This allows suppliers the freedom to offer innovative ways of delivering functionality, without being tied to a technical specification.

A useful introduction to environmental specifications is to be found in the 'International Council for Local Environmental Initiatives' Green Purchasing Good Practice Guide (ICLEI, 2001a) which discusses the use of Life Cycle Assessment to identify environmentally preferable products.

Life Cycle Assessment (LCA) considers, as the scientifically most reliable method, the environmental impacts of a product from its design to its disposal, taking into account all the steps in between including: raw material extraction, manufacturing, packaging, transport, storage and utilization. In the context of LCA, an 'environmentally preferable product' is a product that has the minimum environmental impacts throughout its lifespan, compared with other products or services serving the same purpose and having the same functional qualities.

This method of identifying green products is quite sophisticated and, hence, has its drawbacks. Information is not available for many product groups and for the situations in which they are manufactured and used. In addition, because they go into so much detail, LCAs can be seen as an inflexible and expensive tool, therefore it is likely to be inappropriate for most purchasing decisions. [145]

[144] refer to IEMA, CIPS, NHS, 2002, p. 28
[145] refer to ICLEI, 2001

The misuse of terms such as 'environmentally friendly' and 'recyclable' has led to a degree of cynicism by purchasers, and also to some attempts to address the issue. The International Standards Organization (ISO) has developed standards to bring some clarity to the meaning of the different terms. It has described three types of environmental product claims, termed ISO Type I, Type II and Type III, and has laid down some norms to try to regulate their use and the basis on which they are made.

5.2.2.4.6 Supplier Qualification and Appraisal

In most companies, greening the supply chain requires a comprehensive understanding of one's supplier relationships: which suppliers most affect environmental[146], health, and safety costs, risks, and reputation; which represent the greatest leverage points for efficiency and cost improvements; how to communicate effectively with suppliers on EH&S issues; and what are meaningful and verifiable means of tracking and measuring supplier environmental performance.[147]

Of growing interest and importance to the supply function is the environmental performance of suppliers.[148] A high level of environmental performance achieved by one firm may be broken down by a poor level of environmental management by its suppliers.[149] The issue, however, of how to address the environmental management practices of suppliers may prove to be a costly endeavour for the supply chain if not managed taking into consideration a number of important economic factors. To date there has been only been limited anecdotal discussion of the legitimate incentives for organizations to extend environmental management beyond their immediate boundaries. Typically firms have almost no legal responsibility towards the environmental activities of their suppliers. Customer firms may be liable for their purchased products or services, but they are not legally responsible for their supplier's other activities. [150]

Traditionally, environmental managers focus on the environmental impacts arising from the goods and services provided by their organization. But an organization should also take account of the impacts of goods and services it buys, including those of contractors working on its premises. Purchasing has a key role to play in delivering environmental objectives in both of these respects because:

- Those responsible for purchasing are at an interface with suppliers and contractors;
- They are well placed to gather data from suppliers and others on the environmental characteristics of products and services.

Purchasing and supply chain managers can expect to be more involved than ever before in helping their organizations to manage the environmental effects of bought-in goods and services. They are also likely to become increasingly involved in ensuring continuous environmental improvement amongst companies in the supply base, in areas such as risk assessment, prequalification and supplier development.

There is evidence to suggest that the purchasing function is conscious of the growing importance to the firm of its suppliers' level of environmental management practice .[151]

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[146] refer to Lacroix, Stamatiou, 2007
[147] refer to Lacroix, p. 10
[148] refer to Hall, 2000, p. 455
[149] refer to Faruk, Lamming, Cousins, Bowen, 2002
[150] refer to Ibid.
[151] refer to Lamming, Hampson, 1996

The problem for purchasing function, however, is how to monitor and develop suppliers in environmental management practice without incurring high transaction costs or disrupting the flow of production. Increasingly organizations have looked outside of the firm and to the performance of their suppliers in order to achieve supply chain scale reductions in costs, improvements to quality and service and the extended incorporation of environmental goals into products. In the supply chain management literature customer-supplier relationships have been growing in their significance as an important influence in attaining performance improvement and superior competitive advantage in the supply chain. Suppliers can have a direct impact on a customer's critical dimensions of cost, quality, technology, delivery, flexibility and profits. A well-developed and routinised supply relationship arguably encourages a joint approach to problem solving and leads to reductions in costs, improvements in quality and the import of new and critical knowledge.[152]

The relationship between a customer and its suppliers is promoted as an important facilitator for the successful long-term development of production systems and supplier capabilities.[153]

In the environmental management literature, recent articles indicate that the supply relationship is capable of leading to programmes of collaborative waste reduction, environmental innovation at the interface, cost-effective environmental solutions, rapid development and uptake of innovation in environmental technologies, and allows customer firms to understand better the environmental impacts of their supply chains.[154]

Supply relationships are dominated however, by the importance of cost, quality and delivery. Environment is rarely a critical task when matched against requirements driven by each of these three main supply needs. Supplier performance on environment is also likely to be at extreme risk of opportunism without the protection of appropriate safeguards and monitoring.

There are several benefits possible from a customer choosing to incorporate environment into the performance specifications of its suppliers. Examples include a reduction in the risks associated with chemical management and storage, more effectively meeting corporate social responsibility targets, benefits to the manufacturing system through improved process and opportunities for innovation. It increases the capacity of the customer to respond more rapidly to issues of environmental performance in suppliers and ultimately protect the firm's investments and its reputation.[155]

Also, corporate customers are placing demands on their suppliers that relate to the suppliers' environmental performance. The electronics and automotive sectors have been particularly demanding. For example, suppliers to General Motors have been advised of the requirement to achieve ISO 14001 and have been set deadlines for meeting that requirement.

For manufacturing and process-oriented firms, such as DaimlerChrysler, green procurement practices look at the materials, substances and chemicals in the products and services they provide. Subsequently, this approach looks beyond the company's "gates" to include the materials, substances and chemicals its suppliers use. In ongoing efforts to reduce costs, leading companies use life-cycle assessment and material tracking tools to identify materials, substances and chemicals in their products that pose significant environmental, health and safety risks and re-design their products to reduce or eliminate such materials.

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[152] refer to Dyer, Nobeoka, 2000
[153] refer to Scannell, Vickery, Droge, 2000
[154] refer to Geffen, Rothenberg, 2000
[155] refer to Simpson, Damien, 2005

Often, the risk of using a material of concern is associated with quantifiable costs to the company (e.g., NPRI reporting costs), its suppliers (e.g., special handling and transport costs), the user (e.g., costs for protective equipment and training) or end-of-life processor (e.g., hazardous waste disposal costs) [28]. Leading companies have been able to capitalize on reducing these risks to reduce costs and achieve business benefits.

General Motors of Canada works with suppliers and dealers to establish pollution prevention practices that reduce environmental impacts and operational costs. By purchasing 6,650 reusable crates and pallets to deliver plastic parts to dealers, the company has eliminated the need for roughly 266,000 cardboard crates per year.

5.2.2.4.6.1 Green Supplier Selection

Supplier selection is a process of selecting key suppliers based on a pre established set criteria; it is a useful and an objective way of deciding the right members to deal with in the supply chains. An organization may use Standardized selection criteria or any criteria arising from the organization's core processes requirements. Standard selection criteria generally intend to cover issues such as quality, capacity in terms of finance, services, and equipments, quantity, responsiveness, and others. Green supplier selection criteria arise from an organization inclination to respond to any existing trends in environmental issues related to business management and processes.

