

## **CHAPTER-2**

### **INTRODUCTION TO MATERIALS MANAGEMENT**

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Materials constitute a major cost component for any Industry. The total cost of installed materials (or *Value of Materials*) may be 60% or more of the total cost (Stukhart 2007, Bernold and Treseler 1991), even though the factory cost may be a minor part of the total, probably less than 20-30%. This is because the manufactured item must be stored, transported, and restored before it is put in place or "consumed" at the site. The total cost of materials will include, in addition to the manufacturer selling cost, the cost of procurement (cost of placing processing and paying the material, physical distribution, the distributor's cost, and the transportation of materials), and the site-handling costs (cost of receiving, storage, issuing, and disposal). The efficient procurement and handling of material represent a key role in the successful completion of the work. It is important for the contractor to consider that there may be significant difference in the date that the material was requested or date when the purchase order was made and the time at which the material will be delivered. These delays can occur if the contractor needs a large quantity of material that the supplier is not able to produce at that time or by any other factors beyond his control. The contractor should always consider procurement of materials is a potential cause for delay (Willis, 2008).

Poor planning and control of materials, lack of materials when needed, poor identification of materials, re-handling and inadequate storage cause losses in labor productivity and overall delays that can indirectly increase total project costs. Effective management of materials can reduce these costs and contribute significantly to the success of the project.

## 2.1 BACKGROUND

The Webster's dictionary defines materials as "*the elements, constituents, or substances of which something is composed or can be made.*" Ballot (2006) defines materials as the physical materials that are purchased and used to produce the final product and does not suggest that materials are the final product. In other words, materials are the parts used to produce the final product. Bailey et al. (2009) define materials as the goods purchased from sources out of the organization that are used to produce finished products. Stukhart (2007) defines materials as the items that are used to produce a product and which include raw materials, parts, supplies and equipment items.

Dobler and Burt (2009) classify manufacturing materials into five categories. These categories are:

- **Raw materials-** materials that the company converts into processed parts. This might include parts specifically produced for the company and parts bought directly off the shelf (i.e. bolts, nuts).
- **Purchased parts-** parts that the company buys from outside sources (i.e. rubber parts, plastic parts).
- **Manufactured parts-** parts built by the company (i.e. tower case for a computer).

- **Work in process-** these are semi-finished products found at various stages in the production process (i.e. assembled motherboard).
- **MRO supplies-** maintenance, repairing, and operating supplies used in the manufacturing process but are not part of the final products (i.e. soap, lubricating oil). Chandler (2001) states that construction materials can be classified into different categories depending on their fabrication and in the way that they can be handled on site. He classifies the materials into five categories. These categories are
- **Bulk materials-** these are materials that are delivered in mass and are deposited in a container.
- **Bagged materials-** these are materials delivered in bags for ease of handling and controlled use.
- **Palleted materials-** these are bagged materials that are placed in pallets for delivery.
- **Packaged materials-** these are materials that are packaged together to prevent damage during transportation and deterioration when they are stored.
- **Loose materials-** these are materials that are partially fabricated and that should be handled individually.

Table 2.1 presents some examples of commonly used materials in construction and their classification.

**Table 2.1: Classification of Materials (Adopted from Chandler, 2001)**

Material	Bulk	Bagged	Palleted	Packaged	Loose
Sand	X				
Gravel	X				
Topsoil	X				
Paving Slabs					X
Structural Timber					X
Cement	X	X	X		
Concrete	X				
Pipes				X	X
Tiles				X	
Doors			X		
Electrical Fittings				X	

Stukhart (2007) states that the main categories of materials encountered in a construction project are engineered materials, bulk materials, and fabricated materials.

- **Bulk materials-** these are materials manufactured to standards and are purchased in quantity. They are bought in standard length or lot quantities. Examples of such materials include pipes, wiring, and cables. They are more difficult to plan because of uncertainty in quantities needed.
- **Engineered materials-** these materials are specifically fabricated for a particular project or are manufactured to an industry specification in a shop away from the site. These materials are used for a particular purpose. This includes materials that require detailed engineering data.
- **Fabricated materials-** these are materials that are assembled together to form a finished part or a more complicated part. Examples of such materials include steel beams with holes and beam seats.

### **2.1.1 Importance of Materials for a Project**

Problems related to managing the flow of materials can be found in every organization. The efficient management of materials plays a key role in the successful completion of a project. The control of materials is a very important and vital subject for every company and should be handled effectively for the successful completion of a project. Materials account for a big part of products and project costs. The cost represented by materials fluctuates and may comprise between 20-50% of the total project cost and sometimes more. Some studies concluded that materials account for around 50-60% of the project cost (Stukhart, 2007 and Bernold and Treseler, 1991). Materials are critical in the operations in every industry since unavailability of materials can stop production. In addition, unavailability of materials when needed can affect productivity, cause delays and possible suspension of activities until the required material is available. It is important for a company to consider that even for standard materials, there may be significant difference in the date that the material was requested or date when the purchase order was made, and the time in which the material will be delivered. These delays can occur if the quantities needed are large and the supplier is not able to produce those materials at that time or by any other factors beyond the control of the company. The company should always consider that purchase of materials is a potential cause for delay (Willis, 2008). Unavailability of materials is not the only aspect that can cause problems. Excessive quantities of materials could also create serious problems to managers. Storage of materials can increase the costs of production and the total cost of any project. When there are limited areas available for storage, the managers have to find other alternatives to store the materials until they are needed. Some of these alternatives might require

re-handling of materials, which will increase the costs associated with them. Provisions should be taken to handle and store the materials adequately when they are received. Special attention should be given to the flow of materials once they are procured from suppliers.

It is obvious that materials should be obtained at the lowest cost possible to provide savings to the company (Damodara, 2008). In the late 1970's, construction companies experienced an increase in costs and a decrease in productivity. Owners of these companies thought that these increases in cost were due to inflation and economic problems. Further research concluded that these companies were not using their resources efficiently and that the decrease in productivity was also attributable to poor management (Stukhart, 2007). Material Management has been an issue of concern in the construction industry. 40% of the time lost on site can be attributed to bad management, lack of materials when needed, poor identification of materials and inadequate storage (Baldwin et al, 2004).

The need for an effective materials planning system becomes mandatory. Some companies have increased the efficiency of their activities in order to remain competitive and secure future work. Many other firms have reduced overheads and undertaken productivity improvement strategies. Considerable improvement and cost savings would seem possible through enhanced materials management. Timely availability of materials, systems, and assemblies are vital to successful construction. Materials management functions are often performed on a fragmented basis with minimal communication and no clearly established responsibilities assigned to the owner, engineer or contractor. Better material management practices could increase efficiency in operations and reduce overall cost. Top management is paying more attention to material management because of material

shortages, high interest rates, rising prices of materials, and competition. There is a growing awareness in the construction industry that material management needs to be addressed as a comprehensive integrated management activity.

### **2.1.2 What is Material Management?**

Different researchers provide different definitions for material management, therefore different definitions can be found in different references. Basically, material management is concerned with the planning, identification, procuring, storage, receiving and distribution of materials. The purpose of material management is to assure that the right materials are in the right place, in the right quantities when needed. The responsibility of one department (i.e. material management department) for the flow of materials from the time the materials are ordered, received, and stored until they are used is the basis of material management.

- Ballot (2006) defines material management as the process of planning, acquiring, storing, moving, and controlling materials to effectively use facilities, personnel, resources and capital.
- Tersine and Campbell (2004) define material management as the process to provide the right materials at the right place at the right time in order to maintain a desired level of production at minimum cost. The purpose of material management is to control the flow of materials effectively.
- Beekman-Love (1998) states that a material management structure should be organized in such a way that it allows for integral planning and coordination of the flow of materials, in order to use the resources in an optimal way and to minimize costs.
- Chandler (2001) states that material management systems should be

implemented to plan, order, check deliveries, warehousing, controlling the use of materials, and paying for materials. He adds that these activities should be interrelated.

- Ammer, Dean (1991) defines material management as the process in which a company acquires the materials that it needs to achieve their objectives. This process usually begins with the requisition of materials from the supplier until the material is used or incorporated into a product.
- Bailey and Farmer (2009) define material management as a concept concerned with the management of materials until the materials have been used and converted into the final product. Activities include cooperation with designers, purchasing, receiving, storage, quality control, inventory control, and material control.
- Gossom (1999) indicates that a material management system should have standard procedures for planning, expediting, transportation, receipt, and storage to ensure an efficient system for materials control.
- Cavinato (1994) states that material management involves the control of the flow of goods in a firm. It is the combination of purchasing with production, distribution, marketing and finance.
- Arnold (2001) states that material management is a function responsible for planning and controlling of materials flow. He adds that a materials manager should maximize the use of resources of the company.
- Stukhart (2007) defines material management as the activities involved to plan, control, purchase, expedite, transport, storage, and issue in order to achieve an efficient flow of materials and that the required materials are bought in the required quantities, at the required time, with the required quality and at an acceptable price.



- Plemmons et al. (1995) define material management as the plan and control of all activities to ensure the correct quality and quantity of materials and equipment to be installed are specified in timely manner, obtained at reasonable cost and are available when needed.
- Dobler and Burt (2009) state that material management is designed to improve the activities related to the flow of materials. They add that material management should coordinate purchasing, inventory control, receiving, warehousing, materials handling, planning, and transportation.

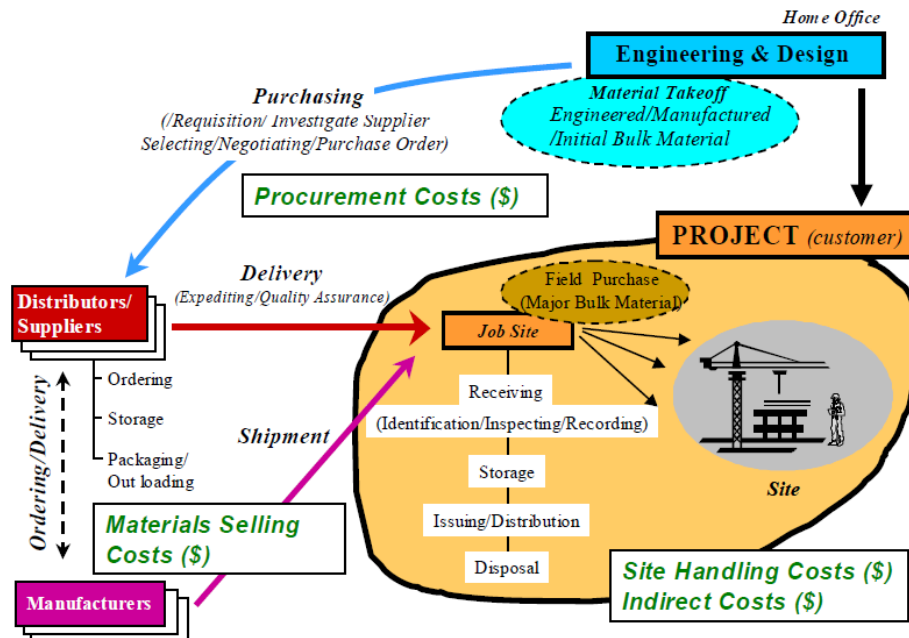
The role that a materials manager plays in an organization is strictly economical since the materials manager should keep the total cost of materials as low as possible. The person in charge of handling materials should keep in mind the goals of the company and insure that the company is not paying extra money for materials. The goal of every company is to make a profit. This is the basis for company's survival, costs should not exceed income, but keeping in mind customer's expectations.

The typical tasks associated with a material management system are {(Tersine and Campbell (2004), Ammer (1999), Stukhart (2007))}:-

- Procurement and purchasing
- Expediting
- Materials planning
- Materials handling
- Distribution
- Cost control
- Inventory management / Receiving/ Warehousing
- Transportation

Purchasing and procurement deals with the acquisition of materials to be used in the operations. The primary function of purchasing and procurement is to get the materials at the lowest cost possible, but keeping in mind quality requirements. Expediting is the continuous monitoring of suppliers to ensure on time deliveries of materials purchased. The purpose of materials planning is to procure the materials for the dates when they are needed, storage facilities, and handling requirements. The primary function of materials handling is to manage the flow of materials in the organization. The manager has to assure that the costs associated with handling materials are kept to a minimum. In cost control, the manager has to insure that the costs to buy materials are kept to a minimum. In other words, the manager has to insure that he is buying the products at the lowest possible price. The inventory management deals with the availability of materials. Transportation involves using the safest most economical means to transport the materials to the site where they are needed.

Figure 2.1 depicts the different phases of the material management process including the relationship and interdependency between the different activities in each phase. From this figure it can be seen that decisions taken at each phase in the system, directly affect the activities of the phases that follow:



**Figure 2.1: Typical Material Management in Construction**  
 (Source Thabet, 2001)

As a result, a successful implementation of a material management system needs to consider the different decisions made at various phases of the supply chain.

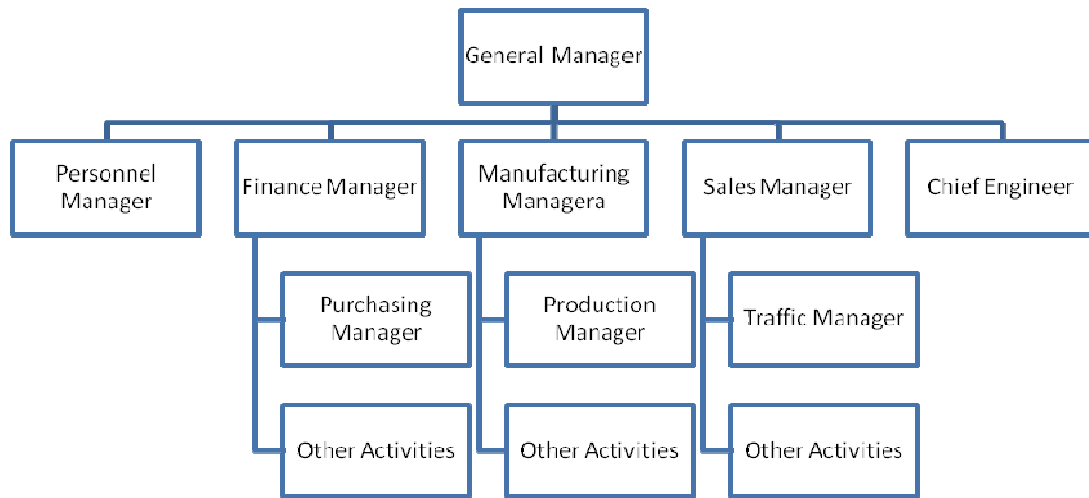
## 2.2 NEED FOR MATERIAL MANAGEMENT SYSTEM

The costs associated with material management are hidden in other activities or included as overhead costs. Stukhart (2007) states that studies from the Construction Industry Cost Effectiveness Project (CICEP) concluded that senior management have not recognized the contribution of material management to cost issues in projects, that personnel involved in material management activities do not receive an adequate training, and that the computer systems used by companies are not good sources of information for materials control. Historically managers had paid more

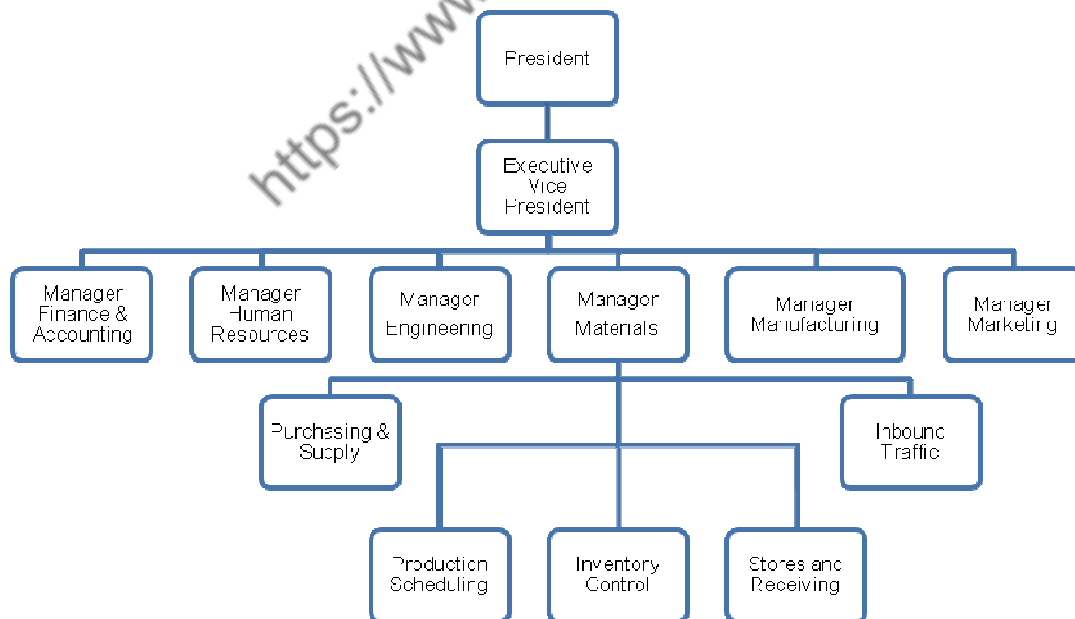
attention to the costs associated with personnel, equipment and plant and little attention has been given to materials. For manufacturing organizations, the costs related to materials have increased and had become the largest expenditure of the organization; therefore more attention has been placed into activities related to materials (Tersine, 2004). The cost of materials has escalated to twice the cost of labor between 1975 and 1980 inducing companies to pay more attention to activities related to materials (Bernold and Treseler, 1991).

Traditionally the responsibilities for activities related to materials flow have been divided between different departments. Figure 2.2 depicts the division of responsibilities for material management. The activities related to material management are divided between different departments. For example, the finance department is in charge of the purchasing activities while the manufacturing department is in charge of the control of materials during production. This division of responsibilities makes it difficult to coordinate the activities related to materials. In addition, this division can make the control and identification of materials extremely difficult.

The integration of the functions related to materials into a single department makes it easier to control and identify all the activities related to material flow and costs. Figure 2.3 depicts the integrated approach for Material Management. Material Management is designed to coordinate and control the materials needed and activities related to those materials. In a typical organization, the material activities are interrelated (Dobler & Burt, 2009).

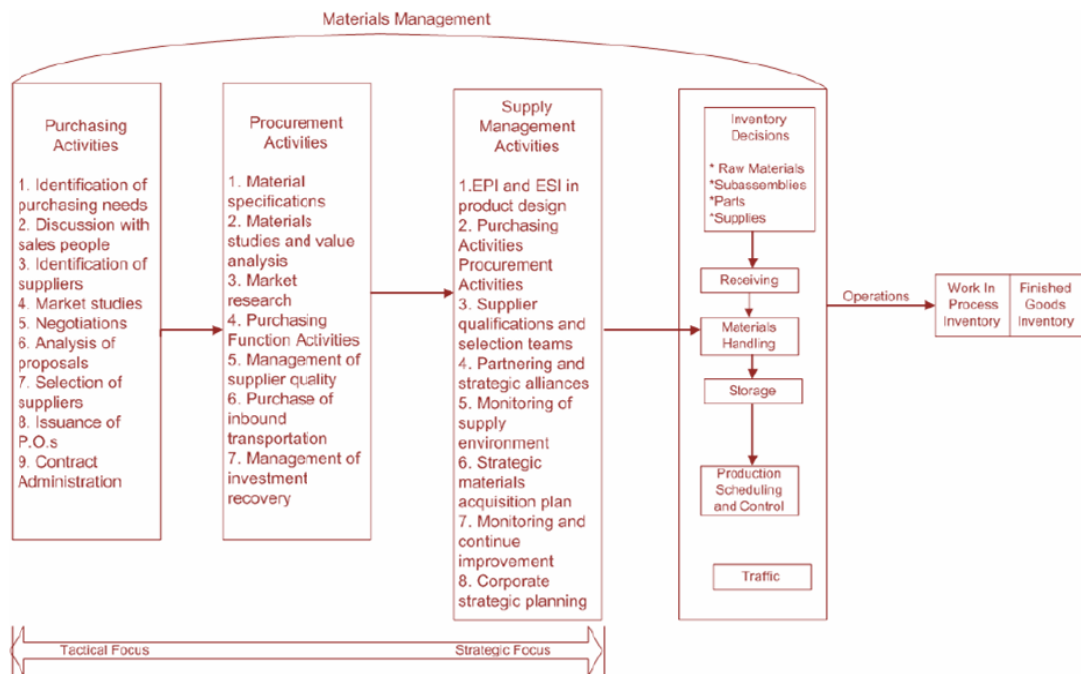


**Figure 2.2: Division of responsibilities for Material Management (Adopted from Ammer, 1999)**



**Figure 2.3: General Structure of a Material Management System in a company (Adopted from Dobler and Burt, 2009)**

Figure 2.4 illustrates a typical flow of materials, and material activities in an organization. From the figure, it can be seen that decisions taken at early stages in the material management flow might affect other activities and decisions to be made in later stages. For example, if the proposals from suppliers are not analyzed (i.e. step 6 in the purchasing activities), then the selection of suppliers might be affected (i.e. step 3 in the supply management activities).



**Figure 2.4: Relationship of purchasing/ Procurement/ Supply management with Material management (Adopted from Dobler and Burt, 2009)**

Coordination is needed in order to reduce the impact that a decision at a certain stage might have in other activities. Communication is essential among members of the team to avoid conflicts and to take the better decisions regarding materials flow.