This aspect relates to the fact that an increasing number of companies select its suppliers not only on the basis of quality, cost, or service, but also based on an environmental record of the supplier. This record might e.g. relate to the supplier′s source of raw material, his disposal methods, his efforts to reduce surplus packaging or fuel usage, or whether environmentally friendly practices are in place in order to reduce costs.

Zhu and Geng[156] argue that purchasers are key personnel for ensuring environmental preferable decisions in supplier selection and that they are best placed and best qualified to adopt a more environmental friendly purchasing practice.

Purchasing can impact many areas including Materials used in product design, Product design processes, Supplier processes, Supplier evaluation and selection, Materials delivery.[157] Having seen the significance of collaborative supply chain and centralized purchasing in environmental management performance it is now obvious that deciding which suppliers to collaborate with and how to select suppliers is a very crucial decision for the organization performance. Incorporation of objective environmental criteria in the evaluation systems will ensure higher environmental performance in the collaborative supply chains.

Green Supplier Selection Criteria

Green supplier selection criteria may be developed with intent of focusing on meeting government regulations, focusing on process improvement, and focusing on buying company's environmental policy. Humphreys[158] categorize the green criteria into two groups of Qualitative and Quantitative Criteria. Depending on whether an organization is using a reactive or proactive environmental management strategy, one or both groups of criteria may be used at the same time. Figure 5-5 illustrates the environmental framework for incorporating environmental criteria into the supplier selection process.

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[156] refer to Geng, 2001
[157] refer to Humphreys, 2003
[158] refer to Ibid.

- **Quantitative Environmental Criteria**

These criteria are based on the cost in monetary terms. A potential supplier may incur costs investing in environmental management of its processes or it may be a source of environmental costs because of its destructive processes.

- Pollutant costs / effects: Representing environmental costs caused by a potential supplier.
- Improvement cost: Represent the degree of commitment the supplier has in environmental management.

- **Qualitative Environmental Criteria**

These are more subjective criteria and their application depends on the weight given to each one depending on its importance to the organization or industry and total points score obtained on the bases of the measured parameters.

- Management competences
- Green image
- Design for Environment (DFE)
- Environmental Management Systems
- Environment competencies

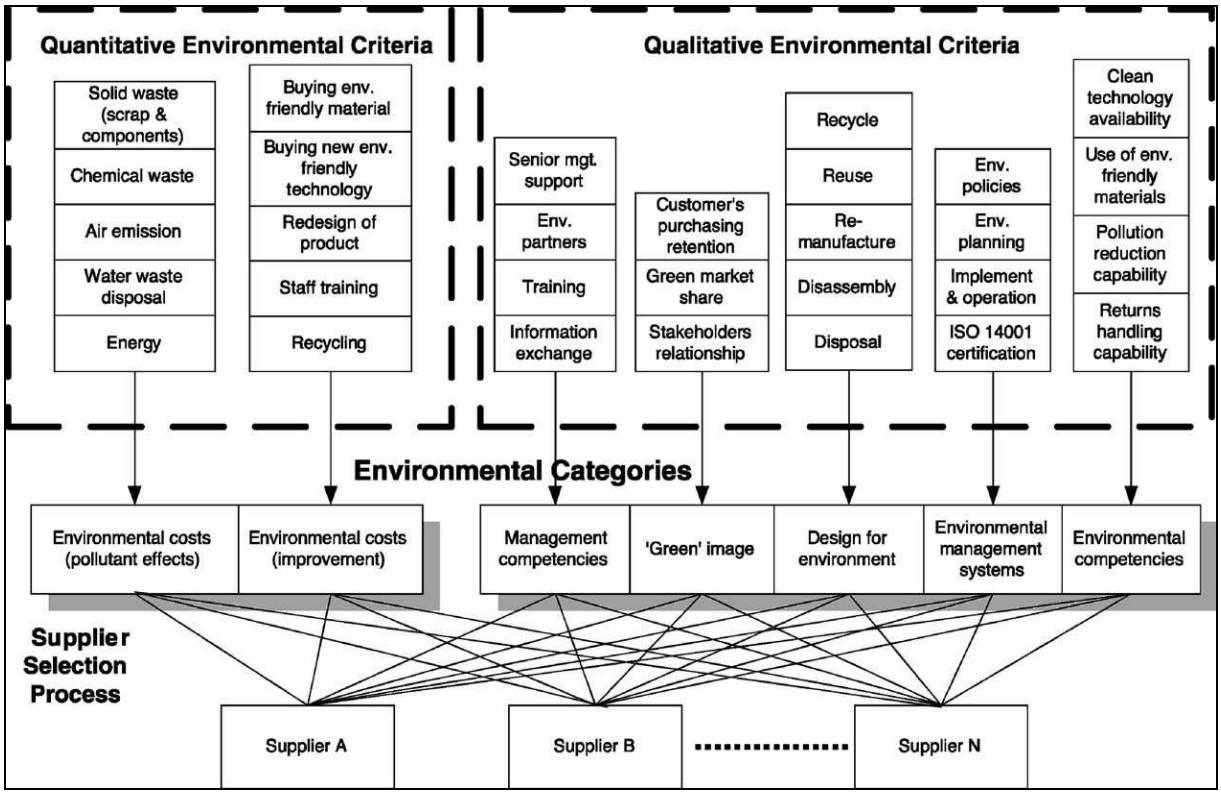

Figure 5-5: Environmental framework for incorporating environmental criteria into the supplier selection process[159]

[159] refer to Humphreys, 2003

5.2.2.4.6.2 Pre-qualification

Most organizations use a set of criteria - often on a pass/fail basis, to ensure that suppliers meet their standards. 'Pre-qualification' involves a company vetting potential suppliers of goods and services to identify those able to meet the required standard. In the private sector this typically results in being placed on a list of 'approved' suppliers. Purchasers are then able to buy from companies on the list.
Many organizations now include environmental factors in their prequalification criteria. This is one simple approach to integrating environmental considerations into purchasing.

5.2.2.4.6.3 Supplier Appraisal

Many companies now recognize that their environmental performance and public profile are heavily influenced by the environmental performance of companies in their supply chain.
Supplier appraisal is a procedure routinely used by purchasing professionals. It can be extended to appraise a supplier's impacts on the environment, and the extent of a supplier's engagement with environmental issues. The telecommunications company BT provides an early example of a company taking account of the environmental impacts of its suppliers. A large proportion of BT's environmental impacts are associated with bought-in goods and services, and the company introduced an environmental impact Standard known as GS13 for its suppliers. The BT document states that it was developed to help BT's suppliers to deal with the relative environmental impacts of their products and services. The document is intended to help suppliers focus on areas for improvement and forms part of the adjudication and contract review process.

In fact, a study found that already in 1997, more than 40% of the analyzed supply chain managers included such an environmental performance of suppliers into their formal supplier monitoring.[160]

Some of the questions that a firm′s purchasing manager should ask the supplier in order to test his environmental competence might be the following:[161]

- What is the supplier′s level of commitment to environmental quality? Has he developed an adequate environmental management and auditing system? Does he practice lifecycle environmental accounting?
- What evidence is provided of his improvement efforts in resource conservation, recovery and recycling, elimination of toxics, ozone depleting substances and greenhouse gases?
- What efforts has a component supplier made to enable product modularity and component recovery and reuse? Has he adopted engineering practices such as simplified joining or fastening technology, part identification and separability, and avoidance of labels, paints and finishes?
- Has he demonstrated a commitment to reducing energy use, both in his manufacturing operations and in the power requirements of his products?
- Is he working toward pollution prevention through programs such as process waste minimization or packaging reduction and recycling? Does he take a collaborative approach toward supporting our own product take back and recycling efforts?
- Does he provide helpful information regarding safe and environmentally benign use, handling and disposal of his products?
- Are the supplier′s costs higher than those of competitors, potentially signifying that he has had to pay environmental cleanup fines in the past?[162]

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[160] refer to Edwards, 1997
[161] refer to Fiksel, 1995
[162] refer to Walton, Handfield, Melnyk, 1998, p. 211

But the role of the purchasing manager goes even beyond these questions. In fact, the purchasing department must be seen as the gatekeeper of the company who has a major influence on the quality of the materials that enter the firm, both in terms of technical and environmental quality. Therefore, it is also his job to analyze whether a specific material or supplier bears certain risks such as a raw material no longer being available in the near future or being prohibited for environmental reasons.

Especially in process-intensive industries, these monitoring activities are crucial to lowering the own firm′s risk, as sometimes the usage of certain materials or processes by a supplier might even cause a certain liability for the purchasing company, which might result in expensive lawsuits.[163]

On a more abstract level, this transfer of environmental concerns from the purchasing to the supplying company represents a normative conceptualization of the supplier / buyer relationship. This shift is again comparable to some of the ramifications of quality philosophies, which require the supplier to make necessary technological adaptation, so that the purchaser can rely on a certain quality level (in this case, an environmental quality level).

The questionnaire is one of the most widely employed techniques in appraisal, although its use is not always problem-free. Table 5-3 below shows a typical range of questions contained in a supplier environmental questionnaire:

[163] refer to Fiksel, 1995

Environmental Management Questionnaire

i. Does your organization have a named officer responsible for Environmental Management? **Yes/No**
If 'yes', please state the name, position and qualifications of that person:
Name:
Position:
Qualifications:

ii. Does your organization have an Environmental Policy? **Yes/No**
If 'yes', please enclose a copy

iii. Does your organization have in place an Environmental Management System? **Yes/No**
If 'yes', do you have any objection to this being inspected? **Yes/No**

iv. Does your organization hold either of the following accreditations?
EMAS **Yes/No**
ISO14001 **Yes/No**

v. Has your organization compiled a register of environmental regulations and legislation relating to your business operations? **Yes/No**
If 'yes', do you have any objection to this being inspected? **Yes/No**

vi. Has your organization compiled an environmental effects register? **Yes/No**
If 'yes', do you have any objection to this being inspected? **Yes/No**

vii. Do you have an environmental action plan in place to reduce your adverse impact on the environment? **Yes/No**
If 'yes', do you have any objection to this being inspected? **Yes/No**

viii. Outline on a separate sheet the specific environmental impacts associated with providing the product/service and what steps are being taken to minimize them.

Table 5-3: Environmental Management Questionnaire[164]

The Value of Questionnaires

Questionnaires are often used to gather information on supplier environmental performance and the environmental effects of products and services because they:

- are a familiar technique to purchasing professionals,
- can appear to offer a cost-effective means of gathering information, particularly where one questionnaire is used for all circumstances,
- can produce substantial amounts of data on suppliers and products.

They can be used at the pre-contract stage to influence the tendering process or post contract as part of contract management. To be an effective purchasing tool, supplier questionnaires need to be carefully designed. Those using them need to know exactly how the responses from suppliers fit into the purchasing process as a whole, especially when the questionnaire asks about environmental factors. Suppliers need to know this too.

[164] refer to IPF, 2001

5.2.2.4.6.4 The Environment Agency's Supplier Environmental Evaluation Model - for high-value/high-risk contracts

The elements of the evaluation matrix, shown in Table 5-4, have been chosen to represent the key measures of the environmental maturity or capability of suppliers. Each statement in the matrix reflects a different level of environmental capability.

The supplier is sent a pack containing a copy of the matrix with which to assess his own capability, and providing the necessary justification for the score assigned on a separate sheet. (see Table 5-5) The supplier is also sent a questionnaire seeking a range of evidence on the policies and organization of the company - the questionnaire links into the matrix headings.

The Agency Procurement Officer and the Environmental Management Unit staff, as appropriate, will then assess the evidence provided, together with the statements made in support of the self assessment. The result of the assessment should be a score for each element, which can then be transferred to a simple profile chart.

In most cases the questions can be linked directly to each of these profile attributes (for example, element 4 of the matrix on Environmental Management Systems links closely to question 4 on the form). The EA will need to use any information provided by the supplier to support and justify the capability levels assigned to a supplier. Thus, question 5 regarding communications would be assessed by taking into account any evidence provided in response to the questionnaire.

- **Constructing the Profile**

Once the supplier's score has been determined (levels 1 to 5 for each element), the resulting mark is transferred to the chart, producing a graphical representation of their environmental capability profile.

The second line on the chart identifies the supplier whose profile is considered to be 'best in class'. This can then be used as the target for all other suppliers to aim for to ensure ongoing improvements in environmental performance.

The third line is the preferred profile for suppliers. This is defined internally, so the Agency needs to decide what constitutes a realistic target for suppliers of that product or service. This will not preclude suppliers from achieving 'best in class' status, but will be seen as a target to be reached by all suppliers.

- **Categorizing of Suppliers**

The profile can be used to determine where each supplier fits within the Agency's marketing strategy to target effort on environmental improvements to the supply chain.

A supplier who is assessed predominately at Level 1 will generally be seen as being UNAWARE within the definition in the marketing plan. This will usually mean that the company has made no real effort to consider the environmental impact of supplying the products or services. It is likely to be primarily price-focused or cost-focused in those areas that offer a direct return to the business (for example, energy consumption). Any environmental benefits will only arise as a by-product of the cost or production changes implemented by the business to maintain its market competitiveness.

A supplier who is assessed predominately at Level 2 or 3 will be seen as a SETTLER. The supplier will generally be aware of environmental issues associated with any product or service provided and will be looking to incorporate their impact into the production and purchasing activity. The extent to which they are included will depend directly upon the individual's commitment to or influence over the business policy. The basis of any consideration will be either risk avoidance, in the case of pollution and potential prosecutions, or cost reduction, in the case of energy consumption and waste minimization.

A reactive rather than pro-active approach is likely and there will be wide variations across the total business operation. The level of personal commitment to environmental issues is the key driver in determining the extent to which the business incorporates environmental issues into its everyday operations. Personnel in the business will probably give personal views on what is being done rather than referring to an organizational strategy. Initiatives will be specific to functions and their benefits will be uncoordinated.