### **2.3 GOALS OF MATERIAL MANAGEMENT**

As was mentioned previously, the role of the materials manager is strictly economical within an organization. This section will describe some of the aspects that the materials manager should keep in mind to handle all activities related to materials appropriately. Cavinato (1994) states that the objectives of a material management system should include lowest final cost, optimum quality, assurance of supply, and lowest administrative costs. The materials manager should obtain the materials needed at the lowest cost possible. By buying products at the lowest possible costs, operating costs can be reduced and profits can be increased. Proper handling and storage of materials can reduce the total cost of materials; therefore the materials manager should ensure that materials are handled properly and stored in the most adequate places. Quality is a very important aspect that the materials manager has to keep in mind. When specifications require a high quality product, quality could become the most important objective. Suppliers play an important role in any organization. Many companies rely greatly in outside suppliers for the materials needed for production. Good relations with suppliers might be decisive for a company to be in business. Companies that have good relations with suppliers could be more successful in attracting customers than companies that have bad relations with suppliers. When a company has good relations with its suppliers it could benefit from cost reductions, cooperative environment from the employees of the supplier, and willingness to help with materials ordered and orders pending. When a company has bad relation with their suppliers it might be possible that it experiences late deliveries or wrong materials delivered. This will have an impact in the total cost of the product, possibly increasing the total costs, and delaying the completion of the final product. Materials acquisition from the procurement time until it is received in the field can

have a significant impact on the schedule of a construction project. Based on the studies presented, it is clear that effective management of materials can minimize the impact that lack of materials or improper management of materials could have in the overall schedule and cost of the project. The materials manager should assure that effective and economical transportation are used to transport materials to the site.

## **2.4 BENEFITS OF MATERIAL MANAGEMENT**

An effective material management system can bring many benefits for a company. Previous studies by the Construction Industry Institute (CII) concluded that labor productivity could be improved by six percent and can produce 4-6% in additional savings (Bernold and Treseler, 1991). Among these benefits are:

- Reducing the overall costs of materials
- Better handling of materials
- Reduction in duplicated orders
- Materials will be on site when needed and in the quantities required
- Improvements in labor productivity
- Improvements in project schedule
- Quality control
- Better field material control
- Better relations with suppliers
- Reduce of materials surplus
- Reduce storage of materials on site
- Labor savings
- Stock reduction
- Purchase savings
- Better cash flow management



This chapter provided an introduction to material management and the benefits that could be realized by having an effective material management system. The basic knowledge needed to understand the basis of the research and why it is important to undertake this research work was presented. The next chapter will present the current state of knowledge in material management, particularly for the small scale Electrical Contracting industry. In addition, areas related to material management that are particularly important for this research work, such as cultural change and knowledge management, are also described.

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# Purchasing: 6 Major Principles of Purchasing – Explained!

Article shared by Smriti Chand

Some of the major principles of purchasing are: 1. Right Quality 2. Right Quantity 3. Right Time 4. Right Source 5. Right Price and 6. Right Place.

## 1. Right Quality:

The term right quality refers to a suitability of an item for the purpose it is required. For producing the goods of best quality, the best grade of raw material may be the right quality whereas for producing items of medium quality, the average lowest grade may be the right quality. The quality of the item is called as grades. It can be measured by physical tests, chemical analysis or by any other methods depending upon the nature of a product. The use of standard specification, brand name or trade name helps in purchasing the required qualities of materials. 'The quality must be built into the product'. It is the duty of the purchasing department to ensure that materials are purchased from those suppliers.

For creating goodwill, right production, standardisation, elimination of waste and for better results, right quality purchases are very essential. Quality for different materials is decided by the concerned departments.

In case of workshop equipment, the decision is taken by the plant engineer and for stationery it is the user department. However, purchase department may question the requirements of the different departments on the basis of its experience and suggest various alternatives. The inspection department must verify whether the goods supplied are in accordance with the order

Thus, the right quality is the suitability of items purchased for a given purpose. The best quality of materials purchased need not be the right quality.

## 2. Right Quantity:

Materials purchased should be of right quantity. The right quantity is the quantity that may be purchased at a time with the minimum total cost and which obviates shortage of materials. Ensuring and maintaining a regular flow of materials for carrying the production activity is the vital aim of any purchase organisation. Excess purchases should be avoided, it results in overstocking and capital is unnecessarily blocked and inventory carrying cost goes up.

**Economic Order Quantity (EOQ) helps in determining the right quantity of materials to be ordered. It is calculated by applying the following formula:**

EOQ =

A stands for annual consumption of material, C for cost of placing an order and S for Annual Storage and carrying cost per unit.

For deducing the amount of right quantity to be purchased, certain important factors must be considered by the management. These are the nature of the manufacturing process, the nature of material to be used, prevailing market conditions i.e., changes in the tastes and preferences of the people, cost of materials to be purchased, cost of possession and storing capacity of the organisation.

Along with the economic order quantity, there are two more concepts, viz.; bulk order quantity and arbitrary order quantity which needs to be understood.

Bulk Order Quantity is the quantity which is larger than the economic order quantity. It combines the ordering quantity of more than one order so as to round off to 3, 6 or 12 monthly requirements and place a single order for the full requirements of a period under consideration.

Bulk order quantity ensures various economies of price, lesser operational cost in the purchase department. Inexpensive and slow moving items are generally purchased in bulk quantity.

Arbitrary Order Quantity is the outcome of the weaknesses of economic order quantity and bulk order quantity. Due to varying market conditions, it is not advisable to always strictly adhere to the economic and bulk order quantities.

Certain factors viz.; uncertain order from the market, uncertain financial position, uncertain production schedule and uncertain lead time are responsible for the adoption of arbitrary order quantity on the part of the purchase manager.

### **3. Right Time:**

The time at which the purchases are to be made is of vital importance. In case of items used regularly, right time means the time when the stock reaches the minimum level. The reorder level of material is fixed for each item under the principle of right time.

Action for the purchase of new supplies should be immediately initiated, when the material reaches the reorder level. Reorder level for each type of material is calculated by applying the following formula.

Reorder level = Maximum Consumption x Maximum Reorder Period. The materials control department sends the purchase requisition to the purchase department for the purchase of materials. In case materials are required for special jobs, the Purchase Department ensures that the materials are delivered in time.

Another important factor to be considered is the delivery of materials from stores to production departments. Any under delay in supplying the materials on different jobs delays the production.

#### **4. Right Source:**

Selecting the right source for the purchase of materials is an important consideration in the purchase procedure. The right source for the procurement of materials is that supplier who can supply the material of right quality as ordered, in right quantity as ordered, at a right time at which the materials were required to be supplied, at an agreed price with the supplier, who is in a position to honour the commitment without much follow-up, who has necessary financial resources and adequate man-power to handle the order and who is well established with higher reputation and proven business integrity.

The source of material should be located within a reasonable distance from the buyer's organisation. This will minimise the delivery delays, higher transportation charges and improve the personal contact between the buyer and the supplier and enable better after-sales service etc.

As far as possible the middlemen and brokers should be avoided in the purchase of materials. A direct liaison should be established with the supplier. It would be helpful in improving the quality of the material in future.

While selecting the supplier certain factors must be kept in mind, viz., location of the supplier, warehousing facilities available with the supplier, relations of the employers with the labour, credit worthiness of the supplier, size of the supplier's firm and quality control observed by the employer etc. A personal visit to prospective supplier's premises will be helpful in assessing the capabilities of the supplier.

#### **5. Right Price:**

Determination of right price is a difficult task. It is the main object of any organisation to procure the material items at the right price. It is that price which brings the best ultimate value of the money invested in purchasing the materials.

Deciding the right price of a product depends on variety of factors, viz.; quality, delivery time and ultimate life of the material, demand and supply curve, extent of competition, government restrictions, after sales services, discount offered, and terms of purchase etc. It may be pointed out here that the determination of proper price depends not only on market knowledge but also a clear understanding of the pricing process.

The buyer should keep in touch himself with the above mentioned factors in the process of determination of price. He must consider that whether a proposed item to be purchased represents the best value for money or not.

This is known as "value analysis". The prevailing market prices also provide basis for the price determination. There should be negotiation between the purchase department and the suppliers for the determination of proper price.

#### **6. Right Place:**

Besides obtaining the materials of the right quality and quantity from the right source at the right price, it should be ensured that the materials are available at the right place. Transportation and material handling costs are greatly affected by the selection of the right place from where the materials are to be acquired. For minimising these costs, selection of right place for the acquisition of material is of utmost importance. If local as well as outside supplier fulfills these conditions, the former should be preferred. The above mentioned principles of purchasing can be summed up as the six R's of purchasing. These are also known as the "essentials" to be followed by the purchasing executive.

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## **Chapter 12**

### **Materials Handling**

To manufacture any product, it is necessary either that materials move from one step of the manufacturing process to another or that operators move to the materials. The most common practice, of course, is to move the materials. This movement of materials from one processing area to another and from department to department necessitates the use of much personnel and equipment and the handling of treatment tonnages of materials.

Consideration for the handling of work-in-processes materials, as well as raw material and finished goods, has always been a part of the production systems design process. Basic cost accounting evaluation of the cost of manufacturing products reveals that when materials handling costs are separated from other costs, they can be seen to be significant.

Recently, the materials handling function has been undergoing significant changes in concept and implementation. Management has been changing its view of materials handling as the routine transfer of materials from place to place and is beginning to think of it as part of a total materials flow system. This change in thinking has come about largely as a result of new automatic handling and storage equipment and systems that are integrated closely with automatic processing and sophisticated management information and control systems.

#### **Definition of Materials Handling**

In a broad sense, materials handling includes all movement of materials, in a manufacturing situation. It has been defined by the Materials Handling Division, American Society of Mechanical Engineers, as follows: "Materials handling is the art and science involving the moving, packing, and storing of substances in any form." This is an all inclusive definition and can include fluids and semi-fluids, as well as discrete items. For the sake of simplicity, we shall limit our discussion in this chapter to the movement of discrete items, such as gears, tires, castings, and boxes. Similarly, we shall consider only the movement of materials within the plant or storage areas. Movement of materials between plants- particularly when common carriers are used – is generally considered a problem in traffic and is frequently handled by a separate traffic department.

#### **Objectives of Materials Handling**

The simplest solution to the materials handling problem- "No movement, no cost" is hardly practicable for a complete manufacturing process. It is basically sound approach when one is attempting to improve a complete production cycle and when the number of handling can be reduced. It is also a good solution in the making of heavy industrial equipment.

In the latter situation it is often more feasible to bring the tools and workers to the product than to transport the product to the machine or work area.

In addition to the objective of reducing the overall costs of materials handling by reducing the number of handling involved, the following may be considered as objectives of the engineer in his or her approach to this problem.

*Lower the unit materials handling costs.* It is obvious that if the overall materials handling costs are reduced the unit costs will be reduced. This approach requires the costs of handling be allocated to or identified with the units of product, or its component parts that moved.

*Reduce the manufacturing cycle time:* The total time required to make a product from the receipt of raw materials to the finished goods can be reduced through effective materials handling.

*Contribute toward a better control of the flow of goods:* A principle way in which good materials handling practice can effect savings is by making the control of goods easier—particularly in continuous manufacturing, where all operations are “tied together” by the materials handling plan.

*Provide for improved working conditions and greater safety in the movement of materials* many of the provisions of the Occupational Safety and Health Act require adherence to safe handling practices. These must be followed. In addition, it is evident that the safe handling of materials will be reflected in a better industrial accident record.

*Provide for fewer rejects :* Care in the handling of the product will contribute to a better quality level of the goods produced. Products damaged by inefficient handling are all too often a major cost to manufacturer.

*Achieve decreased storage requirement:* Better movement and storage of materials should increase the utilization of storage space.

*Gain Higher productivity at lower manufacturing cost :* Any materials handling system, if it is worth its investments, is design to improve productivity. This improvement should be achieved by moving materials in the fastest, most efficient and economical way possible.

## **Principles of Material Handling**

A good materials handling engineer will generally have several years of experience that can be brought to bear on the solution of materials handling problems or the design of materials handling systems.

For many years, discussions of principles of materials handling have been published by many experts in the field. The following list has been adapted from two of these sources:

1. Eliminate wasteful methods by
  - a. Reducing to a minimum the number of handlings of materials.
  - b. Eliminating unnecessary mixing and subsequent sorting.
  - c. Using mechanical aids to eliminate the use of hand labor in movement of materials.
  - d. Avoiding the unnecessary transfer of materials from floor to workplace or from container to container.
  - e. Increasing the speed of handling.
  - f. Utilizing containers and unit loads.
  - g. Utilizing gravity as a moving force wherever practicable.
  - h. Introducing automaticity into the materials handling plan.
2. In laying out the plant:
  - a. Plan a system for materials flow and combine handling with processing wherever possible.
  - b. Provide for continuous or appropriate intermittent flow of materials.
  - c. Provide for the optimal flow of materials between operations and with a minimum of retrograde movement.
  - d. Plan the layout of the work-station area for a minimum of handling of the product.
  - e. Maximize the quantity and size of weight handled.
  - f. Coordinate the overall materials handling throughout the entire plant.
  - g. Provide for safe handling and safe equipment and integrate with the management information and control system.
  - h. Plan for adequate receiving, storage and shipping facilities.
  - i. Make optimum use of building cubage.
  - j. Design adequate aisle and access areas.
3. In the selection and application of materials handling equipment:
  - a. Plan activities and analyze equipment needs before considering the purchase of new equipment.
  - b. Ensure that the existing equipment is being used effectively.
  - c. Use the simplest equipment that is adaptable to the problem: avoid the use of complicated mechanisms and controls.
  - d. Adopt standard equipment if possible; ensure that the purchase of special equipment is economically justified.
  - e. Select equipment that is flexible in its application.



- f. Select equipment that will minimize the ratio of mobile equipment deadweights to pay loads.
- g. Determine comparative costs of equipment before purchasing.
- h. Recognize the need for different equipment for different jobs.
- i. Recognize the need to provide suitable building conditions for the equipment.
- j. Provide for alternative methods for use in emergencies.
- k. Give consideration to the maintenance of the equipment.
- l. Replace obsolete methods and equipment with more efficient ones.

### **Analysis of Materials Handling Problems**

In chapter 10 we discussed a systematic approach to the solution of methods problems. The same procedure will work equally well in solving materials handling problems. It requires establishing an objective, collecting as much factual data as possible, analyzing the data, applying known principles, and formulating a solution. In collecting the data careful attention should be given to the effect of handling on the product, the present method, and cost factors.

Hughes Aircraft described an example of the use of simulation to study a materials handling problem. They describe an effort to combine six storerooms into a single, automated facility. The simulation analysis enables the materials handling and process engineers to identify key interrelationships and dependencies that had to be considered in the new design.

### **General Types of Materials Handling Equipment**

Tompkins and White divide materials handling equipment into five classifications. They give the following list but note that numerous variations can exist within each category:

1. Conveyors
2. Monorails, hoists, and cranes
3. Industrial trucks
4. Containers and supports
5. Auxiliary and other equipment

### **Factors Affecting the selection of Materials Handling Equipment**

The selection of materials handling equipment requires the attaining of proper balance between the production problem, the capabilities of the equipment available, and the human element involved. The ultimate aim is to arrive at the lowest cost per unit of material handled.

Equipment factors to be taken into consideration may well include the following:

**Adaptability:** the load carrying and movement characteristics of the equipment should fit the materials handling problem.

**Flexibility:** Where possible the equipment should have flexibility to handle more than one material, referring either to class or size.

**Load capacity:** Equipment selected should have great enough load-carrying characteristics to do the job effectively, yet should not be too large and result in excessive operating costs.

**Power:** Enough power should be available to do the job.

**Speed:** Rapidity of movement of material, within the limits of the production process or plant safety, should be considered

**Space requirements:** The space required to install or operate materials handling equipment is an important factor in its selection.

**Supervision required:** As applied to equipment selection, this refers to the degree of automaticity designed into the equipment.

**Ease of maintenance:** Equipment selected should be easily maintained at reasonable cost.

**Environment:** Equipment selected must conform to any environment regulations.

**Cost:** The consideration of the cost of the equipment is an obvious factor in its selection.

### **Accounting for Materials Handling Costs**

The cost of materials handling arises from two sources: the cost of owning and maintaining equipment and the cost of operating the system. General cost-accounting practice classifies the cost of handling materials as an indirect cost or overhead. This classification is based on the position that the movement of the materials does not contribute to their physical change or add value to them as a product or as a component part thereof.

In some manufacturing situations, such as a carbon black plant where the material is constantly moving during the production process, this contention of the cost accountants might be challenged. However, the problem of classification of unit handling costs of most situations is more of an academic than a practical nature.

### **Relation of Materials Handling to Flow of Material and Plant Layout**

The pattern of flow of materials in a plant definitely affect the materials handling costs. The production process should be so planned and the machines and benches so

arranged that the handlings of materials are reduced to a minimum with as little backtracking of goods as possible. The type of manufacturing is a major factor in this respect.

In the layout of a plant for continuous manufacture the pattern of flow is planned well in advance; because of balanced machine and assembly lines, it lends itself to a well-planned flow of component parts, subassemblies, and assemblies. This makes it possible to plan the handling of materials in advance, procure and install the best equipment for the job, and design for a minimum materials handling cost. However, once installed, the plan lacks flexibility- usually it cannot be changed without major expense.

## **Storage**

Material in storage is generally thought to be stationary or idle. But the use of conveyors as storage devices is quite popular. These conveyors may be overhead and constantly moving, yet utilizing ceiling – space storage. Such an installation is pictured in figure 12-10. Other storage installations may be like the skate conveyors shown in figure 12-11b. In one Midwestern furniture plant the complete floor of the finish drying room is covered by a large slat conveyor that moves very slowly: pieces placed on this “floor” at one side of the room are dry when they reach the other side.

## **Packaging**

Whether packaging is or is not a phase of materials handling is to some degree an academic question. The unit load is in itself a “package”. Generally speaking, however, the term packaging is used to cover the preparation of the final product for shipment, particularly if the product is a consumer good.

From the viewpoint of a material handling problem, packaging of the incoming materials as well as of the outgoing product directly affect materials handling methods and equipment – and the resultant materials handling costs. The designing of the package of a product, although usually identified as a separate activity or function, is closely interrelated with materials handling, methods of production, and marketing. Attractively packaged goods on the shelves and counters of the store, as well as the identification of large shipments on trucks and railroad cars, are effective advertising and sales promotion.

## **Organization For Effective Materials Handling**

Good materials handling practice is the responsibility of all members of the manufacturing team, from the top management down to the trucker working in the aisle of the plant. Very few other elements of manufacturing activity must be so carefully considered by each function in the manufacturing organization. Optimum effectiveness of materials handling procedures can only be attained if each individual recognizes and plays his part. Education and training in materials handling are prerequisite to minimum materials handling costs.

Responsibilities assigned such a staff group may well include:

1. Determining all new methods for the handling of new materials or products and selecting the equipment to be utilized.
2. Conducting research in materials handling methods and equipment.
3. Conducting education and training for all manufacturing personnel in good material handling practices.
4. Establishing controls of current materials handling costs by analysis of costs and comparison to budgets of either unit or total materials handling costs.
5. Initiating and conducting a continuing materials handling cost-reduction or cost improvement program.
6. Determining measurements for effectiveness of materials handling that can become the yard – sticks for progress in this activity.
7. Developing and conducting a preventive maintenance program for all materials handling equipment.



**CHALMERS**

DEPARTMENT OF TECHNOLOGY MANAGEMENT AND ECONOMICS

# PURCHASING MANAGEMENT

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## Preface

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Purchasing has gone through a lot of changes during the last decades. Some even refer to it as a 'revolution in purchasing'. Hence, the area has received an enormous interest both from academia and practice.

At Chalmers University of Technology purchasing is part of research and education in the wider area of *Supply Chain Management*. A master's programme was started in 2004 and since then about 200 students have taken their degrees. A majority of these students have started a career in Supply Chain Management and quite a few are specialising in Purchasing. Owing to a generation shift in many companies, accompanied with major strategic changes such as supplier base reduction, development of supplier relationships and outsourcing, their careers have been accelerated.

This book is based on an advanced course in *Purchasing Management* as part of the master's programme in Supply Chain Management. The whole course focuses on exploring the state of the art in Purchasing. Based on literature reviews and case studies the students have worked on different themes with the joint ambition to describe and discuss what is happening in purchasing today.

As much as the book may give an idea of current developments in purchasing, it might also provide a presentation of a coming generation of purchasing professionals. This new generation has been thoroughly trained in project work in a multi-cultural setting. They have also, in addition to purchasing, studied subjects such as logistics, industrial marketing and production that during recent years have become integrated into Supply Chain Management. This makes them well prepared to take on the challenge of creating the necessary links between companies, and between company functions, that is often claimed to be lacking to enhance supply chain performance. This book addresses some of the key issues in this endeavour.

Prof. Anna Dubois, examiner

Gothenburg, December 2008

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**Martin Dahl**, a becoming graduate mechanical engineer at Chalmers University of Technology. After taking an additional course in logistics Martin decided to join the Masters programme of Supply Chain Management at Chalmers. Martin plans to finish his degree during the spring of 2009. He then hopes for an international career within purchasing and logistics.

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**Si Shen** obtained her Bachelor degree of Traffic and Transportation at Shandong University in China. After that she took the international master's programme of Supply Chain Management at Chalmers University of Technology in Sweden. She hopes to work within Supply Chain Management area after graduation, especially with those companies which expand business in China.

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**William Wahrén** took his Bachelor degree in Industrial Engineering and Management at Chalmers University of Technology. After this he spent one semester at the University of Twente in the Netherlands studying Business and Administration. This was followed by a few months working as consultant before joining the master's programme Supply Chain Management at Chalmers. William continued to work part-time as a consultant in parallel with the studies. He envisages a future career working with productivity enhancement and continuous improvements.