A supplier who is assessed predominately at Level 4 or 5 will be seen as a PIONEER. The supplier will be fully familiar with the concept of environmental impact analysis and will always include appropriate environmental considerations in their own purchasing decisions. They will have a formal method of evaluating performance, possibly using a formal environmental management system and the company will be either registered or working towards ISO 14000 registration. Each department will have its own internally developed targets aligned to an overall organizational target with clearly defined associations to the business objectives. There will be a formal audit of performance, either internally or externally based, and a good system of communication of achievements and reporting methodology. (see Table 5-6)

Element	Level 1	Level 2	Level 3	Level 4	Level 5	Score
Policy (1)	No policy	An unwritten set of guidelines	Unadopted environmental policy set by departmental manager	Formal policy but no active commitment from top management	Environmental action plan and regular review with commitment from top management	
Organization (2)	No environmental management or any formal delegation of responsibility for environmental impact	Environmental responsibility is the part time function of someone with limited authority or influence and no reporting requirement	Environmental responsibility post reporting to adhoc committee line management and authority unclear	Environmental manager accountable to environment committee chaired by a board member	Environmental management fully integrated into Management structure with clear delegated authority	
Review (3)	No review undertaken	Informal review of limited areas of the company	Review of organization undertaken, no follow-up actions taken	Formal review of all company operations, actions plans agreed and supported by management	Formal review undertaken on behalf of board, action plans signed off by board as part of integrated management plan	
EMS (4)	No EMS in place	Processes in place for individual impact areas, no coordinated systems	EMS available to all parts of company, but no requirement to implement, or report on specific areas	EMS in place across company, reporting required, regular review of performance by top management	EMS fully integrated into business, regular review of performance by top management and supplier evaluation programme	
Communi-cation programme (5)	No Communications plan in place	Informal plan in place for company	Formal plan in place for company	Formal plan in place for company with ad-hoc Communications with support	Comprehensive plan in place covering staff and suppliers	
Audit programme (6)	No audit programme	Informal review of processes as part of other audit regimes	Formal audit of all compliance issues and general audit of other processes	Formal audit of EMS against policy and performance targets	Externally verified audit of EMS against policy and Performance targets	
Reporting (7)	No external reporting	Annual report and accounts includes the company environmental policy statement	Annual report and accounts includes a review of Environmental activity	Annual environmental report published as part of company external reporting	Annual environmental report published as part of company external reporting including external verification of audit findings	

Table 5-4: Supplier environmental evaluation matrix[165]

[165] refer to IEMA, CIPS, NHS, 2002, p. 84

Profile element	Score	Justification
Environmental policy		
Organization		
Review		
Environmental Management Systems		
Communications programme		
Audit programme		
Reporting		

Table 5-5: Justification for self-assessment by supply company[166]

Profile element	Level 1	Level 2	Level 3	Level 4	Level 5
Environmental policy					
Organization					
Review					
Environmental Management Systems					
Communications programme					
Audit programme					
Reporting					

Supplier
Best in class
EA profile

Table 5-6: Graphical Profile of Supplier Score[167]

5.2.2.4.6.5 Supplier Vetting and Auditing[168]

Organisations may audit their suppliers and prospective suppliers at different points in the purchasing process, using a variety of approaches.
Auditing can be carried out by environmental specialists, but most organizations do not employ this type of specialist in-house. Frequently, environmental auditing is combined with other forms of auditing, particularly quality auditing. Environmental questions may be added to existing auditing routines. Some corporate customers audit their suppliers' performance even when those suppliers have achieved certification to an environmental management systems standard.
Some leading companies have recently begun to re-design its supplier appraisal system to bring together its health, safety and environmental systems, and to give responsibility for assessing significant aspects of environmental performance to in-house auditors. This has considerable training implications for the company, but ensures that a much fuller picture is available on which to evaluate suppliers, since the company already operates a supplier assessment system which includes reference to environmental performance.

[166] refer to IEMA, CIPS, NHS, 2002, p. 85
[167] refer to Ibid.
[168] refer to Ibid., p. 47

5.2.2.4.7 Tendering and Tender Evaluation

Organisations can incorporate their own environmental priorities into tenders for goods and services. This helps to make environmental purchasing an integral part of business operations, particularly where environmental criteria are used alongside traditional purchasing criteria such as quality, delivery and fitness for purpose.

Tender evaluation criteria can be set by internal customers and purchasers working together. Potential suppliers will appreciate the signal being sent by key customers if environmental criteria are explicitly part of the routine of purchasing practice

Companies implementing environmental purchasing strategies need to set out contract award criteria for the benefit of suppliers competing for their business. Many companies apply weightings to environmental and other criteria used in evaluating competing bids and these are usually made clear to potential suppliers. So, it is possible that environmental factors may be given a higher weighting in purchasing arrangements for products and services where there is a high degree of environmental risk.

In order to determine which tender should be considered to be the most economically advantageous, the contracting authority has to indicate beforehand the criteria to be applied.

The most economically advantageous tender
Examples of the criteria that may be applied in order to determine the economically most advantageous tenders are:

- price
- delivery date
- delivery period
- period for completion
- running costs
- cost-effectiveness
- quality
- aesthetic and functional characteristics of the goods or services
- after-sales service
- technical assistance
- profitability
- technical merit

As a general rule, the EC Public Procurement Directives impose two conditions with regard to the criteria that are applied for determining the most economically advantageous tender. First, the principle of non-discrimination has to be observed and second, the criteria applied shall generate an economic advantage for the contracting authority. Economic considerations can include aspects of environmental protection such as the energy consumption of a product.

The common factors shared by all criteria used for the evaluation of tenders are that they must relate to the nature of the work to be carried out and the manner in which it is done. The criteria should give the contracting authority discretion to compare the different tenders objectively and to accept the most advantageous on the basis of objective criteria. The purpose of the assessment is to establish which tender best fulfils the needs of the contracting authority. Therefore, the function of the award criteria is to assess the intrinsic quality of the tenders. This implies that the award criteria have to be linked to the subject matter of the contract.

5.2.2.4.8 Contract Management and Contract Review

Organisations seeking to drive improvements in their supply chains need to ensure that environmental considerations are integrated into the contract management and review process. This involves setting targets for environmental performance improvements by suppliers and contractors over the course of a contract.

Where organizations engage in long-term commercial relationships with suppliers, it is important to convey the message that environment is a priority for the customer. This could encourage suppliers to bring forward innovative solutions to environmental problems. Knowing that major corporate customers will continue to treat environmental improvement as a serious issue gives suppliers confidence to invest in process improvements, research and development. Contract management and review, linked to the achievement of targets puts the environment firmly on the commercial agenda and has the effect of 'ratcheting-up' environmental improvements along supply chains. Many companies now use key performance indicators (KPI) to measure their own performance and that of their suppliers. Contract management using KPIs for suppliers helps to maintain focus on targets for improvement.

5.2.2.4.8.1 Environment as Part of the Review Process

Contract management and review, linked to the achievement of targets puts the environment firmly on the commercial agenda and has the effect of 'ratcheting-up' environmental improvements along supply chains. Many companies now use key performance indicators (KPIs) to measure their own performance and that of their suppliers. Contract management using KPIs for suppliers helps to maintain focus on targets for improvement.

Targets for environmental improvement in the supply chain can cover the whole spectrum of environmental impacts from raw materials sourcing through production, transportation and use, to options for end-of-life management.