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## Introduction

The aim of this book is to present current developments as well as the state of the art within Purchasing Management. To do this in a meaningful and structured way the book's definition of Purchasing Management must first be established. This definition will be presented to the reader in this chapter and the rest of the book will onwards be based on this definition. This chapter will also highlight the importance of Purchasing Management within an organization. Furthermore, some readers will have previous experience with the topic of Purchasing Management and therefore also be familiar with the historical developments within the area. Others, however, will not have this knowledge and for this reason this chapter also presents and outlines the trends and events that led to the current state of the art. The developments, which this book will focus on, are the ones of the second half of the 20<sup>th</sup> century. The emphasis will be on the 1990s, since that period of time includes the most significant developments within this topic.

## Definition of Purchasing Management

There does not exist many definitions of Purchasing Management and the difference to the well known concept *strategic purchasing* is not very clear. Strategic Purchasing is often described and defined as: when purchasing activities are linked to the corporate strategic planning process. Here is one more explicit definition of strategic purchasing written by Carr and Smeltzer (1997):

*“Strategic purchasing is the process of planning, implementing, evaluating, and controlling strategic and operating purchasing decisions for directing all activities of the purchasing function toward opportunities consistent with the firm's capabilities to achieve its long-term goals”.*

This book will be based on this definition and it will in other words work as a definition for the books concept Purchasing Management as well. This is done since Purchasing Management can be defined as the concept of managing strategic purchasing. The structure of the book and the concept of Purchasing Management will also be described with help of a conceptual model which is developed and mostly based on existing literature within the topic of purchasing and supply chain management. The main focus of this model is that Purchasing Management is located at the boundary between a corporate organization's external and internal business network. The business network is defined as a network of activities, resources and actors (Ford, et al., 2003). On the internal side of the business network the activities are often represented of internal process within the own organization and resources are often owned by the focal firm. The actors here are usually employees or departments within the corporate organization. On the external side of the industry network, the activities are represented by supplier activities or joint activities between different actors as competitors, customers and suppliers. The resources are owned by suppliers or jointly owned by different actors

such as competitors, customers and suppliers. The actors on the external side of the industry network are primarily the suppliers, see Figure 1.

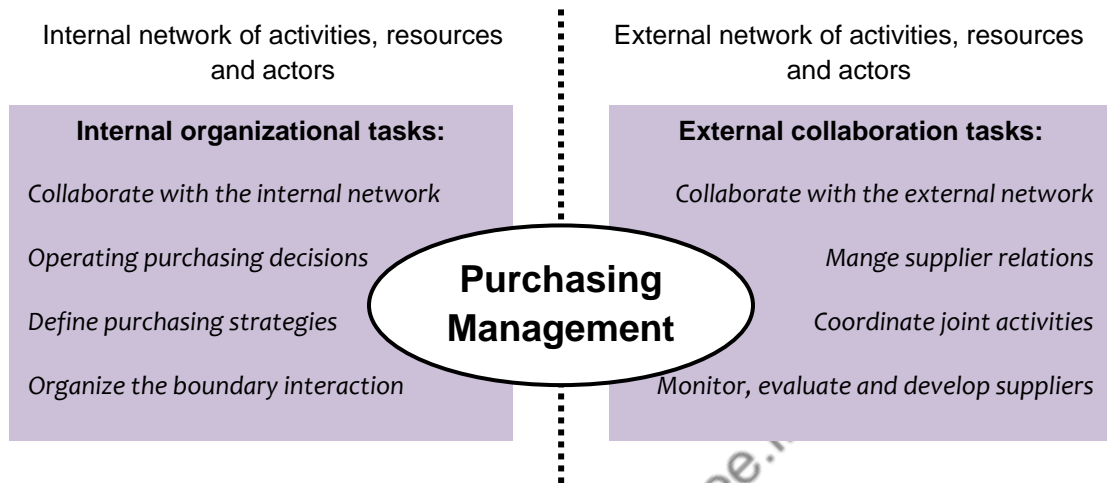


Figure 1 - Conceptual model of Purchasing Management.

The purpose with this book is to cover the conceptual model (see Figure 1) by describing the various elements of the model in to the books different chapters. Furthermore, the purpose of the book is to present a state-of-the-art way of operating and manage purchasing activities. This will be done by presenting some successful guidelines and methods based on both literature and real business case examples.

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## The impact of Purchasing Management

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A large study based on 175 company surveys with a respond rate of 22% performed by Carr and Pearson (2002) shows that the factors strategic purchasing and Purchasing Management have a positive impact on the firm's financial performance in both small and large firms. Carr and Pearson (2002) also write that Purchasing Management and supplier involvement does affect the success of a new product introduction. This study also shows that a link exist between implementation of strategic Purchasing Management and achievements of a firm's comprehensive goals. It is also stated in the report by Carr and Pearson (2002) that it is believed that most firms recognize the importance of strategic purchasing, because they spend a large percentage of their sales on purchased inputs.

Carr and Pearson (2002) also finish their study with the words "Based on this study, management should better understand the importance of Purchasing Management, supplier involvement, strategic purchasing and its relationships with firm's financial performance.

---

## Purchasing Management and corporate strategies

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To complement the findings of Carr and Pearson (2002) one additional study, made by Ellram and Carr (1994) was selected. That study clearly indicates that purchasing strategy should be a part of the overall corporate strategy. The movement toward global sourcing, rapid changes in technology, and increased competition requires purchasing to assume more responsibility in the planning and implementation of strategies to support the overall corporate strategy. Suppliers do also more and more start to play a critical role regarding the support of a firm's competitive strategy (Ellram, et al., 1994).

Ellram and Carr (1994) also define four stages of purchasing organization related to the level of strategy development. The four stages are:

*Stage I* is a passive stage, in this stage the purchasing process normally begins as a reactor based on requests from other departments in a corporate organization. Many of the purchasing activities and processes are handled by totally other functions than pure purchasing functions within the corporate organization (Ellram, et al., 1994).

*Stage II* is an independent stage where the purchasing departments spend considerable time attempting to professionalize the own purchasing function by introducing such things as computerized information systems, formalized supplier programs and communication links (Ellram, et al., 1994).

*Stage III* is a supportive stage where the purchasing departments are viewed by top management as an essential business functions. The purchasing organization is expected to support and strengthen the firm's competitive advantage by providing timely information to all surrounding departments in the firm about for example potential changes in the price and availability of goods and services which may impact the firm's strategic goals (Ellram, et al., 1994).

*Stage IV* is the integrative stage, in this stage the firm's competitive success rests significantly on the capabilities of the purchasing department's personnel. The purchasing department's role within the firm is also changed from facilitator to functional and this development process must be implemented, significant supported and guided by management. The long-term perspective is also of great importance regarding development to this stage (Ellram, et al., 1994).

Hopefully, it is now clear that Purchasing Management should be treated at a strategic level within the corporate organization and that the purchasing department should be managed and used as it is representing an important part of the firm. The following part of this book's chapter will focus on some historical trends and changes within the area of Purchasing Management.

## History and trends within Purchasing Management

*“Procurement is regarded by executive management as a negative function — it can hinder the company if not done well, but can make little positive contribution.” (Henderson, 1975)*

This was stated in the mid 1960s, by the purchasing professional Bruce D. Henderson, who spoke about the situation and opinions regarding purchasing at the time. He argued that purchasing was a neglected function in most firms because of executive management’s belief that it was not important or relevant to mainstream problems. (Trent, et al., 1998)

Since 1960s and since the middle of the 1980s in particular, the strategic role of purchasing and Purchasing Management has received considerable attention in academics and trade journals as well as in popular press. As firms started to see the importance of purchasing input in their organization the role of purchasing was changed from a not considered important part of the organization versus a more important strategic role and resource of the firm (Carr, et al., 2002). Over the past three decades, purchasing has slowly started to gain visibility in firms all around the world. This evolutionary process has been slow in words of time due to the fact of continuous general management failures. Managers have failed to understand the critical role of purchasing and thereby not focused on its issues and strategies. Ammer (1989) noted that prior to the 1973-74 oil crises, top management viewed purchasing as having a passive role in the business organization. But a major point in the recognition of purchasing strategy occurred when Porter (1980) emphasized the importance of the buyer in his model of the five forces that impact the competitive nature of an industry. The 1980s marked the beginning of a shift in attitude towards including the purchasing role in corporate strategy. In the 1970s and early 1980s, purchasing took a supportive role, ensuring that supplier quality met the required standards for production. During the 1990s, the literature indicates a movement toward integrating purchasing into the firm's strategic planning process. Today, the purchasing department's ability to impact strategic planning has increased in a number of firms. (Carter, et al., 1996b).

Figure 2 summarises the development of purchasing from 1970s to 1990s.

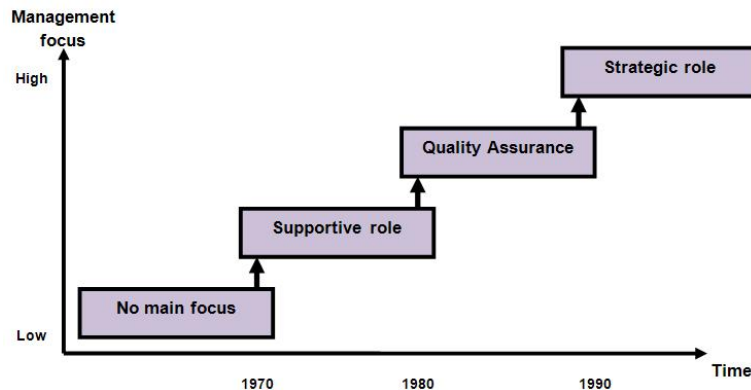


Figure 2 - Historical development of purchasing management

## Trends within Purchasing Management in the 1990s

As mentioned above, Purchasing Management has undergone a high degree of change since its neglected state back in the 1960s. This is particularly true for the 1990s, where there was a great change in opinion regarding purchasing. According to a yearly survey conducted at Michigan State University the perceived importance of suppliers and purchasing/sourcing increased significantly during the 1990s and was widely acknowledged by executive managers by the end of the decade (Trent, et al., 1998). By this time several researches argued that the performance of the purchasing functions did in fact affect overall company performance and that it should be considered as part of the corporate strategy (Johnson, et al., 1998). A study performed by Kempainen and Vepsäläinen (2003) also showed that the perceived importance of purchasing, compared to other functions, had increased significantly from then 1990s to the start of the naughtiest. This trend was most likely supported by the increasing status of Supply Chain Management.

According to Trent and Monczka (1998) the increase in supplier importance is a result of at least five factors that affect most industries:

1. The need to control unit costs
2. The need to reduce the total cost of acquisition
3. The increasing influence that suppliers have on the purchaser's ability to respond to end customers, particularly as it affects time-related requirements
4. An increased reliance on fewer suppliers, and
5. A willingness of purchasers to rely on suppliers to design and build entire subassemblies and subsystems. These factors have heightened the suppliers. (Trent, et al., 1998)



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### Internal organisational trends

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The shift since 1990 in purchasing responsibilities reveals a large-scale movement away from tactical commitments and movement toward strategic or value-adding tasks (Trent, et al., 1998). The trend towards strategic purchasing was also evident in the results from the 1994 North American Executive Purchasing Roundtable (Carter, et al., 1996a).

The 1990s also saw the start of EDI and system development. The use of these systems grew yearly in the 1990s but the rate of growth was newer meet the predicted rate (Trent, et al., 1998). At the 1994 North American Executive Purchasing Roundtable it was concluded that EDI and increased use of information systems was both ranked amongst the top five most significant trends (Carter, et al., 1996a). Other studies, however, show that the outsourcing of IT grew dramatically during the 1990s since it was not considered a core competence. (Kakabadse, et al., 2002)

During this period emphasis also grew on the use of cross-functional teams to support sourcing decisions, such as evaluating, selecting, and managing suppliers. There were, however, still many firms who did not succeed in establishing such teams despite their willingness (Trent, et al., 1994). The emphasis and subsequent use of cross-functional teams does however seem to be increasing. In 1990, less than half of firms included in the Michigan survey stated that they emphasised the use of cross-functional teams. This number had increased to over 75 percent by 1997. The study also found that purchasing groups organized around commodities decreased while groups organized around end item increased during the 1990s. (Trent, et al., 1998)

The 1990s also witnessed an increased focus on the concept of corporate social responsibilities (European Commission, 2001) (Carter, 2000) as well as that of green or environmental purchasing. By the end of the decade green purchasing efforts were, however, still largely reactive. There were also many obstacles, primarily economical, which prevented green purchasing from becoming effective. (Min, et al., 1997)

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### External collaboration trends

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There is evidence of an increased dependence on suppliers for product technology. According to the study conducted at Michigan State University the reliance on external sources for product technology increased from 37 percent to 44 percent between 1993 and 1997. Concentrating on core competencies and technologies and an increased emphasis on outsourcing non-core processes are factors that contributed to the growth in external reliance. Furthermore, pressure to include the latest technology in product designs makes supplier contribution increasingly important. According to the study executive management's awareness of the importance of the supplier's role in supporting product development increased steadily during the 1990s, growing from 4.5 in 1990 to 5.9 in 1997 (where 1 = limited importance and 7 = significant importance). (Trent, et al., 1998)

Close to 75 percent of firms taking part in the Michigan survey decreased the number of suppliers they maintained between 1993 and 1998. Furthermore, over 80 percent of the firms expected a continued

reduction in the size of their supply base through the year 2000. The reductions in supplier numbers were however most aggressive as the late 1980s and early 1990s (Trent, et al., 1998). A survey conducted by Carter and Narasimhan (1996c) also showed that firms were expecting to decrease their supplier base.

During the 1990s the percentage of long-term contracts as well as the percentage of dollar value handled by long-term contracts increased. The percentage of longer-term contracts to total contracts has increased from 24 percent of total contracts in 1990 to 36 percent in 1997. Dollar value percentage increased from 34 to 50 percent during the same time period (Trent, et al., 1998). Simpson et al. (2002) also found to a growing focus on long-term relations with suppliers. Related to this, Kakabadse and Kakabadse (2005) conclude that there is an existing trend emphasising managing relationships with key trusted suppliers. Also, the importance of strategic alliances with suppliers was emphasised at the 1994 North American Executive Purchasing Roundtable (Carter, et al., 1996a).

Traditionally the approach to supplier evaluation, if one existed within a firm, in purchasing was focused on price, quality and delivery. These factors are still the most used but some firms have started to supplement them with other factors relevant to the industry. This can improve the purchasing firm's ability to choose the most suitable supplier. Examples can be a supplier's process capabilities, equipment and quality management (Goffin, et al., 1997). Other important factors can be communication and continuous improvement efforts (Simpson, et al., 2002). Companies also increased their understanding of the benefits of having a formal way of evaluating and retaining suppliers. Furthermore, it is reasonable to believe that the increased emphasis on green purchasing (Min, et al., 1997) and corporate social responsibility (European Commission, 2001) has also started to influence the supplier selection processes.

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## [2] Purchasing Organization

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*The structure of the purchasing department is especially important in external and internal networks. The organizational model must facilitate activities in different strategic levels as well as cope with changes in external environment. By adjusting formalization and centralization levels, the organization can be positioned to best support the organization. However, no universal solution exists, as the right structure is highly company specific and dynamic over time. Therefore, this is one of the major challenges that Purchasing Management confronts within business networks.*

## Introduction

In this chapter the purchasing organization issues are addressed – what are the prerequisites for such organization and what should be considered beforehand, what are possible solutions and which attributes are there to differentiate between various configurations. In addition, attention is drawn to few key elements that should be considered within any certain structure.

The chapter focuses mainly on manufacturing companies, which leaves service providers as well as public sector organizations out of scope. However, as structural design is an issue in any organization, the underlying principles for the supply department can be applied outside the scope discussed in the chapter.

## The requirements for purchasing organization

Every company can be identified by its goal and the policy for achieving this goal. The policy devises organisational setup to facilitate the activities stated in the policy (Quayle, 2006). Therefore every function that performs those activities runs under a specific organizational structure. Those structural arrangements influence the performance of the individuals in the organization as that is what determines the duties, responsibilities, and relations of the function (Quayle, 2006). Thus, in business networks, interactions and processes among the actors are conditioned by the way companies, business units and departments are organized. (Gadde, et al., 2001)

In order to maximize performance, a company needs to adjust its structure and management processes to the changes in the outside competitive environment and also to facilitate the necessary cooperation between various parts within the company. (Johnson, et al., 2001) Therefore it has to meet both external as well as internal communication requirements. As purchasing is a part of a company that lies in the meeting point of those environments, the issue of structural design becomes especially relevant here.

The starting point for deciding upon appropriate organizational setup is to identify the requirements set for purchasing function by business strategy, external environment, and other factors. In addition, according to contingency theory, it is crucial to recognize ongoing trends and changes in supply processes in order to increase the coherence with current business environment as well as prepare the organization for future. (Wood, 2005), (Johnson, et al., 2008)

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## Functions

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Purchasing needs to facilitate activities of three different characters – operational, tactical, and strategic (Van Weele, 2005). According to Gadde, et al. (2001), the purchasing profession today includes four sub-functions over those different levels: ordering, negotiating, sourcing, and supply chain management in terms of synchronizing material flows.

- ✘ Ordering includes mainly the administrative side of purchasing in the form of expediting orders. This is a purely operational activity.
- ✘ Negotiating deals with selecting the economically most feasible supplier(s) from the list of approved vendors; while
- ✘ Sourcing involves the purchasing function in procurement decisions prior to the decision of approved list. Purchasing is considered strategic from that point.
- ✘ Supply chain management broadens the scope of purchasing by taking responsibility for synchronizing inbound material flows with the rest of company's operations.

Quayle (2006) argues that those sub-functions should not be isolated from one another. For example, it might increase efficiency through specialization to allocate expediting and strategic issues to separate persons but also, having to do the operational work can lead the buyer to select more reliable suppliers. For similar reason of better decisions, it is common that purchasing strategic matters and sales operations are controlled by the same person. It allows better alignment of material and information flows throughout the entire organization. Further discussion on work allocation in purchasing structure will be addressed in later stages of this chapter.

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## Trends

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It is also important to consider the dynamics of supply function when designing the structure. The trends detected in purchasing characteristics today have been previously described in chapter [1] Definition and trends within Purchasing Management. Conclusively they were:

- ✘ increasing strategic role of purchasing in corporate policy; and thus
- ✘ shift towards more centralized control
- ✘ decreasing number of suppliers
- ✘ increasing number of long term contracts
- ✘ buying groups organized around end items rather than commodities

Therefore these are the ongoing changes and activities (the four sub-functions) that purchasing organization has to facilitate in modern business environment. Around that core the rest of the structure can be built.

## Purchasing organization structure

Having identified the goals and requirements for the organization, the appropriate structure for the organization can be considered. Designing an organization refers to *“the process of assessing and selecting the structure and formal system of communication, division of labor, coordination, control, authority and responsibility required to achieve an organization’s goals”*. (Trent, et al., 2005) As goals are different, the actual balance between those factors is highly dependent on the specific company and its surrounding environment. However, despite of numerous possible solutions, only a discrete subset of different organizational configurations has been found to be adopted in practice. (Wood, 2005)

The main attributes differentiating organization structures are considered to be centralization and formalization. (Wood, 2005) In our case of purchasing organization, the first one implies whether the procurement activities of different business units of a company are handled by one central function (centralized) or is every single location/site responsible for its own purchasing decisions (decentralized) (Gadde, et al., 2001). Formalization of the organization expresses the extent to which the procedures, instructions, communication patterns, etc are documented in the company and how are they followed. *“It is the existence and prevalence of written documentation”*. (Wood, 2005) Those two attributes are commonly chosen for adjustment for reasons that they are managerially easily applicable as well as they involve both the formal and informal structure of the company. (Wood, 2005)

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### Centralization

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Centralized purchasing organization can be found applicable in case of similarities between multiple company locations e.g. in used technology, market conditions, purchasing problems, item demand, etc. It is more common to occur in companies offering the same product or service in multiple locations. (Quayle, 2006) In addition, centralized control is found to be prevailing configuration also for single site and relatively small size company where there are no feasible criteria for division of control and thus decentralization would provide no benefits.

However, decentralized purchasing solution is seen beneficial when substantial differences exist between various sites of one company. In such case centralized control would be inefficient as each unit operates in its own area (Gadde, et al., 2001); (Quayle, 2006). Table 1 provides comparative overview of benefits and downsides of both described solutions.

	Centralized	Decentralized
Advantages	<ul style="list-style-type: none"> <li>✗ Increased professionalism of buyers</li> <li>✗ More efficient allocation of purchasing budget</li> <li>✗ Higher bargaining power</li> <li>✗ Less orders and bigger quantities – savings through administrative costs and economies of scale</li> <li>✗ Direct and single-point contact with suppliers</li> <li>✗ Avoidance of competitive buying by parallel departments</li> <li>✗ Increased efficiency through development of common standards and procedures</li> <li>✗ Higher role of purchasing in corporate hierarchy</li> </ul>	<ul style="list-style-type: none"> <li>✗ Purchasing department's better contact with local organization</li> <li>✗ Integration with other functions; buyers are often located together with engineering or manufacturing specialists</li> <li>✗ Ability to focus on local conditions and adjust purchasing activities accordingly</li> </ul>
Disadvantages	<ul style="list-style-type: none"> <li>✗ Indirect contact between supplier and actual user of the component/product</li> <li>✗ Increased specialization can limit purchasing function integration with other department, losing the overall coherence requirement</li> <li>✗ High buying power can be abused by the chase of lower prices resulting in bankruptcy of supplier and changes in market structure</li> </ul>	<ul style="list-style-type: none"> <li>✗ Coordination difficulties between different sites</li> <li>✗ No clear overview of inbound material flow leading to inefficiency</li> <li>✗ Reduced specialization and bargaining power due to smaller scale and scope of the function</li> </ul>

Table 1 - Advantages and disadvantages of different centralization configurations. Based on Gadde, et al. (2001), Quayle (2006), Van Weele (2005)

It can be noted that total centralization and total decentralization are both extreme values of centralization continuum. The majority of companies lie somewhere between these two extremes to utilise advantages of both configurations (Johnson, et al., 2004). In such hybrid structures responsibilities and control between head office and local organization are divided with accordance to business environment. Even though the exact division is highly individual among companies, the tasks often allocated to head office can include:

- ✗ development of purchasing strategies, policies and standards
- ✗ negotiations for common, widely used items
- ✗ stock management between sites
- ✗ purchase of plant equipment and other strategic items
- ✗ training
- ✗ legal matters
- ✗ research and information service

Gadde, et al. (2001), Quayle (2006)

The responsibility for local purchasing organizations would thus be:

- ✗ placing orders for common items
- ✗ negotiating and contracting locally used items

Gadde, et al. (2001), Quayle (2006)

## Formalization

The issue of formalization in purchasing organizations is not much addressed in prevailing literature which implies its relatively small effect on supply performance of companies. However, its combinations with centralization decision help to describe four essentially different organization types which are also suitable for defining different purchasing function's characteristics. Those include machine bureaucracy-, entrepreneurial-, professional-, and adhocracy types (Wood, 2005) (see Figure 3).