5.2.2.4.8.2 Working with Suppliers

Customers can require performance improvements of their suppliers, but they can also involve suppliers in reducing environmental impacts by joint working. The improvements made by suppliers themselves frequently include changes to processes and production methods that have the effect of reducing emissions and waste. Depending upon the performance of suppliers at the beginning of a long-term contract or commercial relationship with a customer, these measures can help suppliers move from non-compliance (in extreme cases) through compliance to leading-edge environmental performance.

Many initiatives involve a certain amount of joint working, where suppliers can collaborate in meeting objectives defined by their major customers. Joint improvement targets typically involve:

- reducing packaging weights and volumes,
- introducing reusable and returnable packaging,
- reducing the hazardous material content of products,
- examining purchasing order quantities and delivery frequency,
- improving delivery scheduling to reduce impacts from transportation.

Many companies with major influence over their suppliers, such as in the automotive sector, set target dates for their suppliers to achieve environmental management system certification. The commercial threat of losing significant business drives suppliers to meet these environmental standards. The automotive sector has encouraged improved environmental performance along supply chains.

For some companies, particularly the small and medium-sized enterprises, achieving EMS certification can seem a daunting prospect. In recent years, corporate customers have directed their suppliers towards sources of support for achieving ISO 14001.

Volvo Cars - Suppliers Crucial to Product Improvement
Since as much as 65-70% of the added value of a Volvo Car is contributed by our suppliers, their environmental performance is also crucial. As a consistent leader in the area, Volvo Cars was very clear on this aspect when it introduced its environmental requirements for suppliers and contractors for the first time in 1996.

These have been observed conscientiously by our suppliers. To meet Volvo Cars' requirements suppliers must, for example, comply with our requirements when specifying chemical products. In addition, all suppliers of production materials to Volvo Cars will be required to have implemented an environmental management system by the year 2000 and all suppliers and contractors will have to meet this requirement by 2002. As a support measure, Volvo Cars is offering environmental training designed specifically for suppliers and contractors.[169]

5.2.2.4.9 Accounting

A major issue for many organizations seeking to introduce environmental purchasing is the apparent constraint imposed by budgetary and accounting regimes. Environmentally preferred purchases are often more cost-effective in the long term, while accounting regimes require savings to be demonstrable over a much shorter period of time. Short payback periods and environmental purchasing can be hard to reconcile. This is where accounting regimes need to be sufficiently flexible to allow whole life costing exercises to deliver both cost savings and environmental improvement.

In some organizations, financial directors may need to be persuaded, sometimes by purchasers, of the benefits of environmental purchasing to their organizations. Allowing budget holders to retain savings generated through environmental improvements in purchasing gives them an incentive to make further savings, but it can take time and effort to find opportunities to save money and improve environmental performance.
Environmental purchasing is stimulated or constrained by how budgets are allocated. When resource allocation takes account of all of the costs associated with the purchase, use and disposal of products and services, the business benefits of environmental purchasing begin to be revealed

The costs associated with a purchase will include costs which are often 'hidden' within overheads. All of the costs associated with the purchase, use and end-of-life management of a product should be transparent and should be fed back to those responsible for making purchasing decisions. The results of whole life costing exercises need to be fed back to decision makers. This has implications for management information systems. When organizations are able to identify and trace these costs back to the point of purchase, the 'environmentally preferred' product is often found to be the most cost-effective option. But organizations working without this level of detail cannot identify the hidden costs or the opportunities they are missing.

[169] refer to http://vcc.volvocars.se/environment/management/suppliers.asp (30.06.2009)

5.2.3 Integrating Environmental Purchasing Into Environmental Management System

Due to customers‘ varying product use, all suppliers are faced with the issues associated with corresponding production changes and product formulations. Through the application of environmental management systems such as ISO 14001, each production combination and customer application can be better evaluated for possible environmental consequences. These then can be more effectively managed to assure business interests are best addressed.[170]

More and more firms have begun to voluntarily adopt ISO 14001 as a tool for continuous improvements to meet the goals of sustainability. At the same time, these firms have also encouraged their suppliers to apply for the certification of ISO 14001 and to regulate the certification as a minimum requirement in selecting suppliers.[171]

Many companies with major influence over their suppliers, such as in the automotive sector, set target dates for their suppliers to achieve environmental management system certification. All of the major automotive companies have recognized the value proposition that ISO 14001 can bring within their supplier relationships. They have imposed the requirement that their Tier 1 suppliers achieve ISO 14001 certification for all facilities that directly produce products for them. Ford Motor Company requires at least one supplier location to have achieved certification by December 31, 2001 with the remaining facilities completing their certification by July 2003. General Motors set the deadline of December 31, 2002 for all Tier 1 supplier facilities with DaimlerChrysler establishing the completion date of January 1, 2003. Other automotive companies such as Honda of America, BMW and Toyota, have similar supplier recommendations or requirements. [172]

Environmental purchasing is increasingly being used as an effective tool to mitigate the environmental impacts of consumption and to promote the development of clean production technology (Am Prospect 11 (1992) 71). For environmental purchasing to be fully effective, the link needs to be made with environmental management systems such as ISO 14001. This can be done most effectively in the assessment of significant environmental aspects. The assessment of bought-in goods and services should consider the potential environmental impacts of suppliers’ and service providers’ actions and processes, and it should also consider the environmental impacts associated with products themselves and their constituent materials.

Compliance with environmental legislation and standards affecting products and product life cycle issues should be identified by the organization’s management system procedures. Where compliance with legislation or standards requires some form of supply chain management, the EMS programme should include such activity.

The Table 5-7 below addresses the elements of ISO 14001 in the context of environmental purchasing and provides examples and success stories from organizations that support recommendations for integrating environmental purchasing into EMS.

EPP: Environmentally Preferable Products

[170] refer to Medykowski, Harris, 2002, p. 22
[171] refer to Chung, 2004
[172] refer to Ibid.

ISO 14001 Element	Environmental Purchasing Component	Example
4.2 Environmental Policy	A conforming Environmental Policy Statement can include environmental purchasing, by reference, in the commitments to compliance with legal and other requirements and prevention of pollution. An organization also may include a more direct environmental purchasing commitment, such as: "Organization will consider environmental factors in all purchasing decisions and will give preference to those products and services, that have a lesser or reduced effect on human health and the environment when compared with competing products or services that serve the same purpose."	**US Department of Agriculture (USDA), Agricultural Research Service (ARS), Beltsville Area:** USDA's ARS Beltsville Area operation already has implemented a separate EPP Policy in support of its EMS. Environmentally Preferable Products and Affirmative Procurement Policy, dated February 6, 2003 states: "It is the responsibility of all employees of the Beltsville Area to ensure that environmentally preferable products and services are actively pursued when purchasing. Green purchasing/affirmative procurement includes, but is not limited to, recycled-content products, biobased products, and energy-efficient products. This applies to all purchases including micro-purchases (less then $2,500)."
4.3.1 Environmental Aspects	The procedure to identify environmental aspects and significant impacts must be applied to procurement (purchasing) and contracting as activities that is controlled or influenced. Other activities also may have procurement-related aspects, such as the purchase of products or services that consume resources and/or generate wastes. Procurement and contracting personnel and key purchasers can be included in identifying and ranking aspects and impacts. It must be considered Including compliance with procurement-related legal and other requirements among the criteria for determining significance.	**USDA, ARS, Beltsville Area** USDA, ARS states that environmental purchasing was among the criteria used to evaluate the significance of their environmental aspects. The aspects and impacts analysis allowed them to identify opportunities to create an alliance between their ongoing agricultural research and the use of biobased products in their day-to-day operations.
4.3.2 Legal and Other Requirements	A conforming legal and other requirements procedure should identify all procurement-related laws, and regulations.	
4.3.3 Objectives and Targets	Organization can determine realistic environmental purchasing objectives for each appropriate significant aspect, based on the commitment to pollution prevention, legal and other requirements, significant aspects, and mission requirements.	