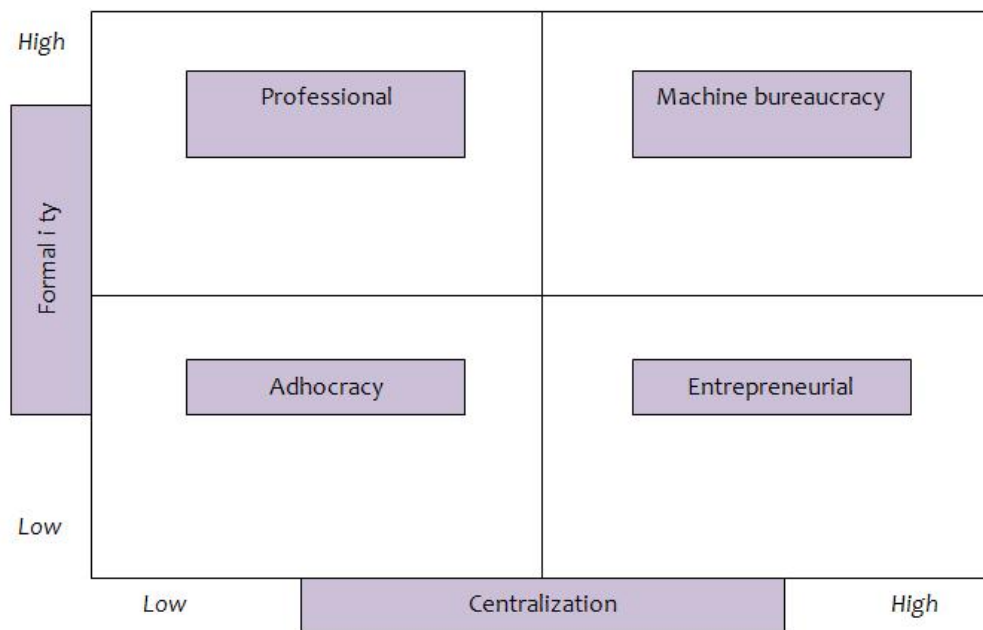


Figure 3 - Different organizational configurations. Based on Mintzberg (1989)

Machine bureaucracy type organizations contain both high levels of formality as well as centralization. This results in an organisation with many formal rules, regulations, and controls where a large part of communication existing in written form. To be able to control that regulations are followed, the decision-making is centralized with very clear and hierarchical division of power (Wood, 2005). Large multisite manufacturing firms that drive for efficiency can be good representatives of such supply organization type.



In the entrepreneurial organization little of its activities are formalized. Control as well as decision-making is agglomerated to the manager which leaves little or no reasons why to formalize the operational communication too much (Wood, 2005). An example of purchasing organization like this can be single site manufacturing company with centralized control and relatively simple procedures. The configuration can also be applied by more complex companies with a small number of central suppliers where local units are responsible only for call-offs from those contracts which require no extensive formalities.

Professional organization type contains high level of formalization with the purpose of facilitating complex procedures that need certain level of formalized control. However, as the formalization is designed to achieve the desired outcome from its members, all professionals share decision-making authority in this configuration. In general, it is considered to be suitable setting for hospitals and universities. (Wood, 2005) In our case of purchasing organization, it fits to a development intense multi site MTO type of company with heterogeneous supply demand where contracts are done autonomously at different locations due to different or changing characters of the product. Also, such configuration is suitable to describe the head office layer of centralized or hybrid supply organization – corporate buyers with high specialization and autonomous decision-making power (Van Weele, 2005).

Adhocracy structure is low in formalization and with decentralized decision-making. (Wood, 2005) As all previous types, there are environments where such design can be considered an appropriate solution. It facilitates fast response and flexibility in the processes. However, it is rather difficult state to control due to tendency for anarchy and poor coordination. It might be suitable for R&D intense development organizations where purchasing activities can be complex and unconventional.

This clustering allows general positioning of the organization. As also hinted in the description of professional organization type, different types can be exist in different levels of centralized or hybrid purchase organizations i.e. head office and local units. Such classification might not be particularly useful to know for buying company itself as more important is the actual alignment with the rest of organization and not which cluster it falls in. On the other hand, it might prove to be great value for selling companies where such grouping can give useful insight how decision-making and power is divided in purchasing function and thus allows “to push the right buttons” by focusing sales effort to right positions (Wood, 2005).

There is no checklist available concerning decisions for designing most appropriate purchasing organization i.e. in which square to be on that graph. The solution is highly context dependent and the context is highly volatile which leads to continuous need to monitor and configure the organizational structure (Gadde, et al., 2001); (Johnson, et al., 2004).

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## Dynamics

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An organizational structure must be able to change in order to cope with outside pressures. However, there are several views on the dynamics of organizational structure. It is suggested as being progressive with different organizational types evolving over time. Also cyclical and oscillating patterns between discrete numbers of configurations have been described. But the bottom line of all of those views is that managers reform the organization in order to enhance the performance and despite the fact whether such configuration has been used before. (Wood, 2005) According to Johnson, et al. (2001) and Wood (2005), it is not proven that CPOs restructure or design the organization driven by and based on an analysis of available alternative. Such reforms are initiated by pressures created by changes in external environment which influence corporate strategy. That in turn necessitates adjustments in corporate structure which inevitably brings along changes in supply organization to maintain coherence throughout the entire company.

Such hierarchy of events leads to two important considerations regarding the design of purchase organization. First, as adjustments to organizational issues are done with the purpose of improving cost structure, even when changing back to setting that has been previously used. That means no perfect organizational design exists but the usefulness is determined by external conditions. Second, as changes are not triggered by managers, but rather external pressures, internal problems, or combination of the two, there is a certain lifetime for one organizational structure (Johnson, et al., 2001). It is just a matter of time before the current configuration is outdated again.

Coming back to the model of four organization types, those two conclusions imply that companies are not determined to be in the matching “square” for eternity. The position changes over time. As companies grow, they can, for example, move from entrepreneurial towards machine bureaucracy due to simple increase in people and volumes. By changing strategy or developing supplier relations, companies can become more development centred with professional-type structure or even downgrade to adhocracy type. Companies can apply several models in different layers of their supply organizations enabling even more directions for a change. The movements in the graph don't necessarily have to cross category borders but also shifts towards certain direction can indicate an important change for the company.

Expressing the ongoing trends of increasing centralization and reducing the number of suppliers in the light of this matrix, the shift to right side of the graph – towards centralization – could probably be detected in all clusters. The change in terms of formality is probably multifold, especially in hybrid structures, and shifts in graph would express various directions depending on business environment making it difficult to detect any clear pattern except for the fact of change itself.

However, it is important to differentiate between the essential drivers behind the shift towards another configuration. As described previously, it can be the result of already changed external factors. In that case, the management of purchasing organization deals with consequences by just

trying to avoid further damages with fast reacting. It resembles driving a car through the rear window where upcoming curves on the road are recognized when the ride is already very bumpy.

In our view it would be highly welcomed if the dynamics of the organization could be more controlled in terms timing and planning the change according to future forecasts. In that way minor adjustments in organizational design can keep the processes well on track and can avoid costly restructurings of the entire organization. Despite the seeming lack of research on that topic, the issues seems to come in focus of practitioners as stated by the study of Johnson (2004) that *coping and prospering despite and, perhaps, because of change, may be the CPO's ultimate test*. As change management regarding external and internal factors becomes recognized part of Purchasing Management, the improvements towards controlled dynamics may be underway.

### Other organizational factors

Once the organization's structural model has been decided, the frame for working conditions and formal communication has been set. It defines the shape and orientation of the function but not what's inside. Therefore the next step in organizational design is "filling" the structure, which also adds few critical decisions to the overall design process.

Previously outlined trends in purchasing practice indicate the increasing strategic role in corporate policy. Along with that comes the need for higher alignment in corporate hierarchy which in turn results in higher reporting level of the CPO. This trend needs to be taken into consideration when designing a structure. Studies by Johnson, et al. (1998) and Johnson, et al. (2004) note that in order to achieve the capabilities of strategic planning and responsibility, an organization must have some kind of centralized control over its processes and prove that purchasing organizations classified as centralized, and also hybrid, have higher rate of participation in major corporate activities than decentralized supply departments. Thus the seemingly external factor of purchasing positioning inside the company correlates to structural design decisions in a very good way – increased centralization facilitates the higher reporting level of a CPO.

The same study indicates another factor which, in terms of organizational structure, might seem irrelevant at first glance – the background and characteristics of the CPO. Managers with higher corporate positions and those with relevant work experience demonstrated wider use of various purchasing techniques, e.g. cross-functional teams, supplier and customer involvement teams, co-location of buyers with other functions. Those methods can significantly determine the actual formal as well as informal communication structure in the purchasing organization along with division of labour and control. Therefore the question how managing positions in purchasing function are staffed must also be considered in the design process.

Among other decisions affecting the way in which a purchasing organization works is the question of division of work. As outlined in the beginning of this chapter, the ongoing trend is formalising buying groups around end items rather than commodities. However, the bottom line is that this division should be done on logical bases, whether it is based on commodities, geographical location, or other factors (Quayle, 2006). As specialization on one category alters the efficiency of the others, the division should be made with considerations to:

- ✘ practical and technical feasibility of dividing the line of work; and
- ✘ sub-tasks should not seriously impact the values of other sub-tasks.

(de Boer, et al., 2003)

In purchasing organization that can be interpreted as, for example, grouping around end items should be easily supported by the organizational structure. The benefits of such a configuration should outweigh the negative impact of changes in commodity and geographical level, i.e. it does not alter functionality of supplying.

For example, (Van Weele, 2005) suggests a division of tasks between the following functions.

Function	Responsibility
Corporate procurement officer (CPO)	Developing corporate purchasing strategies, systems, reporting.
Corporate buyer	Strategic commodities – large volumes, high investment projects and services. Responsible for developing sourcing strategy for key commodities. Long planning horizon.
Purchasing engineer	New materials and components. New suppliers. Discussing spec.-s, market research, selection of suppliers, negotiations. Work on decentralized level. Liaisons between purchasing and R&D.
Project buyer	Similar to purchasing engineer but focus on equipment and services.
Material planners	Materials planning and ordering, order handling – ensuring material supply, calling off materials against annual agreements. Vendor rating - monitor and control suppliers quality and delivery performance.
MRO buyer	MRO supplies – management of the entire assortment of MRO items with regard to overall performance rather than just price focused.

Table 2 - Buyer profiles and division of responsibilities. Based on Van Weele (2005)

As for the organizational structure, it is difficult to state the correct division. It can vary through different strategic levels of the organization (de Boer, et al., 2003) or be uniform for the entire

department. The overall principle is that the solution must provide satisfactory profit and align with corporate values and policy.

The literature has also implied the increasing level of integration of purchasing function to external as well as internal environment, i.e. to suppliers and customers, and other departments of the company, accordingly (Trent, 2004). Common methods of facilitating such interaction are cross-functional teams including various counterparts related to end product, co-location of buyers and other specialists (engineering and manufacturing), supply councils, etc. The study by Johnson, et al. (1998) also indicates the influence of centralization decisions on the use of those tools. Their conclusion is that in centralized and hybrid structures the implementation of those methods is more common than in decentralized organizations. However, the connection between organizational structure and the tactics of carrying out the tasks exists.

## Summary

The idea described in this chapter about organizational configuration of supply function is simple – structural design affects the performance of purchasing to substantial extent and should be paid consideration by decision-makers in the company. It must have a good fit to the rest of the company structure and facilitate the activities necessary for competitive purchasing. More important, the changing character of the “best fit” necessitates the understanding and consideration of ongoing trends in supply function.

However, the solution in this matter is not simple. One can, and should, consider, among other factors, attributes like centralization, work division, or formalization to achieve better alignment with surrounding environment. Nevertheless, as repeatedly stated in the text, there is no uniform configuration or checklist available to download and implement in all situations. The organization must be continuously adjusted in accordance with external forces and corporate policy.

As purchasing has gained strategic value rather recently, the management still seems to be seeing business dynamics through sort of a back window, reacting only when the changes has already occurred and coping with consequences. In terms of organizational design there seems to be a long way to go to “control” the surrounding environment as being able to predict the dynamics, prepare the structure and processes in the organization, and synchronize the changes in organization with changes in external environment. However, as the studies have revealed the understanding of the importance of change management in business practice and along with increasingly strategic role and closer collaboration with suppliers, we can hope to see improvements in that front in sooner future.

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## [3] Internal Collaboration

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*Strategic purchasing is most often associated with external relations. However, purchasing integration and internal collaboration are the enablers of every corporate strategy. The aim of this chapter is to explain the connections between purchasing and the company's competitive priorities as well as emphasize the need for interdepartmental collaboration.*

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## Introduction

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Many literature sources across disciplines have described collaboration as interaction, where communication in the form of meetings and information flows are employed to bond departments (Souder, 1977), (Trent, et al., 1994). Communication by way of task forces was always an important integration mechanism during the start-up and final stages of product development. Souder (1977) defines the interdepartmental collaboration as “A state of high degrees of shared values, mutual goal commitments, and collaborative behaviours”. Nowadays companies more often send to the markets highly complex products and related services. It all requires solid external actions but also necessitates close cooperation between departments within the company where everyone has common goals and understands the importance of communicating with others.

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## Importance of internal collaboration

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Interdepartmental interaction represents the communication aspects associated with activities performed by different departments within a company. Such activities address verbal and documented information exchanges between specific sides; therefore they correspond to both tangible and intangible assets of the company (Trent, et al., 1994). All the activities should be well structured, clarified and standardized whenever it is possible. If the work division is not clear employees may become confused over their roles in the collaboration processes that can contribute to frustration and serious corporate problems. Also, if inefficient, collaboration can be time-consuming and can impact negative outcomes i.e. lack of agreement and understanding between leaders and other participants (Shani, et al., 2008), (Trent, et al., 1994). Therefore it is necessary to define the meaning of collaboration in each company and set the standards for effective information sharing and integration. As mentioned in chapter [2], purchasing organization should be the enabler for effective internal cooperation as well as collaborative with other departments i.e. by using cross-functional teams and leadership. The concept of cross-functional teams has been lately brought up as an efficient tool to manage expectations of the departments and the company. While it is fairly simple in theory, its practical implementation is very often difficult. A lot of firms must change their business behaviour and overcome previously established functional structures of reporting and sharing information. Powerful cross-functional integration requires a corporate culture of participative teamwork within all company's levels and across defined functional limitations. (Trent, et al., 1994)

It is important to define responsibilities of purchasing organization and other organization inside the company e.g. manufacturing, R&D, logistics, marketing. Therefore there should exist so called “department-specific activities” in order to clearly define internal competences. Some of them would be interrelated but the rest would reflect low interdepartmental interaction and low interdepartmental collaboration, since activities would be internal to the department. Nevertheless,



introduction of new products and product changes very often requires collaboration of several departments. In such cases the purchaser's knowledge should be supported by engineers, a development team and sales representatives. It is the common view that provides the best decisions and results. (Kahn, et al., 1996)

Following the discussion it can be stated that purchasing integration involves the active participation of purchasing in the strategic debate in the corporation and is aimed at promoting the alignment of purchasing practices and goals with strategic business priorities. Purchasing integration relates purchasing plans and practices to business vision, and shapes senior management's perceptions of procurement's strategic role in the firm. (Narasimhan, et al., 2001)

Some of the field researchers, however, argue that sometimes interdepartmental discussion meets a lot of problems. Collaboration is understood as an involved process where employees may not be productive because of time and resource spent to take part in cross-functional training and related activities. Such actions without immediate results might be undesirable from upper management's perspective. Thinking in terms of transactions, departments are considered to be independent entities that may compete for company's resources, and the collaboration between specific departments is considered to be occasional and cost-incurring. Due to competition and perceived costs, managers view meetings and information flows with other departments as negotiations, where each department tries to get the best deal at the conclusion of the meeting or information exchange. (Kahn, et al., 1996)

It is important to point out that the level of purchasing success and the following success of the company depends on the fit between the company's functions. In case of purchasing initiative, a structure should be established to enable cooperation with other departments. The departments should give each other a mutual support in order to improve overall company's performance. When setting up collaboration processes, issues like division of responsibilities, field support and information sharing should be determined. By establish the purchasing department's fit into the company's other functions it also creates a support for already established collaboration to improve and deliver outcomes that are in favour for the business performance. Further, it can be observe that the level of involvement of purchasing organization depends on a project and its complexity. Sometimes the internal focus of a project may lie in other departments e.g. manufacturing and product development. Despite the less important role of purchasing in some cases, it is still necessary to exchange knowledge and experience in order to successfully complete the project.

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## **Purchasing collaboration with other departments within the internal organisation**

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It can be stated that purchasing works as an intermediary between suppliers and the focal company and takes a role of a relationship manager. It should have the ability to communicate effectively including the potential contributions to design and technology experts internally. It is important to point out that the purchasing department does not have to coordinate all of the contacts with suppliers. Other important departments like Research and Development (R&D), Manufacturing or Sales may have the main and significant knowledge about a product and supplier market. In this context, a close collaboration between the departments is crucial. The purchasing organization may not constantly play a major role but it should always be responsible for supplier selection, contracting and monitoring as well as maintaining right relationships. The following sections will describe the purchasing department's collaboration with other departments in the organisation. These departments are; R&D, manufacturing and logistics.