	It must be considered targeting all purchases over a threshold amount, based on environmental impact and the amount of influence the facility has over the product or service provider(s) Measurable environmental purchasing targets can be established that can be accomplished within a reasonable timeframe. For example: **Objective:** Improve environmental purchasing practices. **Targets:** • Provide environmental purchasing training to procurement staff. • Identify opportunities to purchase green products and services. • Conduct employee awareness training on the purchase and use of green products and services and participation in recycling programs.	
4.3.4 Environmental Management Programs	Establish programs to pursue environmental purchasing objectives and targets and define a timeframe within which each should be achieved. Identify both human and financial resources to ensure that environmental purchasing programs are effective, as well as metrics to determine progress. Establish a procedure to review new and modified contracts and contract renewals to ensure the contract language includes requirements for environmental purchasing	
4.4.1 Resources, Roles, Responsibility and Authority	Procurement and contracting personnel shall be included on the EMS Implementation Team. A staff can be designated who is responsible for environmental purchasing program management. A staff can be assigned to identify the products and services currently purchased to support the activities, who purchases them and how they are purchased. It may be also assigned responsibility and resources for Environmental Management Programs to achieve environmental purchasing objectives and targets.	**Department of Defense (DOD), U.S. Army, Ft. Lewis WA** Ft. Lewis found that staff lacked understanding of the Affirmative Procurement Program and how to effectively integrate it into the EMS. They also found that organizations and activities outside the environmental program were not taking responsibility for green procurement.[173] To address this concern, an individual is appointed as the Program Management Team Lead for each objective.

[173] refer to Fleming, Lewis, 2003

4.4.2 Competence, Training and Awareness	It must be identified procurement training needs based on significant aspects and legal and other requirements for environmental purchasing preference programs. Procurement staff, contracting staff and product users shall be trained on environmental purchasing and encouraged to request goods and services that reduce environmental impacts and meet performance standards.	**USDA, ARS, Beltsville Area** To enforce the Beltsville Agricultural Research Center's Affirmative Procurement Program, staff developed an online training program. This APP training assures that all BA government purchase card users are aware of and participate in the Program. Names of employees completing the training are monitored by the Safety, Occupational Health and Environmental staff to assure that everyone is "on board." A manual detailing the program to serve as a reference for decision makers, such as procurement and contracting officials, has been developed and distributed.[174]
4.4.3 Communication	The Communication Procedure should include guidance on who is responsible for internal communication on significant aspects, including those related to environmental purchasing, as well as, how, how often and to whom information will be disseminated.	**USDA, ARS, Beltsville Area** The Beltsville Guide to Affirmative Procurement describes the promotion program for location employees and potential contractors or vendors: Familiarize all purchasers with APP requirements; Conduct workshops or training sessions to educate employees about their responsibilities under the APP; Distribute APP policies to all organizations along with APP training resources; Publish a list of local vendors of recycled content and biobased products that meet EPA's CPG requirements or comply with USDA's biobased product guidance; Publish articles in organizational newsletters; Update local operating instructions to include APP requirements; Provide periodic updates through the e-mail system; Recognize outstanding efforts of personnel toward AP.[175]
4.4.5 Control of Documents	Document control procedures will apply to all environmental purchasing documentation, including Affirmative Procurement and EPP Plans, specifications, purchase orders, purchase contracts and lists of green products approved for purchase. This element ensures that documentation, including, for example, product specifications, purchase and contract documents, justification for the purchase of green products and/or lists of green products approved for purchase is readily available to product users and procurement and contracting personnel.	

[174] refer to Prevar, 2003
[175] refer to DOI, ARS, Beltsville Area Guide to Affirmative Procurement, 2003, p.12

4.4.6 Operational Control	Ensure that all significant aspects related to green procurement are addressed by operational controls. Develop and implement control procedures to ensure that product users, specification writers, the procurement personnel and contracting personnel include an evaluation of environmental considerations, along with price, performance and availability, in the criteria for purchasing decisions. Operational control procedures should ensure that purchases of designated and mission-appropriate green products and services support the environmental policy, legal and other requirements and environmental purchasing objectives and targets. Communicate environmental purchasing procedures and requirements to suppliers and contractors, especially those that provide goods and services for activities that have significant environmental aspects.	**USDA, ARS, Beltsville Area** The Beltsville Area's Affirmative Procurement Guide includes the following specific operational controls for procurement: • When USDA completes the biobased product designation, every designated biobased product that is purchased will automatically become part of this AP program. • If a purchaser finds that a biobased product is more preferable due to environmental attributes, technical performance, or price, it can be selected in place of a similar recycled-content product. • Recycled-content products meeting EPA guidelines will always be purchased unless they are not available competitively within a reasonable period of time; at reasonable prices; or to meet reasonable performance standards in the specifications.[176]
4.4.7 Emergency Preparedness and Response	Purchase of environmentally preferable products shall be emphasized to reduce the potential for incidents requiring emergency response.	
4.5.1 Monitoring and Measurement	A conforming procedure will document what environmental purchasing data to collect and how to collect and manage the data related to significant environmental aspects and requirements for reporting on environmental purchasing. The organization may also want to monitor purchases of any other product or service that has a reduced impact on the environment when compared with competing products that serve the same purpose.	**DOD, U.S. Army, Ft. Lewis WA** At Fort Lewis, when objectives and targets are identified, a set of metrics is also developed to measure achievement of the objective. The Program Team Manager for the objective is responsible for providing quarterly progress reports to the Organizational EMS Representative who then provides the information to Management.

[176] refer to Beltsville Agricultural Center. Guide to Affirmative Procurement, 2003

4.5.3 Nonconformity, Corrective Action and Preventive Action	Responsibility must be designated in order to investigate and correct findings of non conformance with the environmental purchasing EMS requirements, in accordance with facility corrective action procedures.	**DOD, U.S. Army, Ft. Lewis, WA** At Ft. Lewis, during an EMS Internal Audit, document control and operational procedures are reviewed. If an auditor finds that a given documented procedure is not being followed, a Preventive Corrective Action Report (PCAR) is written and the activity not adhering to the procedure has to conduct an investigation and recommend a corrective action.
4.5.4 Control of Records	Environmental purchasing records shall be identified, such as training, purchases of specific products, reports to management and government agencies and audits. These environmental records must be maintained in accordance with facility EMS procedures.	**Environmental Science Center (ESC) Environmental Protection Agency (EPA) Ft. Meade, MD** ESC included requirements for records management in their Environmentally-Preferable Purchases Procedure. Written communications with ESC suppliers and contractors will be retained in the EMS records. When this procedure is reviewed, records will be maintained on suggested changes, including procedural changes or tools, and why the changes were or were not included. Data on ESC environmentally-preferable purchases also will be retained in the EMS records.
4.5.5 Internal audit	Ensure that environmental purchasing EMS elements are included in the activities to be considered in either internal or external audits of the EMS.	**EPA ESC Ft. Meade, MD** ESC includes requirements for annual review in its EPP Procedures. Specifically, the EMS Team will meet to review the procedure and EPA's EPP Goals. The EMS Team will discuss the procedure's effectiveness, whether it should be modified, and whether tools (e.g., web site or forms) should be developed to facilitate environmentally-preferable purchasing at ESC. To prepare for the discussion, the EMS Team should survey purchasers and meeting planners at the ESC to discuss the effectiveness of the procedure.
4.6 Management Review	It must be ensured that progress toward achieving environmental purchasing objectives and targets and any environmental purchasing operational controls are discussed as part of the EMS Management Review. Management review must consider recommendations to improve facility environmental purchasing efforts.	