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### **Purchasing – R&D collaboration**

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Purchasing involvement in research and development activities has lately grown into a more strategic issue than ever before. Apart from the internal close collaboration between departments, firms look for supplier capabilities in engineering, design, testing, manufacturing, tooling, delivery and responsiveness. This new approach has been described by Narasimhan et al. (2001), which indicate that with the assurance of increased volume commitment and increased familiarity with a wider assortment of parts, suppliers can focus on design and process improvements. Taking into account this reality, the role of purchasing involvement in product development has increased a lot. More than ever, the interdepartmental collaboration within research and innovation is essential for the company's long-term success and profitability. Leadership and joint problem solving implemented in purchasing organization are the tools to support developing critical products and process technologies. (Narasimhan, et al., 2001)

Purchasing practices may involve extensive investments and development such as quality training for suppliers, organizational change towards integration, developing strong internal ties through membership in strategy development teaming, information sharing, and joint decision-making activities. The total costs tied up into these undertakings may be lowered by an efficient internal collaboration and planning. Further, these benefits can contribute to long-term profits and solid business establishment. For instance, the design for manufacturability can achieve lead-time reduction, better quality, less rework and cost reduction. An effective collaboration between purchasing and product development can lead to better overall materials management in downstream processes inside the company. Bonaccorsi, et al. (1994) concluded in their field research that an early involvement of purchasing organization can enable efficient research within relevant suppliers and

improve a company's performance in the future. However, it can only be achieved when the purchasing involvement and collaboration is managed carefully. (Bonaccorsi, et al., 1994)

Most often the collaboration process with the R&D department involves contacting company's engineers regarding specific components, materials and technological solutions. Typically, growing degrees of project innovation and complexity are expected to lead to the increasing involvement of purchasers. The level of purchasing contribution in product development can be diverse e.g. on part-time basis, full-time basis and project coordination role. (Lakemond, et al., 2001)

According to the same author there must exist several factors that drive the need for purchasing collaboration:

1. The presence of an internal organization that is able to support communication and coordination in product development
2. The competences and skills of the purchasers in terms of personnel with the right education, skills and experience; understood as well-established purchasing organization

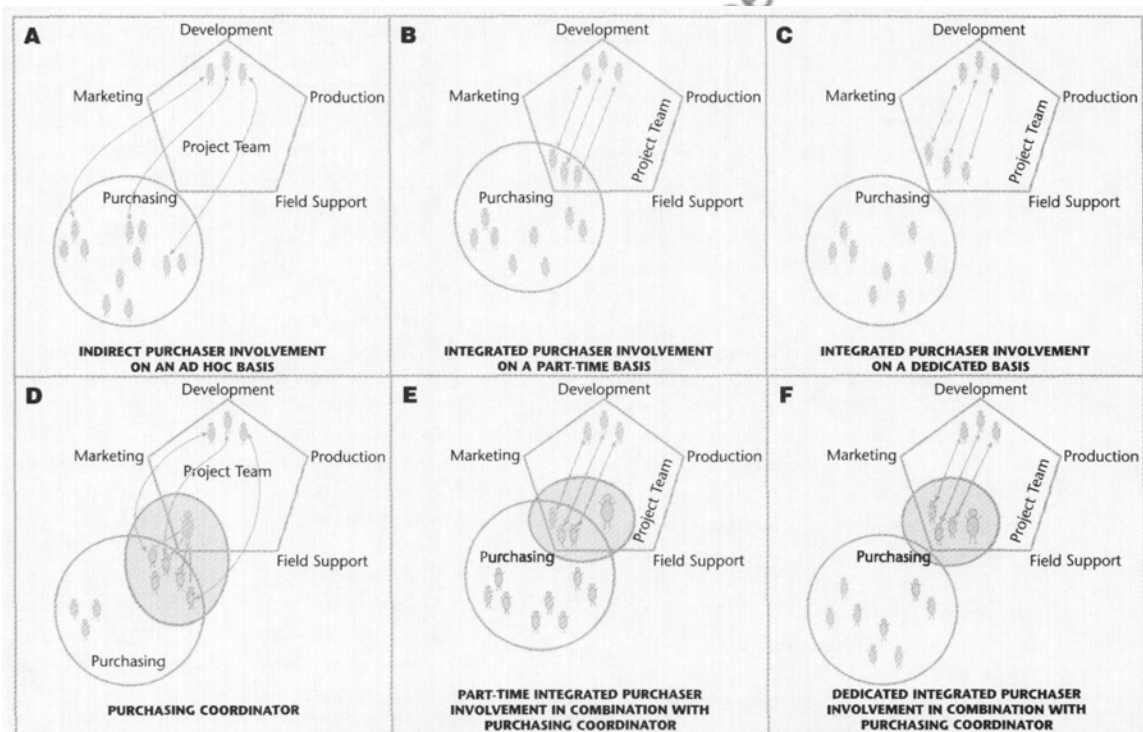


Figure 4 - Configurations of purchasing involvement in product development projects (Lakemond, et al., 2001)

Figure 4 presents different organizational mechanisms that have been suggested to coordinate functional interfaces between the departments of an organization. Purchasing can for instance become involved in a product development project based on direct collaboration between purchasers

or developers and engineers. The purchasing is not really integrated in the project team but is involved occasionally when the support is needed. Generally speaking, the collaboration may have a dedicated basis (purchasers work full time in the development projects), a part-time basis (operational purchasing) or a coordination role where the project work is supported by the purchasing team from the department. (Lakemond, et al., 2001)

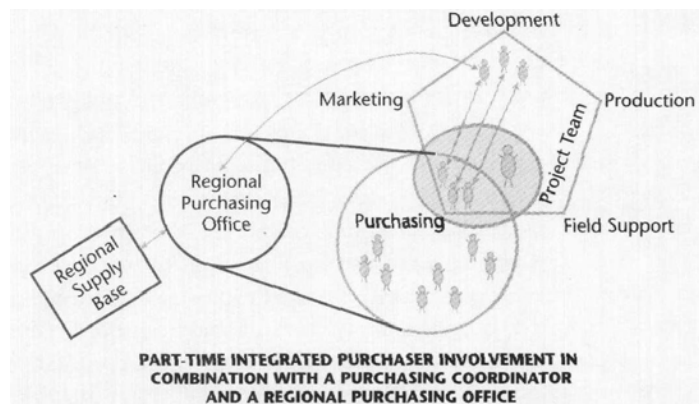


Figure 5 - The regional purchasing office for a regional supply base (Lakemond, et al., 2001)

Figure 5 presents another approach that is common for global companies. Increasing competition and market requirements put more conditions in many industries. Once, a Dutch manufacturer of copier and printing systems established a regional purchasing office in Asia, in order to reduce time-to-market of new products, decrease costs and intensify monitoring global development activities. Initially, the external supplier base was aimed at investigating the Asian supplier market. However, later it moved towards setting up a purchasing specialist role with the responsibilities of an account buyer and regional purchasing market researcher. (Lakemond, et al., 2001)

### Purchasing and Manufacturing collaboration

There exists a strategic and meaningful relation between the activities performed by purchasing and manufacturing departments. Thoroughly selected suppliers and close relationship with them can support production efficiency and reliability. Watts, et al. (1992) emphasized the importance of achieving congruence between purchasing objectives, action plans, manufacturing and business goals. To accomplish this, purchasing must be a full participant in business strategy formulation and implementation. Integration has become a new core competence for a lot of companies. In this part of the book, the central argument is that a well-aligned purchasing strategy has a crucial impact on the achievement of manufacturing and overall business goals.

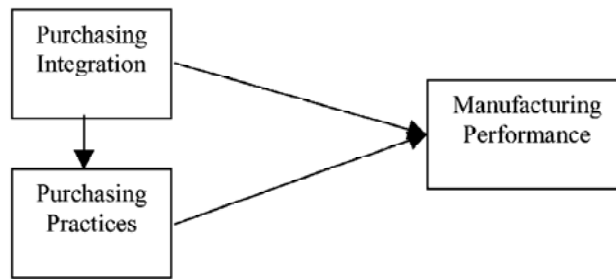


Figure 6 - Purchasing and manufacturing integration - Hypothesised model (Narasimhan, et al., 2001)

The simple model presented on Figure 6 shows purchasing integration and purchasing practices as having a main influence on manufacturing performance. For instance, a positive connection between purchasing practices and manufacturing activities may be maintained by supplier integration and supply base management. Besides, purchasing integration can enhance the alignment between purchasing practices, and manufacturing and business priorities, making it easier for purchasing department to control management attention and secure organizational resources. It is reasonable to argue that besides affecting manufacturing performance, purchasing integration can actually promote investments in purchasing practices that impact manufacturing performance (Narasimhan, et al., 2001). Efficient collaboration between these two departments with cooperation of R&D can positively affect cost-reduction and quality performance. Joint decision-making processes enable building a value chain from introduction of new products to customization and reliable delivery.

It is important to understand that some of the purchasing strategic decisions i.e. supplier selection, contracting and supplier evaluation are not possible without close partnership of the manufacturing department. Very often it is the engineering knowledge that affects external collaboration with suppliers and enhances searching for new product possibilities. In corporate reality, it is the production competences, capacities and efficiency that determine supplier selection and relationships. When it comes to manufacturing performance some of the new trends can be investigated. In the reality of the customer in focus and customization such strategies like engineer-to-order or build-to-order have been brought up. Companies tend to cut their overall supply chain costs as well as try to meet volatile customer expectations. Effective supplier relationship and performance support these strategies and enable high manufacturing efficiency. Besides, when introducing these new trends, close collaboration and information sharing is necessary i.e. supported by a system of order entry, customer monitoring, manufacturing, procurement and finance (Narasimhan, et al., 2001).

Nevertheless, surveys made in firms in production and service industries have shown a different perspective of purchasing integration. Accordingly, top management has low expectations of purchasing contribution into market planning, forecasting, innovation of products and strategy formulation. Most probably, it is because of lacking collaboration between departments, lack of commitment and a holistic view of the company. At the same time, large portion of the companies

start to shift from the routine treatment of purchasing to proactive, cross-functional and more collaborative role (Petersen, et al., 2005).

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### **Purchasing and Logistics collaboration**

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Maintaining efficient and on-time supply chain highly depends on the logistics performance. Supplier relationships and strategies determine logistical actions and put a challenge on the logistics department to perform cost-efficient and well-planned activities. In general logistics operations depend on geographical location of suppliers, type of goods, packaging and carriers as well as administrative issues. Demanding customers and cost-efficiency issues has lately put one more constraint on the logistics and transportation and it is Just-In-Time (JIT) approach (Christensen, 1996).

An enabler to fulfil all the requirements is the close collaboration between departments and mutual support. Purchasing organization should be aware of all the logistical issues when setting up new supplier strategies. Here the focus should be on scheduling, forecasting and positioning of inventories, capacity planning and transport distances. The purchasing team should support the release of orders, quantity controls and scheduling. There are also a lot of visible benefits for buyers when they implement JIT purchasing. This includes reduction of the carrying costs for components, transport, rework, ease of expediting, fast detection of defects, fewer suppliers for contracting, less need for inspection, quick response to engineering changes (Schonberger, et al., 1984). By cross-functional discussion the proper form, locations and shipment parameters must be discussed. Collaborate capacity planning must be done in order to maximize utilization of vehicles and decrease amount of waste e.g. waiting time, damages and shipment of wrong goods. Petersen, et al. (2005) emphasizes that collaborative actions require greater communication and information sharing between internal and external organizations. Also, he states that the collaborative planning can be expected to necessitate that the information shared is of high quality.

Well-organized and planned logistics actions very often have a high level of uncertainty. These, due to that many global businesses have faced the consequences of an increase in the distance between buyer and supplier and higher complexity of transport networks. The purchasing organization that works as an internal intermediary can support upstream and downstream activities in order to increase predictability and set accurate and realistic schedules.

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### **Information sharing structures**

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Direct contact between employees from different departments can be enabled by creation of special collaboration role i.e. a person belonging to one of the involved departments with the responsibility for communicating and achieving coordination between the departments. A project manager is an example of a full-time integrator. Another possibility is creating a task force as a committee where certain issues are discussed by department representatives. The most permanent option is cross-functional teams often combined with project managers' actions. This will most probably fit into the

product development activities that are very often carried out in teams (Lakemond, et al., 2001). Such activities address verbal and documented information exchanges between specific sides, including meetings, fax, teleconferencing, memoranda, conference calls and transmittal of standard documentation. By many practitioners interaction is considered as a tangible asset and can be easily monitored. (Kahn, et al., 1996)

Carter, et al. (2000) stated that:

*“Electronic commerce technology will support electronic efficiency efforts. A very powerful communication integration is underway matching future improvements in the Web with the adoption of enterprise-based systems”.*

The trend comes from an increasing need for efficient and integrated decision-making processes as well as service and product fulfilment to the customers. A lot of firms have decided to use the Internet, common databases and electronic access catalogues for fast and reliable information sharing as well as to support their business strategies e.g. Vendor Managed Inventory (VMI) or Pool-based systems. Such electronic solutions enable integration and collaboration between the departments inside the company. Internet, EDI (Electronic Data Interchange) messages and Enterprise Requirement Planning (ERP) systems are very often utilized in order tracking, financial transfers, production planning and scheduling, invoicing and other corporate activities (Gimenez, et al., 2008). The use of EDI and Internet in purchasing will be further described in chapter [8].

When it comes to purchasing decisions supplier databases are created in order to keep track of supplier performance and enable future evaluation. Such information may be used by other departments like product development, production and logistics in order to support their planning and decision-making processes. The Internet era is now visible not only inside one company but also along supply chains in order to maintain global profitable strategies. Managers have realised that e-solutions can enhance SCM decision making by providing fast information and enabling external collaboration of trading partners (Gimenez, et al., 2008).

In one of his articles Carter, et al. (2000) has created a vision for future collaboration and importance of purchasing organization:

*“Strategic purchasing competency centres will be established at dominant companies with highly trained personnel who study their supply chains and search for opportunities to achieve competitive advantage through their choice of supply chain partners; determination of core competencies; and influence of design, manufacturing, operations and sourcing”*

## Conclusions

For many business representatives and supply chain practitioners purchasing is considered as a representation in top-level management, integrated with the support from cross-functional teams. In addition it is considered as having a meaningful contribution to competitive goals and overall corporate performance. Another group of researchers has however discovered that the role of purchasers comes down only to tactical and supporting responsibilities. Both statements seem to be relevant, although it very often depends of the complexity of the corporation and type of business it performs. What we feel confident of is that purchasing organization is an important link inside the organization and internal collaboration. It plays a major role in materials management and information sharing and supports other departments, with the close cooperation with manufacturing and product development. Whenever, internal collaboration issues are discussed, it is important to point out that a clear division of work and responsibilities must be done. All the departments should see it as sharing of risks but also mutual help and reward sharing, with the company's success in focus.

After reviewing many field studies and industry examples we strongly support the statement made by Ellram, et al. (1994):

*“Purchasing plays a key role in supply chain management through its integration with production, scheduling, logistics, sales and accounting/finance. It has a proactive role to support the overall strategic plan and is regarded as an equal part of the corporate team”.*



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## [4] Sourcing Strategies

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*Sourcing is the activity of securing external components or services needed within the own internal organization. Companies employ different kinds of sourcing strategies and no one is declared to be the optimum solution. Outsourcing which is the foundation to choice of sourcing strategies also intends to align with a company's core competence focus. Important parts of sourcing strategies are for example the choice of location, size and relationship level within the supplier base. Sourcing strategies also often deploys continuous improvement and re-evaluation of suppliers.*

## Introduction

As defined earlier in the book, purchasing has, according to the trends, become more strategically important for companies. The importance of suppliers and purchasing/sourcing increased significantly during the 1990s and was acknowledged by executive managers by the end of the decade (Trent, et al., 1998). This means that more emphasis has lately been taken to the sourcing strategies of the companies.

One example of this was when General Motors developed their concept Strategic Sourcing in the 1980s. Strategic Sourcing is an institutional procurement process for continuous improvement and re-evaluation of the current purchasing activities in a company. Supplier development can also be viewed as a “strategic sourcing tool”. The current trends in this area are toward more complexity in supplier assessment whether by using “finer and finer” details level in the examinations or by use of individually defined metrics for assessing a specific supplier’s performance. (Cavinato, et al., 2000)

Nishiguchi (1994) in his book, “Strategic Industrial Sourcing”, has defined seven steps for strategic sourcing:

1. Current expenditures evaluation
2. Supply markets evaluation
3. Sourcing strategy development
4. Appropriate suppliers identification
5. Negotiations with suppliers
6. Execution of new supply structure
7. Results tracking and re-evaluations

A source is literally defined as the point to purchase the inputs to produce goods or services (Hugos, 2006). Sourcing is defined as the act of securing parts, supplies, materials, services<sup>1</sup> and other items to support production. Companies purchase resources from different locations, based on the scope of their activities or services. Domestic companies usually go for local resources even if the costs would be greater than purchasing from a foreign country. On the other hand, global companies locate resources wherever the cost is the lowest with respect to the overall cost dedicated to their finished product. One example for low labour cost countries is Mexico; a multinational company may locate its assembly line there, but still transport the raw materials from Southeast Asia for the lowest possible cost (O'Connell, 2005).

One dominant sourcing strategy is not rational throughout a portfolio of purchases where there might be willingness to compete among the various suppliers in some categories and in the others, there might be hardly any suppliers. Some categories might be more important than others especially when

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<sup>1</sup> The labor sourcing and staffing activities are basically taken as human resource management activities and are beyond the scope of this chapter.

comparing their effects in total expenditures or on the competitiveness of end products. These are the facts that have to be considered when a sourcing strategy for a category is being decided upon. (Cavinato, et al., 2000)

Companies' processes range from functional to strategic (Seshadri, 2005). Sourcing strategy is defined as the approach developed by the company to procure supplies, for which four elements are defined as: "the buying policy, the number of sources, the type of source and the nature of the company-supplier relationship" (Nicosia, et al., 2006). This is shown in Table 3 below:

Buying Policy	Number of Sources	Type of Source	Supplier Relationship
Subsistence	Sole	Proprietary information	Transactional
Forward	Single	Directed sourcing	Ongoing
Volume purchase agreement	Multiple	Manufacturer versus distributor	
Consignment		Large versus small	
Life-of-product supply		Minority	
End-of-life buy		Local, national, or international suppliers	
		Cooperative/leveraged, joint venture, or integrated supply	

Table 3 - Elements of Sourcing Strategy, (Nicosia, et al., 2006)

Sourcing strategies are perceived as assets in accomplishment of company's overall goals (Nicosia, et al., 2006). This chapter mainly defines different sourcing strategies such as global sourcing, out sourcing, and multiple sourcing. The subsidiary purpose is to provide readers with initial picture of the advantages or disadvantages connected with each strategy.

## Global Sourcing

Global sourcing is a sourcing strategy with the intention of taking advantage from global efficiencies in the purchasing (O'Connell, 2005); initially define as a defensive tactic toward lower prices of foreign products (Cavinato, et al., 2000). In other words, global sourcing can be defined as strategic sourcing in today's global setting (O'Connell, 2005) where international supply management plays a key role in companies' overall competitiveness (Cavinato, et al., 2000).

A company that investigates for feasible places to find resources which can support its production is in fact employing a global sourcing strategy. Basically, existence of Global sourcing is due to supply and price differences in diverse resources. It is also clear that when local supplies are not satisfactory or the relative costs are very high, the firm begins to look for possible options in other places. (O'Connell, 2005)

The global sourcing, similar to many other concepts, comes with specific benefits (and disadvantages) which can go beyond the initial lower cost. Such benefits can include: the learning of possible ways to do business in a potential market, acquirement of international skills or access to resources which

might not be available locally, stimulate competition through development of alternate supplier or vendor sources, and capacity growth of the total supply. (Tsay, et al., 2008)

In contrast, while working with each country entails specific complexities and is unique, there are risks associated with global sourcing. There are five key drivers shaping the global purchasing industry (Cavinato, et al., 2000):

1. Politics
2. Infrastructure
3. Currency
4. Climate
5. Culture

Another issue might be the alignment of the sourcing strategy and the company's other main strategies, in cases like "just in time" (JIT) production, the production strategy is completely in favour of local suppliers (Burt, et al., 1996), especially if there would be high variation in the needed supplies.

A number of major drawbacks with global sourcing can be: increased transportation costs, increased possibilities of supplies interruption which can be caused by natural disasters or political problems for example, also longer lead-times and possibility for delays caused by weather problems for example, dependency on foreign sources of supply (O'Connell, 2005), and unexpected disastrous situations caused by change in the political climate or weather for example (Cavinato, et al., 2000).

Global sourcing disadvantages might also include the hidden costs connected with cultural differences and time zones, financial and political risks due to changing economies, increased risk of intellectual property loss, and increased monitoring costs in comparison to domestic supply. (Tsay, et al., 2008)

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### Low-cost country sourcing

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Low-cost country sourcing (LCCS) is mostly considered under global sourcing as a broader category for a specific series of procurement activities. In LCCS, the company locates materials in countries with lower labour and production costs which lead to cutting operational expenses. The key principle behind LCCS is to achieve sourcing efficiencies by identification and utilization of the cost arbitrage among different geographies (Rae, 2005). The specific problem with LCCS is the efficient volume for transportation that companies are forced to order from areas like Asia (Hugos, 2006).

Common examples of globally sourced products or services can be: labour-intensive manufactured products produced in China, low-cost English speaking call-centres and low-cost programmers' IT work in India (Li, et al., 2008). These examples are for Low-cost country sourcing only while it is important to note that global sourcing is not limited to low-cost countries. New studies show shifts toward

knowledge and design sourcing in high tech countries in Europe for example by Asian companies who feel the need for outsourcing these categories (Tarek, et al., 2002).

## Out-sourcing – In-sourcing

Outsourcing, in contrast with internal sourcing, is defined by the act of purchasing goods or services from an external source. Internal sourcing mainly aims at internal production or purchasing from a subsidiary of the organization (O'Connell, 2005) or in a comparative perspective, bringing activities back into the company (Cavinato, et al., 2000). The strategy is usually functional based on a decision to shift from an internal source to an external one (O'Connell, 2005) i.e. answering the famous make-or-buy question (Burt, et al., 1996). The issue is becoming increasingly critical (Burt, et al., 1996) because it is mainly in favour of focusing on core competence in nowadays' "fast-moving market" and increased competition (Hugos, 2006). The decision to buy is practically made when "it is demonstrated that competing firms possess superior capabilities that leave no chance of catching up, and/or competitors are achieving superior performance" (Cavinato, et al., 2000).

Some firms may decide to do both; making and buying their critical nonstandard items for keeping it safe in the instance of troubles with the supplier. Such a policy can also be followed with the purpose of in-house performance evaluation (Burt, et al., 1996) and competence stimulation.

There are various advantages in outsourcing, such as cost reduction in general resulting from economies of scale, specialized investments and expertise (Anderson, et al., 1986) and possibility of greater concentration on the "core competence" while avoiding "peripheral" operations. On the negative side the control over the operations involved would be reduced; also, less flexibility would exist to react upon unpredictable changes in requirements. Thus the strategy entails important strategic and the operational implications to consider (O'Connell, 2005).

The problems with outsourcing depend on the type of outsourced items or services and their importance; in many cases for example the purchased goods lack high quality or good delivery where as for fundamental services there would be a great potential threat entailing development of new competitors in the market. Following the Kraljic model to choose outsourcing suitable item categories in the system, the ones recommended are non-critical and leverage items, both located on the left side of the matrix, indicating low supply risk. The Kraljic model will be presented in detailed in the chapter [5]

## Single sourcing – Multiple sourcing

Using multiple sourcing i.e. purchasing from several resources, is conventionally preferred to single sourcing (O'Connell, 2005) or sole-sourcing (Cavinato, et al., 2000). And this is due to desirability of having reaction flexibility to strategic consequences of source failure while having more negotiating power in comparison with possible outcomes from single sourcing strategy such as economies of scale, (Segal, 1989) and especially for a satisfactory supplier, their “tacit recommendations” and easier relationships and operations management (Cavinato, et al., 2000).

It is also important to differentiate solo sourcing and single sourcing. Solo sourcing is basically due to scarcity of suppliers i.e. there is only one supplier, such as monopolist, whereas single sourcing is having one supplier selected among a handful of them. The company may select the very new source available for a solo-sourced supply which is called dual sourcing. (Burt, et al., 1996)

In the real business world, it would take management authoritative belief in multiple sourcing strategies to make use of alternative approved suppliers permanently. This is due to several reasons which are in favour of sticking to current suppliers, such as possible inertia, pressure of work, established relationships' strength, or perceived switching costs (O'Connell, 2005). Using market research as the basis for sourcing strategy decision making, multiple sourcing may be a good option if it was revealed that there is potential for “supplier dependence, limited industry capacity, lack of price-volume discounts, and location-specific needs” (Nicosia, et al., 2006).

In fact changing suppliers can be disruptive, time consuming, resource intensive, costly, and even career threatening for purchasing staff in case of making mistakes. To implement such changes in the company, clear benefits have to be identified to overcome systemic inertia, accumulated personal commitment, alternative work priorities, and switching costs (O'Connell, 2005). It is also important to obtain additional data about suppliers with conflicts. This based on assumption of potentially critical issues are involved (Cavinato, et al., 2000).

## Partnership sourcing

Many professionals believe that managing sourcing relationships as partnerships, whether upstream or downstream, can lead to a considerable competitive advantage for the partners involved. While partnership sourcing is mainly defined as a sourcing practice selectively based on a single supplier providing the customer with extensive access to the operations and management systems of the supplier over an extended pre-arranged period (O'Connell, 2005), it should not be limited to relationships that focus on single sourcing or cost reduction (Cavinato, et al., 2000).

“True alliances or partnerships require extensive collaboration” meaning that seeking opportunities through the other party should be aligned with cooperative focus on cost drivers (Cavinato, et al., 2000). This, results in supplier’s guaranteed demand for what they can offer to the customer (O’Connell, 2005) added to opportunities to reduce cost and step toward competitive advantage.

Figure 7 below describes the steps toward implementation of strategic alliance and partnership with the suppliers:

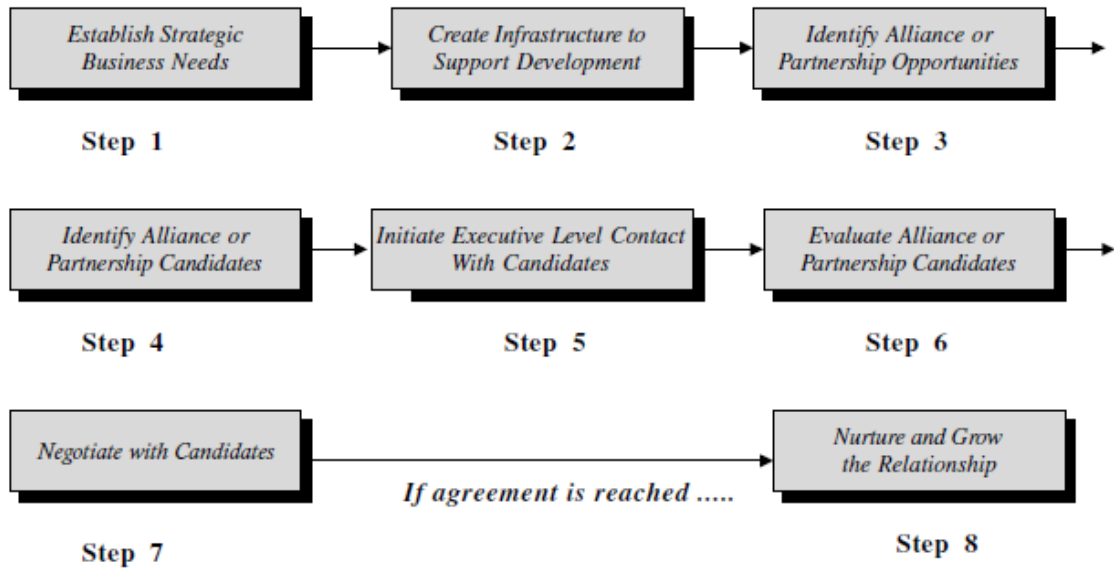


Figure 7 - Strategic alliance and partnership steps, (Cavinato, et al., 2000)

Further information regarding supplier relations and relationship management can be found in subsequent chapters of this book.

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## [5] Purchasing portfolio models

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*There exist many different purchasing portfolio and supplier base models. A natural question to ask is then: which ones do the companies really use? This chapter will explain some of the most well known purchasing portfolio models that are presented in academic literature and compare them to actual company usage. It will be described in the chapter that even though there exists many different models to choose from, the companies that we have studied use their own or not use any model at all. This is illustrated by two real business cases.*

## Introduction

In the previous chapter on Sourcing Strategies it was indicated that different models could be used in order to find suitable sourcing strategies. Purchasing portfolio models have received a great deal of attention during the last decades Dubois & Pedersen, (2002), Olsen & Ellram, (1997), Bensaou, (1999), and Gelderman & Van Weele, (2000). The most famous purchasing portfolio is probably the Kraljic matrix which was first published in *Harvard Business Review* in the article *Purchasing must become supply chain management* in 1983. The matrix introduced a model to classify the company's products in a two dimensional matrix: profit impact and supply risk (Kraljic, 1983). The model has been widely discussed both in the academic and the business world (Bensaou, 1999), (Dubois, et al., 2002), (Gelderman, et al., 2000) (Olsen, et al., 1997). Managing the firm's supplier base is becoming an essential strategic issue for the companies (Dubois & Pedersen, 2002). As an increasing part of companies' products are purchased from external companies the need for efficient and suitable purchasing strategies becomes more important, as seen in the previous chapter. Since companies purchasing activities greatly differ depending on which type of business they operate in, there is a need for differentiated purchasing strategies.

The idea of creating purchasing strategies only using a two dimension matrix has been widely criticized Dubois & Pedersen, (2002), Håkansson & Persson, (2006), and Gelderman, (2000). To deal with the limitations that are related to the Kraljic matrix, both the academic and the business world have made efforts in trying to develop and improve the strategies related to internal purchasing strategies. Some authors suggest a network view on the purchasing activities rather than the traditional channel approach (Gadde, et al., 2001). The supplier's side of the relationship is disregarded in the traditional Kraljic matrix. Some authors such as Håkansson & Persson, (2006) have chosen to focus the purchasing strategies towards the interdependencies between the companies. Other authors such as Lilliecreutz & Ydreskog, (1999) have extended the portfolio approach to include evaluation of the actual supplier relationship (Lilliecreutz, et al., 1999).

This chapter will describe and analyze how the Kraljic matrix (Kraljic, 1983) has been developed and adapted to fit companies in different business areas dealing with different products and different supplier characteristics. Further on, the chapter presents empirical findings on how and at what extent companies are using models originating in the Kraljic matrix (Kraljic, 1983). An empirical study has been performed on the purchasing activities in Volvo Logistics and Sony Ericsson. The two companies have provided an insight into how companies use portfolio models in their daily operations. The findings from Volvo Logistics provide insight on how companies use portfolio models on a more strategic level while the findings from the Sony Ericsson interview shows how theories from portfolio models are used in operational purchasing activities.

The purpose of the chapter will be to describe and analyze the developments and adaptations deriving from the Kraljic matrix (Kraljic, 1983). Further on, the paper will discuss and analyze how companies use the matrix in their own context situation.

This section will be followed by a theoretical background to a number of different portfolio models that have been created. Further on, the chapter presents the empirical findings from the company cases. Finally, an analysis is performed which discusses how companies use ideas originating in the different portfolio models in their purchasing activities.

## Theory and Literature Review

The following sections will provide a brief theoretical background to number of different portfolio models. The chapter will begin with introducing the Kraljic matrix (Kraljic, 1983). This will be followed by a model created by Håkansson & Persson, (2006) focusing on supplier relationships. Further on, the chapter provides an introduction to a model focusing on mutual dependence created by Gelderman, (2000). This is followed by a model which ads evaluation of supplier cooperation, created by Lilliecreutz and Ydreskog, (1999). This will be followed by a model adapting purchasing strategies after supply situations by Van Stekelenborg and Kornelius, (1994). Further on, the chapter provides a description of the article from Olson and Ellram, (1997), "*A portfolio approach to supplier relationships*". The focus is set at the relationships between buyers-supplier. Finally, the chapter describes theories created by Bensaou, (1999) concerning relationships correlation to investments.

### The Kraljic Matrix

Peter Kraljic first mentioned his model in the article "purchasing must become supply management" (Kraljic, 1983). The purpose of the Kraljic matrix is for companies to analyze their purchasing portfolio. The model is a four stage approach, and the stages are; classification, market analysis, strategic positioning, and action plans. Those stages will now be described.

#### Classification

In the classification stage the company has to classify all its purchased items. This is done by looking at two different dimensions; importance of purchasing and complexity of supply market. The importance of purchasing has criteria's such as; percentage of raw material in total costs and value added by product line. The other dimension, which is complexity of supply market the company, considers entry barriers, logistic cost and/or complexity, and monopoly or oligopoly (Kraljic, 1983).

The matrix is then divided into four different categories; materials management, supply management, Purchasing Management, and sourcing management (Kraljic, 1983).

Materials management; is leverage items, such as electric motors and heating oil. The decision making for these items are decentralized and there are of high importance for purchasing. Since they are of high importance the use of many suppliers is necessary to reduce the price of the item. The time horizon for purchasing these items is normally 12 to 24 months (Kraljic, 1983).

Supply management; this is strategic items, such as high-value components or chemicals. The decision making is centralized due to the fact that these items are both of high importance when it comes to profit impact and supply risk. The company should aim for long-term relationships with suppliers and try to establish global suppliers. The time horizon for these items is very long and can be up to 10 years (Kraljic, 1983).

Purchasing Management; these items are the non-critical items, such as office supply and coal. The decision making is not centralized. The suppliers should be local with short term relationship. The horizons for purchasing these items are normally under one year (Kraljic, 1983).

Sourcing management; this is the bottleneck items, which could be electronic parts or out-side service. They should be handled decentralized but with the help of centralized coordination. It is important to focus on cost management and short-term sourcing. The time horizon is depending on availability (Kraljic, 1983).

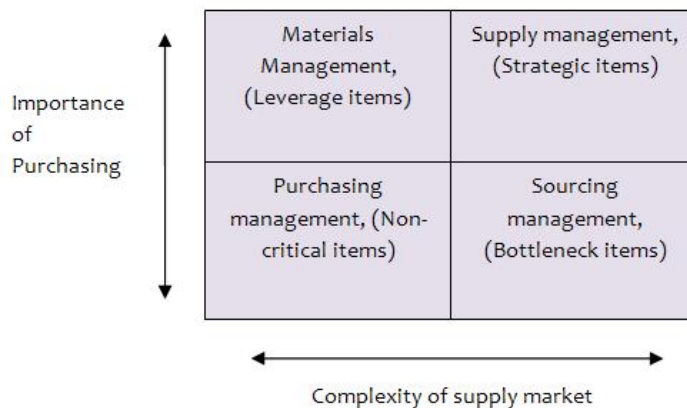


Figure 8 - Stage of purchasing sophistication (Kraljic, 1983)

The next step for the company is to weight the bargaining power towards their suppliers against the company's own strength. When have reviewed for example the supply market and looked at the availability of strategic items, the company then has to analyze its own need to be able to get the best supply terms. Kraljic, (1983) uses something called "purchasing portfolio evaluation criteria" where 10 supplier and company strengths are mentioned. In this list companies could look for supplier strengths and see what they should look for in their own company. For example could supplier strength be "market size versus supplier capacity" the company should then look at "purchasing volume versus

capacity of main units". Of course these criteria's has to be modified to different companies and businesses (Kraljic, 1983).

### Strategic positioning

The next step for the company is to positioning the materials and items in step 1 in the purchasing portfolio matrix. This matrix will help to identify risk and opportunities. The dimensions in this matrix are company strength versus strengths of the supply market. The matrix has three different risk categories; exploit, balanced, and diversify. For example if a company has a dominant role in the market and the supplier strength is low the risk would be categories as exploit. This means that the company has an opportunity to be aggressive and to make a great deal with the supplier. On the other hand if the suppliers' strength is high and the company has a low dominance in the market the risk would be categorized as diversify which makes the supplier more powerful and the company should try to look for other suppliers or materials (Kraljic, 1983).

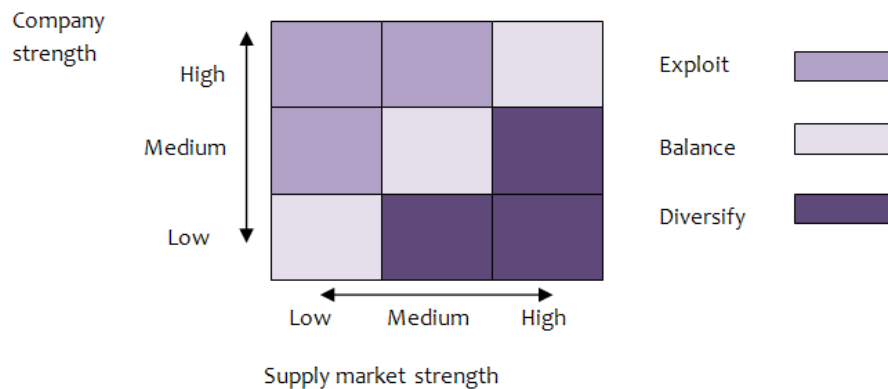


Figure 9- Purchasing portfolio matrix, (Kraljic, 1983)

### Action plans

In this step the company should try to come up with an action plan. The company should also look at a purchasing strategy which include volume, price, inventory policy and supplier selection. This should help to explore different sceneries with different suppliers and to be able to secure a long-term relationship with a supplier or to take advantage of short-term relationships (Kraljic, 1983).

### Supplier segmentations

Håkansson & Persson, (2006) wrote the article "Supplier segmentation – When supplier relationship matters" where the authors explain some of the drawbacks of different purchasing models and also give an idea of how a new model could look. Their model is based on three different interdependencies within and between organizations. According to Håkansson & Persson, (2006)

these interdependencies were identified by Thompsen (1967) and are called pooled, serial or sequential, and reciprocal interdependencies. There will now follow a short description of these three:

**Pooled interdependence** – This relationship between two actors or activities means that they are indirectly dependent. This is because they both are related to a third activity and/or are sharing the same resource. Pooled interdependence can lead to either economies of scale or economies of scope. This is according to Håkansson & Persson, (2006) because efficiency can be increased if an activity shares the use of resources with other activities. Economies of scale will be reached if the activities are the same and economies of scope if they are similar.

**Serial interdependence** – this means that there are a serial of activities. So the output of one activity is going to be the input for the next activity. If a company manages this they could get economies of integration.

**Reciprocal interdependency** – this means that there is always an exchange of output and input between two actors. If the actors manage this they could achieve economies of innovation and agility.

According to Håkansson & Persson, (2006) and Thompsen (1967) these different interdependencies build on each other. The simplest one is pooled interdependence and that one can exist on its own and doesn't need the other two. Serial interdependence needs the pooled interdependence to function and the last one, reciprocal interdependence, are dependent on both the others.

Håkansson & Persson, (2006) has from these three interdependencies managed to identify three basic supplier relationships and what the different management should focus on. These are showed in Table 4 below.

Type of economy	Interdependency	Management focus	Type of relationship
Economies of scale and scope	Pooled interdependencies	Standardisation, similarity and specialisation	Mediating (connecting to others) relationship
Economies of integration	Serial interdependencies	Coordination and adaptation	Linked (stream-lined) relationship
Economies of innovation and agility	Reciprocal interdependencies	Confrontation and learning	Problem-solving relationship

**Table 4 - Three basic types of supplier relationships, (Håkansson, et al., 2006)**

After having divided the different types of relationship into three dimensions mediating, linked, and problem-solving, Håkansson & Persson, (2006) means that any relationship could be developed into a mix of these three relationships. The reason is that companies like to achieve several of the different economies. They have therefore made a matrix where they have identified six different combinations

of buyer-supplier relationship. The result is shown in the table below, also which type of relationship that should be used is shown in the Table 5.

Type of relationship Combinations of content	1 Mediating	2 Linked	3 Problem- solving	Type of relationship	Collaboration Categories
1	High	Low	Low	Distribution relationship	Functional collaboration <ul style="list-style-type: none"> <li>• Specialised</li> <li>• Focused</li> <li>• Performance measurement</li> </ul>
2	Medium	High	Low	Supply of raw materials or standard components	
3	Medium	Low	High	Advisor/ consultancy relationship	<ul style="list-style-type: none"> <li>• Distinct roles</li> <li>• Leveraging resources and skills</li> </ul>
4	High	High	Low	Logistics service provider 3PL service provider Supply of capacity or standard components	Systematic collaboration <ul style="list-style-type: none"> <li>• Broad collaboration</li> <li>• Performance measurement</li> <li>• Leveraging resources and skills</li> </ul>
5	High	Medium	High	Constructor IT-support Support system	
6	High	High	High	System supplier 4PL service provider Supply of strategic sub-system	<ul style="list-style-type: none"> <li>• Joint planning and problem-solving</li> </ul>

Table 5 - Examples of supplier relationships of the combinations identified, (Håkansson, et al., 2006)

The table is divided according to collaboration and this is either functional collaboration or systematic collaboration. Both of these collaborations have three subgroups. The functional collaboration deals only with relationships that use one type of interdependence, and the systematic collaboration relationships that involve a combination of the interdependencies. There are some differences between the two collaborations. The functional collaboration usually has very clear roles for the different actors involve and there is normally easy to find measurement on the performance. This is not how it works in the systemic collaboration where the roles are not that easily shown and where there is difficult to measure the performance. (Håkansson, et al., 2006)

## A mutual dependence-based purchasing portfolio

Gelderman, (2000) states in his article “Towards a Purchasing Portfolio Model, Based on Mutual Buyer-Supplier Dependence, 2000” that it is not clear where the role of balanced power is introduced, and wants to use power in the matrix to make it more clear in strategic purchasing decisions.

Gelderman, (2000) starts discussing a matrix which uses diagonal axis. The first axis would be concerning power, which would split the matrix into a buyer dominated area versus a supplier dominated area. The next axis would be regarding importance of product. This is a combination of high profit impact and supply risk, which will divide the matrix into important and not important. What Gelderman, (2000) has done is to rotate the Kraljic matrix (Kraljic, 1983) and using axes that focus on power and importance into the matrix.

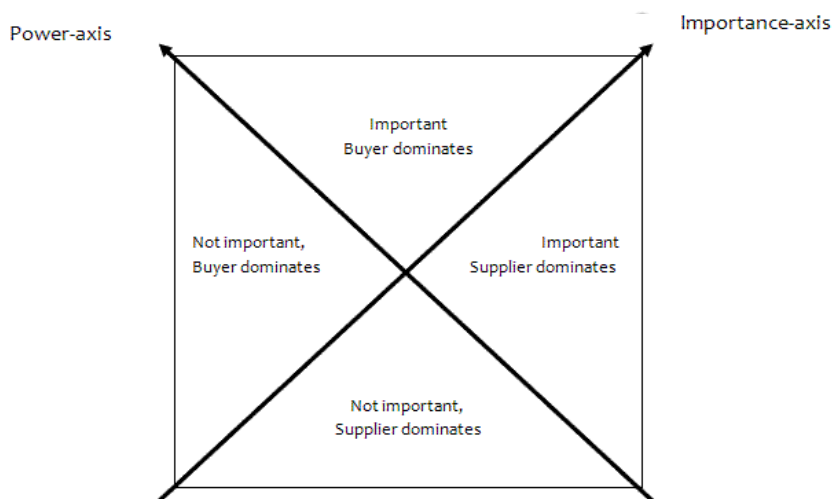


Figure 10 - The rotated Kraljic matrix, (Gelderman, 2000)

However, there are some drawbacks with this model. Gelderman, (2000) argues that the matrix doesn't show balanced power between buyer and supplier, and that power could be balanced in a relationship. Furthermore, he states that the concept of power is limited since it is determined by supply risk and profit impact. Instead, Gelderman (2000) argues for a matrix based on mutual dependence in the relationship between a buyer and a supplier.

There are a number of different articles regarding low and high dependence with respect to buyer and seller dependence. For instance, a relationships classification regarding interdependence and environmental uncertainty is mentioned in Gelderman (2000). They use three levels, high interdependence, unbalanced exchange, and low interdependence. Where the first and third has a mutual interdependence and there for balanced. Gelderman, (2000) draws the conclusion that there



are four combinations of dependence; high mutual dependence and low mutual dependence (which are both balanced), buyer dominated which means high supplier dependence and low buyer dependence, and supplier domination with low supplier dependence and high buyer dependence.

These four dependencies could be expressed in terms of the Kraljic matrix (Kraljic, 1983), where the strategic items and non-critical items would be high respective low mutual dependence relationship, leverage items would be buyer dominated relationship, and bottleneck items supplier dominated relationships. However, instead of using the axis that Kraljic uses in his matrix Gelderman (2000) uses supplier's dependence and buyer's dependence which would make the matrix more generic.

Supplier's dependence

Leverage	Strategic
Noncritical	Bottleneck

Buyer's dependence

**Table 6 - Mutual dependence-based purchasing portfolio model, (Gelderman, 2000)**

Gelderman, (2000) doesn't recommend any generic purchasing strategies in his model. This is something that Kraljic (Kraljic, 1983) does in his model and the recommendations is usually summarized according to Gelderman, (2000) in four concepts; efficient processing, exploit power, strategic partnership, and volume insurance. What is missing in these concepts is how a company should do to be able to move from one position in the matrix to another. This is something that Gelderman, (2000) thinks is very important and every purchasing department should always try to find a better position in the matrix.

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## Adding evaluation of supplier cooperation

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In the article *Supplier classification as an enabler for a differentiated purchasing strategy* (Lilliecreutz, et al., 1999) the author emphasizes the importance of treating different supplier relations in order for the production system to become leaner. The authors believe that the Kraljic model itself is not enough for capturing the dynamics needed in today's buyer-supplier relationships. A second step is proposed involving three areas of focus: performance assessment, relationship characteristics, and network position. Further on, the authors argue the necessity of not only classify the purchased products but also evaluate the cooperation with the suppliers. The classification model is a two-step approach (Lilliecreutz, et al., 1999).