Table 5-7: Integrating Environmental Purchasing Into Environmental Management System[177]

[177] refer to EPA, 2005

6 Conclusion

With globalization, companies are faced with growing competition. Thus, quality has a vital feature for companies to stay competitive and alive in the global market. The quality of the product, which is supplied to customer, depends not only its quality but also on the supplier's quality.

Supplier quality has a large effect on the quality positioning of organizations. Company's quality performance can only be as good as the quality performance of its suppliers. Therefore, supplier quality integration is a critical dimension of achieving quality excellence. There are several methods to control supplier's quality, e.g. incoming product quality control, supplier audits. etc., but to control supplier's overall quality performance is not effortless. Many organizations achieved success because of enforcing strict quality standards on their suppliers.

In this thesis, ISO 9000 and ISO 14000 are considered as supplier selection and evaluation criteria. The ISO 9000 series standards define the minimum requirements a supplier must meet to assure its customer that they are receiving high quality products. Through the ISO standards, suppliers have increased efficiencies in processes, consistencies in operations, improved overall quality performance and they can be evaluated consistently and uniformly. Companies that are certified and registered as meeting the ISO standards will be perceived as viable suppliers to their customers. Companies that decide to go along with environmental purchasing activities are experiencing tangible benefits. Environmental purchasing can create value through increased cost efficiency, enhanced image and market share, and reduced environmental risks.

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8 Appendix

A. Quality Assurance Supplier Survey/Audit Form

Supplier: _____

Address: _____

Supplier Representative: _____

City/State: _____ Title/Position: _____

Zip: _____ Date of Completion: / /

Quality Systems Third Party or Customer Approval

ISO-9001 / 2		AS-9100		D1-9000		SSQA	
Yes	No	Yes	No	Yes	No	Yes	No
☐	☐	☐	☐	☐	☐	☐	☐

Major Customers

Customer Name	Last Surveyed

Number of Personnel

Production	Quality Support	Inspection	Engineering	Other	Total Plant Area

Lead Auditor _____ Department _____

Auditor _____ Department _____

Auditor _____ Department _____

For Modern Industries Use Only

Survey Disposition:

Approved		Conditional Approved		Disapproved
Yes	No	Yes	No	
☐	☐	☐	☐	☐

Date Expires_____ Date Expires_____

Re-surveyed and Approved: Yes ☐Date:_____ Auditor Name:_____

Reason for Conditional Approval:

_____

Reason for Disapproval:

_____

Approved to Manufacture or Service Only:

_____

Survey Notes:

a) **Items noted in the "P" column, on the following pages, indicates a deficient area identified during the performance of the survey/audit**.

b) **A certificate showing third party approval / compliance to either ISO-9001 / 2 or AS-9100 will satisfy the quality systems portion of the survey.**

c) **Recognition by the Boeing Aircraft Company showing compliance to D1-9000 will satisfy the quality systems portion of the survey.**

d) **Recognition by Applied Materials showing compliance ISO-9001 / 2 or SSQA will satisfy the quality systems portion of the survey.**

e) **Recognition by NADCAP showing compliance to a specific special process will satisfy the audit requirements for that process. <u>At a minimum</u> handling, calibration, process control steps, and required logs shall be verified.**

Category I Quality Assurance Organization and Planning

		Yes	No	N/A	P
A	Is the supplier's system of the Quality Assurance adequately described in approved written procedures/instructions/policies?	☐	☐	☐	☐
B	Are procedures/instructions/policies maintained current and made available to all concerned personnel?	☐	☐	☐	☐
C	Has the responsibility for Quality Assurance/Inspection been formally established? (Organization Chart)	☐	☐	☐	☐
D	Does the Quality Assurance/Inspection Department have the freedom to satisfactory perform the quality functions and meet customer requirements?	☐	☐	☐	☐
E	Is a periodic review of the quality program performed by management?	☐	☐	☐	☐

Comments: _____

Category II Initial Quality Planning

		Yes	No	N/A	P
A	Does the Quality Assurance/Inspection Department prepare quality plans to implement identified quality requirements.	☐	☐	☐	☐
B	Does the Quality Assurance/Inspection review manufacturing processes, contract reviews, packaging, inspection / test instructions to assure customer requirements.	☐	☐	☐	☐

Comments: _____

Category III Inspection and Test Documentation

		Yes	No	N/A	P
A	Are inspection instructions available current and used?	☐	☐	☐	☐
B	Do the inspection instructions contain accept/reject criteria?	☐	☐	☐	☐
C	Is completed product subject to inspection and test in accordance with the applicable drawings, specification, inspection instructions, etc.	☐	☐	☐	☐

Comments: _____

Category IV Record Retention

		Yes	No	N/A	P
A	Are records maintained for a minimum of 3 years or required by customer contract?	☐	☐	☐	☐
B	Do inspection records and test records reflect number of observations made, as well number of defects and types?	☐	☐	☐	☐
C	Are records used by management to evaluate manufacturing processes and/or quality programs?	☐	☐	☐	☐

Comments: _____

Category V Corrective Action

		Yes	No	N/A	P
A	Does the supplier have a system that assures prompt and appropriate corrective action when required?	☐	☐	☐	☐
B	Are all corrective actions documented?	☐	☐	☐	☐
C	Is the system applicable to all elements of the quality programs (i.e. design, purchasing, manufacturing, etc)?	☐	☐	☐	☐
D	Does the corrective action system extend to the supplier's vendors?	☐	☐	☐	☐
E	Are trend analysis used to prevent recurrence of the discrepancy?	☐	☐	☐	☐
F	When corrective actions are instituted, is their effectiveness monitored?	☐	☐	☐	☐

Comments: _____

Category VI Drawing, Documentation and Changes

		Yes	No	N/A	P
A	Does the supplier's documented system assure that all manufacturing processes are performed in accordance with the latest applicable revision of the drawings or specifications?	☐	☐	☐	☐
B	Is there a system in place to control the use of old revision drawings, marked up or illegible drawings?	☐	☐	☐	☐
C	When applicable, is "Copy Exact" training performed and documented on a recurring basis	☐	☐	☐	☐
D	Is there a system in place to prohibit the deviation of a purchase order requirement? (i.e. verbal instructions) Explain.	☐	☐	☐	☐