The first step is to distinguish groups of products and their characteristics. The evaluation is divided into two main variables: Economic profile and Complexity and risk profile of the purchased products. Each variable is divided into sub-variables which should be evaluated and given a value from 1 – 5 depending on how closely they correspond to the product that is supposed to be classified. The *Economic profile* variable has four sub variables: product cost per shipment, total cost, value added on end product, and impact on total cost. The variable Complexity and risk profile is divided into five sub-groups: supply market, uniqueness of product, technical complexity of product, influence from outside party, and other risk related to the product. The values of the main variables are then calculated as the mean value of the sub-variables. The purchased product can then be classified into one of the following types of products: non-critical, leverage, bottleneck, and strategic (Lilliecreutz, et al., 1999).

Economic profile	High	Leverage products	Strategic products
	Low	Non-critical products	Bottleneck products
		Low	High
		Complexity and risk profile	

Figure 11 - Product characteristics, desired co-operation, (Lilliecreutz, et al., 1999)

The second step deals with evaluate the actual co-operation. This is done in three dimensions including: Performance assessment, Relationship characteristics and Network position. Each of those are divided into main- and sub variables and given a value from 1 to 5. The variables in the first dimension are: production and delivery, product delivery, experience, quality, time-focus, price and cost, organization and personnel. The main variables in the second dimension are: financial and economic issues, supplier’s customer base, communication and information sharing, technological possibilities, confidence and win-win focus, historical aspects, and strategic direction. The main variables in the third dimension are: Size in the market, reputation, and influence on relationships (Lilliecreutz, et al., 1999).

<p><b>Performance assessment</b></p> <ul style="list-style-type: none"> <li>Production and delivery</li> <li>Quality</li> <li>Price and cost</li> </ul>	<p><b>Relationship characteristics</b></p> <ul style="list-style-type: none"> <li>Strategic direction</li> <li>Financial and economic issues</li> <li>Customers position in supplier’s customer base</li> <li>Organisation</li> <li>Historical aspects</li> </ul>	<p><b>Network position</b></p> <ul style="list-style-type: none"> <li>Size in the market</li> <li>Reputation</li> <li>Influence by other relationships</li> </ul>
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Table 7 - Co-operation characteristics, actual co-operation, (Lilliecreutz, et al., 1999)

## Adapting purchasing strategies after supply situations

In the purchasing model created by Van Stekelenborg & Kronelius, (1994) the authors suggest a typology for characterization of supply situations. The method aims at supporting purchasers when making decisions among the diversity of supply situations. The authors argue that the existing literature in purchasing focuses on “ideal types” of relationship between buyer and supplier; the power balance, the perceived closeness and commitment, the intensity of the relationship, the degree of mutual adaptation, and the solidity of the relation. The authors argue that the description of the buyer-supplier relationship are not linked to specific situations and therefore cannot be used when answering the question “when to do what” i.e. in which purchasing situations to do what. The authors suggest that purchasing not only constitutes of the resource side (the suppliers), but also specifying the “right” demand (production control) and therefore satisfying the internal market demand (in terms of quality, quantity, time and place of delivery, and price). The authors define purchasing to be “a control function that aims at satisfying the internal market demand, by employing the proper sources (i.e. the suppliers) in the external supply market.” (Van Stekelenborg, et al., 1994)

The need for Internal market demand (need of the organization) control and the need for external supply market control can be characterized as “high” or “low”. From this, a matrix is created where the need for internal market demand control (need of the organization) is on the vertical axis and the need for external supply market control is placed on the horizontal axis. This leads to four types of supply situations; plain supply, internally problematic supply, externally problematic supply and complicated supply. To exemplify, in a situation where most control need arises from the internal market demand, purchasing activities should focus on simplifying the situation with regard to the internal market characteristics.

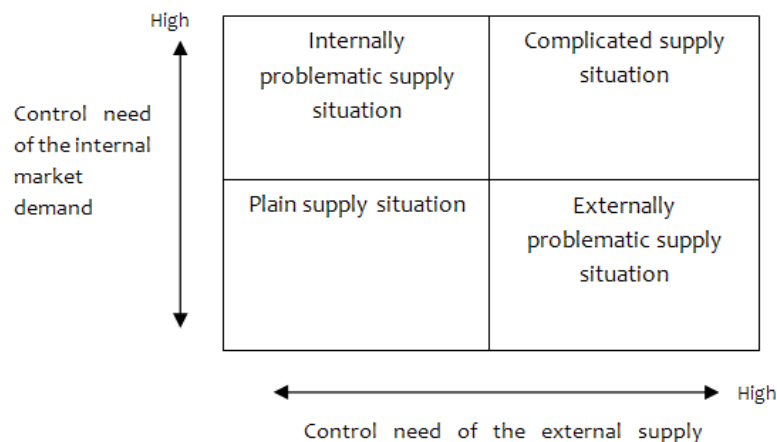


Figure 12 - Typology of supply situations, (Van Stekelenborg, et al., 1994)

The need for external supply market control can be caused by different factors. If the customer is important for the supplier, the need for control is less. A high number of potential suppliers simplifies the supply situation and therefore reduce the need for control. Poor supplier performance and reliability, however, causes a higher need for control activities.

The following section will describe the factors that influence the need of internal market control. The most important factor is related to the strategic importance of the purchased items. The price – as part of the total cost of the final product – has a great influence. Product characteristics, such as complexity of product, degree of uniqueness, and size all have strong influence on internal market demand control. The unpredictability of the customer demand, the more often the demand changes, the more difficulties exist in the procurement. The abovementioned factors force the buying company to control its internal demand to satisfy the customers demand at reasonable cost by using an external supply market. (Van Stekelenborg, et al., 1994)

The portfolio tool helps the organization to position its purchased goods in the four quadrants of the typology. Once a specific product is placed in one of the quadrants it is clear where purchasing activities should be aimed at. (Van Stekelenborg, et al., 1994)

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### The plain supply situation

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In a situation where both the internal control need and the external control are low the purchasing situation is called “plain supply situation”. In this situation the purchased goods are easy to specify and procure and can therefore not justify complicated and expensive purchasing activities. The only information flow needed is related to operational activities, concerning subjects such as rejects and delivery dates. The most important metrics for this situation are price, service, and logistic performance.

The purchase of resistors is mentioned as a good example for plain supply situation. They are considered to be simple and standardized products, their added value is low, and so is their cost. Further on, the demand situation is most often predictable and not likely to fluctuate as much. (Van Stekelenborg, et al., 1994)

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### Internally problematic Supply Situation

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In a purchasing situation where most control needs are related to the internal demand, the most focus should be towards improvements and simplifications of the internal activities. The main goal of the purchasing activities should be focused on transferring information about the internal market demand to the right place in the supply market. Suitable suppliers in this case should be able to cope with the constant changing levels in demand. (Van Stekelenborg, et al., 1994)

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### Externally problematic supply situation

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This situation occurs when the external control situation is high at the same time as the internal control is low. In this situation, the organization should constantly work on finding suppliers and ensuring supply of goods. (Van Stekelenborg, et al., 1994)

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### The complicated supply situation

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Here both the internal market demand as well as the external supply market causes high need for control. This situation often occurs for strategic goods related to very specific specifications. The specificity allows no flexibility in the internal market demand and also limits the possibilities of procuring the goods from the external supply market. Purchasing activities in the complicated supply situation must be integrated with other functions in the buying company such as R&D, marketing and production. (Van Stekelenborg, et al., 1994)

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## Managing supplier segmentation portfolio-models and relationships

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In the article from Olsen, et al., (1997) *A portfolio approach to supplier relationships*, the focus is set at the relationships between buyers-suppliers that should be interdependent and not only of a single type nature. Much of the older literature has tend to forgotten this important type of interdependent relationships, which also is one of the reasons behind why Kraljic matrix (Kraljic, 1983) has been so criticized.

Further, Olsen & Ellram, (1997) focus at assisting management dealing with different supplier relationships by the use of portfolio models. Their approach will here be described as it adds value to enhance the understanding of the extra dimensions that needs to be considered when dealing with these types of issues, namely supplier segmentation and its relationships. Finally, it shows once more how the logic of Kraljic matrix has been developed over the years and how its basic logic can be used although some modifications are added to the matrix.

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### Step 1: Analyses of the company's purchases

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In other words, Olsen, et al., (1997) have developed the Kraljic matrix (Kraljic, 1983) further in a different and more extensive manner. They propose a three-step approach of analyzing a company's supplier relationships. In the first step they have identified factors that influence the strategic importance of purchasing and the difficulties of managing it. The factors influencing the strategic importance are internal to the firm and the other factors connected to the difficulties of managing purchasing are termed as external for the firm. The internal focuses should be on competence, economic, and image, and the external factors focus on product characteristics, supply market characteristics, and environmental characteristics.

These factors has to be weighed by the decisions-makers at the company i.e. be categorized in order to fit in the purchasing portfolio model see Figure 13. Here, the weighed factors should have been evaluated and then be placed in the model. Here it is important to use the entire scale, as the model would otherwise not be very useful if everything were considered as being strategic (Olsen, et al., 1997).

Each category in Figure 13 can be said having a type of idealization in terms of how the supplier relationships should be managed meaning that no comprehensive guide can be given. In brief, (Olsen, et al., 1997) pointed out that non-critical item is easy to handle and of non-strategic importance, thus standardization and consolidation should be focusing at. Leverage items are easy to handle yet strategic important for the company hence a two way relationship should be established focusing on cost reduction by e.g. using system contracting. For bottleneck purchases, the company should try to establish some relationships involving the supplier, e.g. concurrent engineering or finding substitutes if possible. Lastly, the strategic purchases are both difficult to manage and of strategic importance thus a close long-term relationship should be established including joint developments and deep involvement of the supplier. When this has been done, the next step is to focusing on the actual relationship (Olsen, et al., 1997).

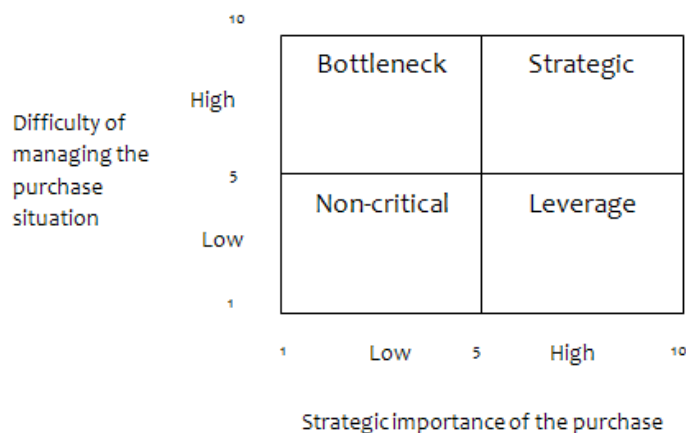


Figure 13 - Portfolio model, (Olsen, et al., 1997)

## Step 2: Analyze the current supplier relationships

In Kraljic's matrix (Kraljic, 1983), focus is placed on the power between actors and how this should be exploited if possible i.e. different strategies should be used as a consequence of the power balance. Olsen, et al. (1997), consider this approach to be dangerous due to the rapid changes in today's market conditions. Their point of departure is that power and risk are only two factors influencing the strategy when managing supplier relationships.

Therefore, they introduced a second portfolio model, which is based on the current relative supplier attractiveness and the actual strength of the relationship between buyers and suppliers. Supplier attractiveness is described as the factors that make a company choose a specific supplier. These factors that shall be used are categorized into five main areas; financial and economic factors, performance factors, technological factors, organizational, cultural and strategic factors and other factors. The same pattern is followed for the other axis, strength of supplier relationship, which is described by Olsen, et al. (1997), as factors that creates bonds between buyers and suppliers. These factors are categorized into economic factors, character of the exchange relationship, cooperation between buyer and supplier and distance between buyer and supplier.

Consequently, the last part in step no. 2 is to elaborate upon the two dimensions, the relative supplier attractiveness and strength of supplier relationship and give a weight at each. Here the authors suggest that also the voice of the supplier should be included e.g. not only have a single flow from buyer to supplier but have a mutual or two-way communication to secure an effective allocation of resources. In this respect, Olsen, et al.'s approach, (1997), focusing more on the mutual dependencies by including the supplier at this stage compared to Kraljic's matrix (Kraljic, 1983).

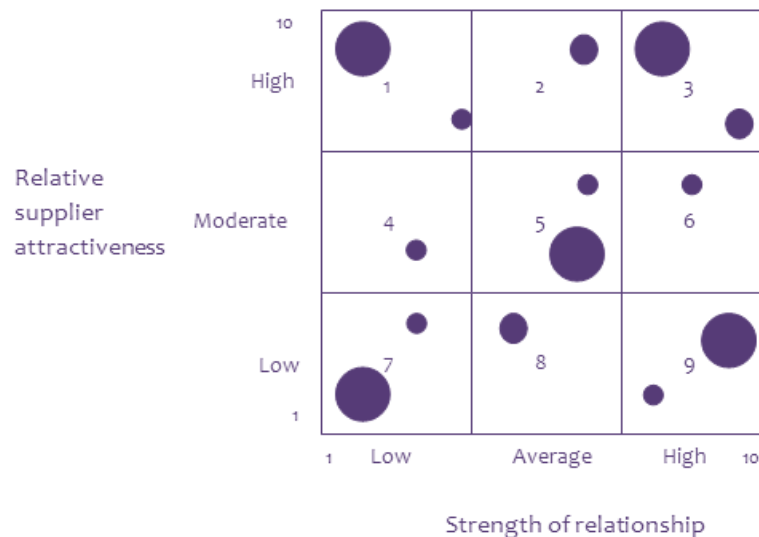


Figure 14 - Analysis of supplier relations, (Olsen, et al., 1997)

### Step 3: Develop action plans

The last step in Olsen & Ellram's, (1997) approach is to develop action plans based on the knowledge gain from step 1 and 2 that is the ideal relationship and then the actual relationship. As pointed out by the authors, no precise and comprehensive approach can be described for such action plans. However, three general groups of action plans have been identified. The first concerns cell 1, 2 and 4 and basically focuses on strengthening the supplier relationship by for instance increase volumes for

the supplier or enhance communication. However, as for any of these cells in the second portfolio model, it must be in line with the set conditions from step 1 i.e. how the company should manage their relationships. For cell 3, 5 and 6 the aim must be to maintain the strength of the relationship e.g. by reallocate resources. Cell 7, 8 and 9 contains supplier that have low supplier attractiveness. Here the logic reasoning would be to change supplier as also has been suggested from Kraljic portfolio model (Kraljic, 1983). Olsen & Ellram, (1997) though, suggest a network perspective, meaning that the focal company must look carefully into how a possible change might affect the company's network position. Thus, the supplier relationship perhaps should strived for to strengthen it and increase the attractiveness instead of changing supplier as it cost both time and money and also contains risks. Finally, it should be emphasized that step 1 and step 2 must work and influence each other in a comprehensive manner, meaning that by combine the views on the how the relationship should be managed and how the relationship currently is managed and depending on those inputs create future action plans and allocate the right resources (Olsen, et al., 1997).

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### **Relationships correlation to investments**

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As has been pointed out, managing supplier relationship plays an important role when it comes to purchasing activities. Olsen & Ellram, (1997) identified supplier attractiveness and the strength of relationships as two basic variables for setting up appropriate action plan together with their categorization of purchasing strategies. However, there are other points of views among the authors in the field of purchasing and its variety in relationships.

Bensaou, (1999) has taking a different point of departure in the analyses of buyer-supplier relationships in the context of purchasing. Bensaou, (1999) studied the car industry with the objective to investigate the performance of altered types of relationships. Accordingly, a correlation between specific investments made by either partner to the relationship and the practices commonly related to strategic partnerships such as mutual trust, long-term relationships, cooperation and such was found Bensaou, (1999).

The investments made by either buyer or supplier could be of both tangible and intangible nature. Tangible buyers investments are for instance tooling, buildings, equipment etc. that are dedicated to the supplier and examples of intangible investments are spent time and resources on learning, sharing knowledge and information that fostering the relationship and the same pattern could be found for suppliers making tangible and intangible investments. Consequently, the type of relationship as a result of investments made could then be classified in a matrix as seen in Figure 15 (Bensaou, 1999).



Buyer's specific investments	High	Captive	Strategic partnership
	Low	Market exchange	Captive supplier
		Low	High
		Supplier's specific	

Figure 15 - Buyer- and supplier specific investment, (Olsen, et al., 1997)

Cell A, *Market exchange*, represent the category of which neither partner have made any specific investments for working together meaning that nothing hindering any of them from switching to another partner. Cell D on the other hand, *Strategic partnership*, represent a relationship that both parties have made distinctive mutually investments thus tying them closer to each other. Those two types of relationships correspond according to Gadde & Håkansson (2001), to the core of low- and high-involvement relationships. Cell B *Captive buyer* represent a situation where the buyer has made specific investments while the supplier has not. Therefore, the buyer could be said being more dependent on the supplier than vice versa. Finally, cell C *captive supplier* correspond to the opposite i.e. the supplier has done more specific investments thus being more dependent on the customer (Bensaou, 1999).

An interesting issue to consider here is that according to Bensaou's observations, no significant performance differences between the various relationships occurred. Even the strategic partnership was not more superior in its performance, which address that each type of relationship can be well or poorly managed. Therefore, Bensaou stresses first; "that each firm must match the optimal type of relationship to the various product, market and supplier conditions and secondly; they must adopt the appropriate management approach for each type of relationship". To conclude, a failure in this respect is either a mismatch in the relationship design or the management design approach. (Bensaou, 1999)

Consequently, in order to answer questions such as "how can managers determine when a captive buyer design is more appropriate than a strategic partnership", Bensaou suggest two contextualised profiles. The first profile helps concerned people to identify which type of relationships to use under some specific conditions surrounding the products, services or market. The second profile aims at design the appropriate management models for each type of relationship. To conclude, it is suggested that good practises according to Bensaou means first, balancing a portfolio of relationships tailored to some given market and product conditions and secondly, managing each relationship in an appropriate manner. (Bensaou, 1999)

## Empirical study

The following section will take its point of departure by describing two case examples from Volvo Logistics AB and Sony Ericsson respectively. As described in the purpose the focus will be to connect theory with practise thus increases the understanding of how and in which way companies actually apply theory in their own contextualized situations.

### Case study: Volvo Logistic

Volvo Logistic Corporation (VLC) designs, handles and develops comprehensive business logistics systems mainly for the automotive industry and is a subsidiary within the Volvo Group. To clarify, this case will focus on logistics services that are bought by VLC from different transportation companies such as DHL, Schenker, and DSV among others. The interview was carried out at VLC global purchasing department in Gothenburg, Sweden. Ronny Börjesson, who was truly helpful by sharing his insights, was interviewed hence a summary will be presented for the reader as it provides the basis for the coming analyse.

Historically, Volvo Logistics has not used any outspoken model for purchasing strategy development in addition to the standard purchasing processes and methods i.e. that have provided the employees with directives and such issues. This can be explained by the fact that VLC previously was considered being a relatively small player thus had more control and verbal communicating throughout the company. However, as the company continually has increased tremendous in size, a clear strategy that makes the organization working homogenous needed to be in place. (Börjesson, 2008)

Consequently, their newly developed purchasing model consists of three steps. In brief, the first step aims at clarifying the current situation by looking at global spends. The second step is about categorizing commodities and formulating a desirable purchasing strategy. The third step deals with opportunity assessment and is the last step to carry out before a *concluded strategy* can be determined. (Börjesson, 2008)

#### **First step, global spends**

As mention, the first part in the purchasing model aims at clarifying the current situation. Here, it is important to thoroughly understand the prerequisites before moving to the next step. Hence, obtain the full picture of what the spends in fact are, where they are placed at and the current market situation. For instance how large volumes are presently bought and from which suppliers, what are the terms and conditions for these volumes, how is the bargaining power, how does the capacity behave in the market place? Briefly put, where does VLC place their money and what are the preconditions and saving possibilities? Such issues must be clarified and understood, before continuing to the next step, see Figure 16. (Börjesson, 2008)



Figure 16 - Spend analyse (1)

### Second step, commodity analyses

The second step is about categorizing commodities into a 2x2 matrix by using workshops and scorecards hence formulating a desirable purchasing strategy. The variables used in the matrix are of internal and external nature and are termed *criticality* and *complexity* respectively. These two represents the axes that are used in the matrix, which give the matrix the structure showed in Figure 17. The logic used is close to the one in Kraljic's matrix. *Standard* commodities for instance are those that are neither complex nor critical to buy for VLC such as simple transportation routes that most transportation companies easily can carry out. *Bottleneck* commodities on the other hand are services that are difficult to come across in the marketplace thus price and volumes are not as significant. The critically is therefore rather low but the complexity is usually high for these commodities e.g. special transportations that few suppliers can deliver. Further, the category *leverage* commodities are considered being important or critical for VLC, yet not complex, meaning that many transportation companies would be able to deliver the service. Therefore, prize becomes the most important factor to reflect upon in this respect. Lastly, *strategic* commodities are the ones, which are considered being both highly critical (internally) and complex (externally). Examples here could be logistic services with routes stretching over several countries, which uses different transportation modes (boat, train and road) and constitutes a big share of VLC's total volume. Consequently, the aim is to strive for having long-term relationships with these suppliers. (Börjesson, 2008)

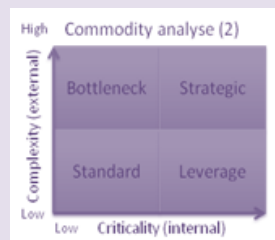


Figure 17 - Commodity analyse (2)

As mentioned, scorecards are used for the categorization in step number two. The commodities are weighted based on some specific factors reaching from 1-10, thus the

axis in the matrix spans from low to high. These factors that are being used here are tailored to their own particular business and can be determined through workshops or be specified right from start. Moreover, during the interview it was concluded that such factors would vary from time to time hence there is no comprehensive list covering all aspects. Instead, due to changing market conditions, such as the instability in today's economy, the factors will vary thus being dynamic rather than static. However, some factors that more or less always are considered as important in this business context are price, capacity, quality, delivery precision, volumes, flexibility and attitude of the suppliers. (Börjesson, 2008)

### Third step, opportunity assessment

The third step, termed *opportunity assessment*, is the last step to carry out before a *concluded strategy* can be determined. Here, a two-times-two matrix is present as well. The horizontal axis represents benefits and the vertical costs, both in respect to some proposed opportunities. As seen in Figure 18, the axes are stretching from low to high. This means that some weighing of factors by using workshops and scorecards are done here as well. Accordingly, the most desirable area to reach, for a given opportunity, in this matrix must be where the costs are low and the possible benefits are high, which would be in the bottom-right corner. (Börjesson, 2008)



Figure 18 - Opportunity assessment (3)

Furthermore, these opportunities derive from both the ideas and evaluations from previous steps and on new ideas and experiences from people working within the purchasing organization. Obviously, it could be people working outside the department as well i.e. all valuable opportunities should be considered. However, the aim is to take advantage of the skills and experiences of the people working with such issues. Consequently, this step could be said being based on past experience thus being a forum for new innovative ideas, which might result in certain earnings for the company. As mentioned, the evaluations of ideas are carried out in workshops and by using scorecards. Consequently, some given opportunities are assessed and weighed thus finally placed in the matrix. (For enhance the understanding of this step, an example is provided later in the analyse)

Finally, at this point a *conclude strategy* should be reached based on the inputs from previous steps, one to three. Consequently, the final model can be outlined representing the different steps in a schematic order, Figure 19.