Comments: _____

_____

_____

Category VII Measuring and Test Equipment

		Yes	No	N/A	P
A	Does the supplier's quality system assure that inspection measuring and test equipment, process control devices and tooling used for media of acceptance are inspected and calibrated at required intervals in accordance with the requirements of a calibration specification. Please indicate calibration specification.	☐	☐	☐	☐
	Calibration Specification:_____				
B	Is all such equipment identified and traceable to individual records attesting to the last calibration, calibration due date, the requirement for calibration?.	☐	☐	☐	☐
C	Are the reference standards which are employed in the inspection and calibration of equipment, currently certified and traceable to NIST?	☐	☐	☐	☐
D	Are un-calibrated or outdated items identified and stored in a manner as to prevent their use pending calibration?	☐	☐	☐	☐
E	Does the supplier maintain written instructions/procedures providing detailed methods for calibration?	☐	☐	☐	☐
F	Is the measuring and testing equipment used by the supplier adequate to control the products involved?	☐	☐	☐	☐
G	Are personally owned tools calibrated and controlled when used for product acceptance?	☐	☐	☐	☐

Comments: _____

_____

_____

Category VIII Purchase Responsibility

		Yes	No	N/A	P
A	Does the supplier have a system for selecting qualified vendors?	☐	☐	☐	☐
B	Does the supplier re-audit those vendors not performing to a quality acceptance rate?	☐	☐	☐	☐
C	Does the supplier's procurement system allow for information feedback and early correction of vendor nonconformance?	☐	☐	☐	☐
D	Does the supplier's purchase order to sub-tier sources clearly state applicable specification and/or approved secondary processes?	☐	☐	☐	☐
E	Do purchase orders reflect the revision number and effective dates?				

Comments: _____

_____

_____

Category IX Materials and Materials Control

		Yes	No	N/A	P
A	Are purchased supplies or products inspected upon receipt to assure conformance to drawings or customer specification?	☐	☐	☐	☐
B	Is incoming raw materials adequately identified and certified?	☐	☐	☐	☐
C	Are certified raw materials stored in a controlled area, separated from uncertified material and protected from damage and corrosion?	☐	☐	☐	☐
D	Is raw material issued and remnant controlled?	☐	☐	☐	☐
E	Are all remnant material properly identified and controlled?	☐	☐	☐	☐
F	Is customer furnished material controlled by identification and segregated?	☐	☐	☐	☐

Comments: _____

Category X Production Process Control

		Yes	No	N/A	P
A	Are process control procedures integrated as part of the inspection system when called out in the contract?	☐	☐	☐	☐
B	Does the supplier have a predictable manufacturing process documented?	☐	☐	☐	☐
C	Are periodic measurements and/or testing performed on critical dimensions or processes?	☐	☐	☐	☐

Comments: _____

Category XI Final Inspection

		Yes	No	N/A	P
A	Are final inspections, evaluations, and test performed by inspection personnel?	☐	☐	☐	☐
B	Are final inspection reports filled out for product and forward to customer with each delivery?	☐	☐	☐	☐
C	Does the inspection department have the freedom to report and reject nonconformance material?	☐	☐	☐	☐

Comments: _____

Category XII Stockroom Control

		Yes	No	N/A	P
A	Is a controlled area maintained for the storage of production supplies and materials?	☐	☐	☐	☐
B	Is the identity and status of stored material clearly established?	☐	☐	☐	☐
C	Are materials protected from damage, corrosion, and deterioration?	☐	☐	☐	☐

Comments: _____

Category XIII Packaging, Marking and Shipping

		Yes	No	N/A	P
A	Are items checked for damaged and part prior to packaging and shipping to customer?	☐	☐	☐	☐
B	Prior to shipping is paper work audit to assure that all processes, inspection points, part markings and certification accompany the parts?	☐	☐	☐	☐
C	Is documented evidence of such controls maintained?	☐	☐	☐	☐

Comments: _____

Category XIV Nonconforming Material

		Yes	No	N/A	P
A	Does the supplier's quality system provide the formal controls for documenting nonconformance of materials, including the ability to identify and segregate products?	☐	☐	☐	☐
B	Does the supplier maintain records of rejected items?	☐	☐	☐	☐
C	Does the supplier maintain a separate hold area for nonconforming part and is area controlled?	☐	☐	☐	☐
D	Is the customer notified of nonconforming material?	☐	☐	☐	☐

Comments: _____

_____

_____

Category XV Statistical Sampling

		Yes	No	N/A	P
A	Does the supplier perform sampling inspection per the MIL-Std-105 or other approved plan?	☐	☐	☐	☐
B	Does the sampling inspection plan (other 100%) classify the various characteristics and define levels of sampling?	☐	☐	☐	☐

Comments: _____

_____

_____

Category XVI Facilities/Housekeeping

		Yes	No	N/A	P
A	Are manufacturing process areas clean, orderly and adequately lighted?	☐	☐	☐	☐
B	Are inspection areas clean, orderly and adequately lighted?	☐	☐	☐	☐
C	Are dangerous chemicals identified and properly stored?	☐	☐	☐	☐
D	Are MSDS 's visible and readily available?	☐	☐	☐	☐

Comments: _____

_____

B. Curriculum Vitae

CONTACT INFORMATION

Name	Ezgi PALA
E-mail	ezgi.pala@hotmail.com

PERSONAL INFORMATION

Nationality	Turkish Republic	**Resident of**	Turkey
Date of Birth, place	23.02.1985, Izmir/Turkey	**Gender**	Female
Marital status	Single	**Driving License**	B Type

EDUCATION

2007-July 2009 (Estimated)	Vienna University of Technology, M.Sc. Industrial Engineering
2003-2007	Dokuz Eylul University, B.Sc. Industrial Engineering (GPA: 3.34 / 4.00 : Honor of 3rd highest grade) Vienna University of Technology (2006-2007 Erasmus Exchange Programme)

WORK EXPERIENCE

10.2008-02.2009	**Chrysler Austria GmbH** (Vienna, Austria) Project-based Internship
06.2008-07.2008	**UEFA European Football Championship 2008** (Vienna, Austria) Welcome Service Volunteer Team in Vienna International Airport
07.2006-08.2006	**BOSCH Thermotechnology Manu. and Trading INC**. (Manisa, TR) Internship of Management (Health, Safety and Environment Department)
07.2005-08.2005	**VALFSEL Armature Co. INC.** (Manisa, TR) Internship of Manufacturing (Planning Department)
06.2005-07.2005	**VESTEL Electronics Manufacturing and Trading INC.** (Manisa, TR) Internship of Manufacturing (Quality Assurance Department)

PROJECTS

10.2008-02.2009	**Chrysler Austria GmbH** (Vienna, Austria) CRM Process Optimization Projects based on Customer Satisfaction Survey and Questionnaire Optimization of Internal Processes in Service & Parts
10.2008-02.2009	**Developing a Qualification Profile for an Industrial Engineer** (Vienna University of Technology)
03.2007-06.2007	**Bachelor's Thesis** "Six Sigma Approach in Quality Management Systems" (Vienna University of Technology)
10.2005-12.2005	**DEKORPAN Manufacturing and Trading INC.** (Izmir, TR) Improvement of Facility Layout and Line Balancing
12.2005-01.2006	Ergonomic Observation of Working with Computers in Ege University Campus (Izmir, TR)