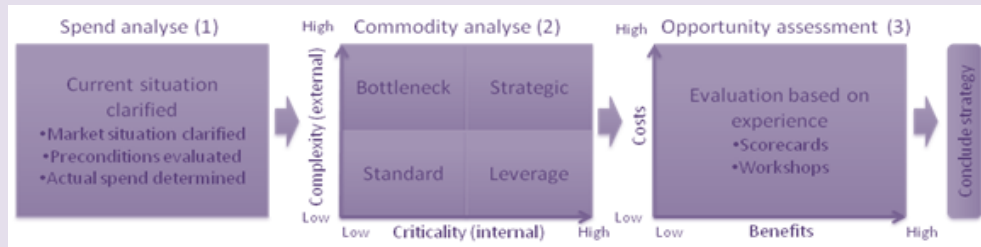


Figure 19 - Steps in schematic order

### Case study: Procurement of plastic parts at Sony-Ericsson

This section will describe how Sony-Ericsson purchases their plastic parts for mobile phones. The text derives from an interview with Fredrik Ohlin, commodity team leader for plastic parts, at Sony-Ericsson. The following section will give a brief introduction to the company and their operations this will be followed by a description of the purchasing process of plastic parts.

Sony-Ericsson Multimedia Communications is a global provider of mobile multimedia devices, including mobile phones, accessories, and PC cards. The company was established in 2001 by the telecommunication provider Ericsson and consumer electronic provider Sony. Sony-Ericsson undertakes product research, design and development, manufacturing, marketing, sales, distribution and customer services. The Global management office is based in London, and R&D is in Sweden, UK, France, Netherlands, India, Japan, China and the US. (Sony Ericsson, 2008)

Sony Ericsson has a purchasing organization divided into two parts where one part is strategic and the other one is project based. The project based organization part is co-located with the development units and intends to meet and serve the needs of the development units. The first stages of the product development are performed in-house without any cooperation within the suppliers. However, once the product reaches the final stages of the development joint development projects are initialized. (Ohlin, 2008)

In every project, there is one or several person responsible for a certain commodity type. The number of commodity located to each purchaser is based on the strategic importance and the constraints related to the product. If a purchased product is considered to be of a more simple nature, a purchaser can be responsible for supporting several projects with that commodity. (Ohlin, 2008)

The plastic purchasing section at Sony-Ericsson does not have any general approach or model for setting up supply strategies. The persons responsible for each commodity group create their own supply strategies based on the specific situation. The department in question does not use any standardized portfolio model which can be applied for all product categories. Further on, there is no specified strategy of model for analyzing supply markets when searching for new suppliers. (Ohlin, 2008)

In most cases the traditional purchasing procedure is not applied at Sony Ericsson. In a traditional purchasing procedure, the purchasing process begins with the company determining product specifications which is followed by a supplier selection and a contracting. However, in Sony Ericsson's case, an unspecified proposal is sent out without any product specifications. Sony Ericsson uses its market position to delay the final specification of the product until late in the process. This allows Sony Ericsson and the supplier to have a longer development phase before specifying the final product. Further on, by using its company strength this way, Sony Ericsson can postpone price discussions until late in the process where they have a much better bargaining situation. (Ohlin, 2008)

Sony Ericsson use a rating model for existing suppliers' abilities based on past experiences. Suppliers are selected based on past experiences, knowledge, suitability, and production capacity. There are a number of abilities as being especially suitable as supplier characteristics; ability to produce various technologies in-house, amount of support from supplier during development project, and price. Quality is mentioned being a parameter which is very hard to measure and is often based on past experience of the supplier. Sony-Ericsson is in its turn evaluated by the suppliers on a yearly basis. Factors that are evaluated are mostly from a performance point of view rather than evaluation of "soft" values. (Ohlin, 2008)

## Analysis

This section will cover the analysis of the theory that has been presented and the empirical studies. It will focus on similarities and differences between theory and empirical study. Further on, will this chapter help the reader to get an understanding how purchasing works at Sony Ericsson and Volvo Logistic, and the differences between their way of doing it to the way theory explains it. Consequently, the following section in this chapter will centre at enhancing the understanding of how theory and practise under certain conditions are connected and when they are not.

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## Volvo Logistic

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As has been described, Volvo Logistics used a three step purchasing approach. Similar three step approaches could be found in the literature as well. Olsen & Ellram, (1997) for instance use an analogous approach yet in a slightly different set up. In their portfolio model the first step is to analyse the companies' actual purchases by give answers to certain factors such as economic value of purchases, supplier market characteristics, product characteristics, competence factors etc, and then place the analysed commodities or purchases into their portfolio model. In this manner an ideal strategy for the commodities are provided.

Similarly, the first step for Volvo Logistic, termed *spend analyse*, dealt with the clarification of the actual or current situation hence provides inputs for their second step that is *commodity analyse*. In this respect these two approaches (VLC's and Olsen & Ellram, (1997) are closely linked. Still, not surprisingly Olsen & Ellram, (1997) propose a generic approach, meaning that the factors are not tailored made for any specific business such as in VLC's case. Further, the actual spend is very emphasized in practise but rather rarely mentioned in theory. This address that spends still is recognised for being one of the single most important factors to consider for companies. Besides, this step (spend analyse) is considered being an extensive one in practise, meaning that the resources allocated to carry out this part of the analyses are considerable This statement can be further strengthened by Cap Gemini, which accordingly recognize this step as being extensive in its nature i.e. the amount of collection of data and the structuring of it is both time and resources demanding. Therefore, this may imply why the clarification is seen as a separate step in practise and not in the literature and why it is not directly integrated together with the actual classification of commodities i.e. determining a company's ideal purchasing strategies.

In general, theory does not emphasize the actual spend in the same extensive manner. Rather, it is indirectly described, meaning that some universal areas such as economic factors, product complexity etc. are found hence does not provide any extensive explanation of how companies should do in their own practical environments. By extending that argument, companies (especially the ones that are less mature in this area) might therefore lack in successfully connecting useful theory to their own business situation.

However, as has been revealed in the literature, the authors insist that companies must contextualise the authors' suggestions i.e. the generic factors that influencing the categorization cannot be seen as comprehensive or tailored to any specific business. Bensaou, (1999) for instance suggests two contextualised profiles that should help practitioners applying theory in their business situation. Still, these two profiles are more focusing on supplier relationships and how to managing it i.e. later steps in the purchasing portfolio models. This address a differentiation of where emphasize are placed at. Having one practise oriented part delegating much focus into the current spend analyses i.e. determining where the money actually are placed and another theory-oriented part focusing more on later more strategic steps e.g. relationships, segmentation strategy and the actual logic behind it.

The logic reasons for this might simply be explained by that there are natural differences in interests between the practitioners and the authors in the field thus working at different levels where one could be said being more business oriented and another being more theoretically oriented. Nevertheless, at some level, we can see how closely related theory and practise actually are. As seen in the first step, *spend analyse*, market situation should be clarified, current preconditions should be evaluated. Questions such as volume bought, bargaining power, capacity, supplier characteristics and more has been addressed. Here, a strong correlation can be found with the literature. For example, (Lilliecreutz, et al., 1999), Olsen & Ellram, (1997), and Kraljic, (1983) all suggest similar questions or factors that should be asked at the classifications stage. At this level of interest theory and practice could be said be very similar thus be connected to each other.

The second step of Volvo Logistics' newly developed purchasing model have great similarities to some of the models presented in literature. As was mentioned in the empirical part, the second step of the purchasing model aims at categorizing commodities into a 2x2 matrix by using workshops and scorecards hence formulating desirable purchasing strategies.

The vertical axis in Volvo Logistics' matrix for commodity analysis classifies the external supplier market complexity into high and low. This axis is very similar to the horizontal axis in the Kraljic matrix (Kraljic, 1983), which is called "complexity of supply market". In the theory from Kraljic, the author suggest this axis to focus on issues such as complexity of supply market the company, entry barriers, logistic cost and/or complexity, and monopoly or oligopoly, which can be considered to be quite similar to the factors suggested by Volvo Logistics.

Further on, this axis has resemblance to the horizontal axis on the matrix created by Van Stekelenborg & Kornelius, (1994) called "control need of external supply market". In this model, the need for external supply market control can be caused by different factors. If the customer is important for the supplier, the need for control is less. A high number of potential suppliers simplifies the supply situation and therefore reduce the need for control. Poor supplier performance and reliability, however, causes a higher need for control activities (Van Stekelenborg & Kornelius, 1994).

In the first step of the portfolio model suggested by Lilliecreutz & Ydreskog, (1999) the authors also suggest a model to distinguish groups of products and their characteristics. The axis in this case is called "complexity and risk profile" and is divided into five sub-groups: supply market, uniqueness of product, technical complexity of product, influence from outside party, and other risk related to the product. This can, as with the other models, be seen as a classification of the external risks and complexity associated with the suppliers.

The horizontal axis on the model created by Volvo Logistics refers to the "internal criticality" of the product i.e. how important the product is for the organization from a strategic perspective. In Kraljic's approach this dimension is called "importance of purchasing" and has criteria such as; percentage of raw material in total costs and value added by product line (Kraljic, 1983). Further on, Van Stekelenborg & Kornelius, (1994) call this dimension "control need of internal market demand". In this



case, the most important factor is related to the strategic importance of the purchased items. The price – as part of the total cost of the final product – has a great influence. Product characteristics, such as complexity of product, degree of uniqueness, and size all have strong influence on internal market demand control. The unpredictability of the customer demand, the more often the demand changes, the more difficulties exist in the procurement. Lilliecreutz & Ydreskog, (1999) call this dimension “economic profile”, this variable has four sub variables: product cost per shipment, total cost, value added on end product, and impact on total cost.

As can be seen above the models suggested in theory have great resemblance to the second step of Volvo Logistics’ newly developed purchasing model. Moreover, when looking at the different product groups the resemblance is even greater. Several authors, as well as Volvo Logistics, classify their products into Leverage-, Strategic-, Non-critical, and Bottleneck-items ( (Kraljic, 1983), (Gelderman, 2000), (Lilliecreutz, et al., 1999), (Olsen, et al., 1997)). The difference though is that Volvo Logistics have chosen to change “Non-critical items” into “Standard items”. Finally, as seen above the differences are minor, meaning that both literature and practise suggest similar parameters to consider, leading to comparable strategies.

However, the dependency within the relationships, and to some authors even more important the mutual interdependency, is not considered being equal. As has been elaborated upon previously, parts of the criticism towards the Kraljic matrix derive from this diverse view of dependency and the exploitations of the relationships. Linking this to VLC, they could be said using similar logic as the one of Kraljic, meaning that relationship with mutual dependency is mainly considered for the upper right corner in the matrix. Extending this by moving towards the network perspective, some authors suggest that the relationship must be considered in a network context, meaning that the focal companies action might be reflected out in the web and in worst case also influence the company’s position or options negatively. This aspect might appear to be forgotten by looking at the second step in VLC’s purchasing method, but it could also be a matter of prioritizing of what VLC address as being more important and how long the organization as a whole has reached in the understanding to these multifaceted issues, which requires a certain maturity or experience within the field of purchasing.

During the interview some pre-set factors, that more or less always were considered during the evaluation phase in step two for VLC, was discussed. In other words VLC have listed some business specific factors that always should be evaluated thus given a weight at e.g. prize, volumes, quality, delivery precision and more. This address a prioritisation between the very factors initially considered in the business practise. In contrast, the literature suggest different generic factors that later should be given weight at. In respect to that companies not unusually lack in time and resources, this could be the natural explanation of this. However, the drawback of this could be that factors that are not predefined i.e. are set during the workshops trough discussions could easily be forgotten and thus become treacherous. In that respect VLC could beneficially use the generic lists of factors presented in the literature in order to not forget or overlook important dimensions that might impact positively.

In the third step of the purchasing model, the opportunity assessment of e.g. a transport is evaluated. The purpose of this third step is to make the model business specific by using experience. Many portfolio models suggested in literature are very generic while VLC introduces this third step to make the model suit their own business. Using a single portfolio model for setting up supply strategies for all types of business, product categories, and supply situations can be considered to be difficult. By adapting existing theoretical models from theory to own company usage the models become case specific and more suitable for creating successful and accurate strategies.

As described, VLC uses their knowledge and experience and evaluate ideas based on that with respect to costs and possible benefits. Compared to Olsen & Ellram, (1997) approach for instance, in which the action plan simply is based on the inputs from the two earlier steps, VLC adds one extra dimension i.e. experience. Moreover, the two approaches use different variables i.e. basing their decisions on different values. Olsen & Ellram, (1997) mainly focuses on the supplier attractiveness as the major decision variable i.e. if the supplier are recognized as being attractive the aim must be to strengthen the relationship. However, by evaluating the suppliers based on costs and possible gained benefits and also experience, the supplier can turn out to become less attractive e.g. since the people know by their experiences that the flexibility, cash flow etc. will be decreased. Hence the aim should not be to add more resources to the supplier in terms of e.g. increasing the volumes, enhance communication and such. Consequently, this address how issues putted in a specific context can make the output (i.e. the decisions that shall be taken), change due the practical environments. To increase the understanding of what has been stated an example is provided.

For instance, for a given transportation route carried out on road, the *spend analyse* (step one) shows that the actual spends are relatively high and the *commodity analyse* (step two) shows that the commodity is categorized as being leverage (i.e. not complex to carry out for the suppliers but critical for VLC due to high volumes).

In the last step, based on experience and knowledge, the *opportunity assessment* is mapped based on a number of attributes. These attributes are then used in the evaluation of benefits and costs. Consequently, the output from step one and two might suggest that the cost should be lowered, which could be done by changing the transportation mode from road to sea freight, given that it is possible in reality. Accordingly, this might lower the cost thus might appear to be beneficial.

However, based on past experience this shift in transportation mode will certainly lower the flexibility and decrease the cash flow since capital is tied up. In fact, due to the knowledge and experiences within the organisation the opportunity should in this case be abandon and instead, resources should be allocated to the existing supplier with the aim of lowering the costs in other ways e.g. increase the volumes, integrate computer systems and more. Consequently, this extra dimension termed experience can obviously change the outcome since it implicitly considers more dimensions.

Finally, this section has shown the importance for companies to adapt portfolio models suggested in the theory to suit their supply situation. The example above shows that business is dynamic in its

nature and is surrounded by an infinite number of parameters, which should be considered when performing the evaluations. To conclude, qualitative inputs measured from experience and knowledge is hard to put into portfolio models hence makes theory and practice somewhat difficult to connect in a comprehensive manner.

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## Sony Ericsson

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This section will analyze the empirical findings from the interview with Fredrik Ohlin, commodity team leader at Sony Ericsson, to the theory which has been given in the beginning of the chapter. The following section will analyze the differences and similarities between some well known portfolio models and the purchasing strategies at Sony Ericsson. Ohlin, (2008) describes Sony Ericsson's purchasing procedure as follows:

*“Traditional purchasing procedure is not applied at Sony Ericsson. Traditionally the company sends out specifications on requested products to a number of suppliers in order to get a quotation. However, in Sony Ericsson's case, an unspecified proposal is sent out without any product specifications. Sony Ericsson uses its market position to delay the final specification of the product until late in the process. This allows Sony Ericsson and the supplier to have a longer development phase before specifying the final product. Further on, by using its company strength this way, Sony Ericsson can postpone price discussions until late in the process where they have a much better bargaining position.” (Ohlin, 2008)*

This way of working can be related to the third step in the Kraljic portfolio model. In this step Kraljic argues that the company should weight their strength towards supply market strength and position the company in a matrix. This should help the company to find opportunities and risks and to position the risk with the supplier as either exploit, balanced, or diversify. In Sony Ericsson's case they have an exploit opportunity towards the supplier which means that they could have an aggressive approach and make beneficial contracts with the supplier, which is exactly what they are doing. Gelderman, (2000) also describes the importance of power and the dependence between buyer and supplier. In Sony Ericsson's case they have a buyer dominated relationship since they seem to use their power to gain advantages. According to Gelderman, (2000) theories on buyer- and supplier dependence this suggests that the items that Sony Ericsson purchases for this department are leverage items which could be the case when purchasing plastic parts to mobile phones.

Sony Ericsson's use of their company strength enables them to restructure the traditional purchasing procedure into one which is more suitable for them. Van Weele, (2005) describes the traditional purchasing process to look as follows (Figure 20):



Figure 20 - Traditional purchasing process, (Van Weele, 2005)

However, Sony Ericsson take advantage of their market position to restructure the purchasing process into one that is more suitable for the company.



Figure 21 - Sony Ericsson's purchasing process, (Ohlin, 2008)

By adapting the purchasing process as described in Figure 21 where the price discussion has been relocated to appear later in the purchasing process, Sony Ericsson have a much better position to negotiate since the supplier has already booked capacity in their production. Further on, the delay of the final specifications gives the development team more time to finalize the product. This is an important factor since mobile phones have become a fashion-related product. The customers' increased awareness and demand on design forces the mobile phone companies to postpone final completions of products until the very end. This way customer demands on certain designs and colours are better known (Ohlin, 2008).

According to Kraljic, (1983) it is important to use a strategy for analyzing the market when searching for new suppliers. Ohlin, (2008) explains that Sony Ericsson does not have a specified strategy or model for analyzing supply markets when searching for new suppliers. This could be related to Gelderman, (2000) which states that a buyer should not have a generic purchasing strategy and perhaps it is good to not have generic strategy for analyzing the market and instead look at each individual case.

This could also be related to that the fact that there are no ranking for characteristics for potential suppliers. However, Sony Ericsson uses a rating model for existing suppliers' abilities based on past experiences. Olsen & Ellram, (1997) have as a second step in their portfolio model which includes a supplier evaluation. They evaluate the supplier either by relative supplier attractiveness (which are factors like economic factors, performance, and technology) and the strength of relationship (which is factor like cooperation, exchange and distance). This could be related to the characteristics that Ohlin describes:

*“The abilities that are especially suitable as supplier characteristics are; ability to produce various technologies in-house, amount of support from supplier during development project, and price”.* (Ohlin, 2008).

Further on, Lilliecreutz & Ydreskog, (1999) emphasizes the importance not only to classify the purchased products but also evaluate the cooperation with the suppliers. As mentioned Sony Ericsson uses a rating model for existing suppliers' abilities based on past experiences (Ohlin, 2008). Lilliecreutz & Ydreskog, (1999) suggest a two-step model of evaluating supplier relationship where the first step evaluates ideal supplier relationship and the second step evaluates the actual supplier relationship. While Sony Ericsson evaluates the performance of the suppliers numerous authors suggest models for evaluating the relationship between the actors rather than one single actor's performance (Olsen, et al., 1997), (Lilliecreutz, et al., 1999). Much of the older literature on supplier evaluations tends to forget this important type of interdependent relationships, which also is one of the reasons behind why Kraljic matrix (Kraljic, 1983) has been so criticized. However, Ohlin, (2008) emphasizes the importance of the suppliers' contributions to the product development process to be an important performance and evaluation measurement. This can be seen as an indicator on how well the supplier performs in a cooperative environment. However, the evaluation of the relationship is far from as extensive as suggested in literature.

Ohlin, (2008) mention quality, which could be an important measurement, as being very hard to measure and often based on past experience. Looking at the way Ohlin describes important characteristics for supplier and the way Olsen & Ellram, (1997) are doing it, there are very similar. Even though Ohlin does not use as many as Olsen & Ellram, (1997) all of his characteristics are presented in their portfolio model.

Sony Ericsson does not follow a portfolio model when selecting suppliers, Ohlin says that:

*“Suppliers are selected based on past experiences, knowledge, suitability, production capacity, and ability to produce certain technologies in-house”.*  
(Ohlin, 2008).

In companies' pursuit of reduction in supplier base, suppliers are increasingly requested to supply companies with numerous types of items. As Ohlin, (2008) mention above the suppliers' production capacity and knowledge in different production technologies are proving to be increasingly important. Large companies like Sony Ericsson need suppliers that can deliver huge quantities with short notice, which sets high demands on the suppliers and therefore reduces the supplier base. This reduces the need for using a portfolio model when selecting suppliers since the supplier base is very limited.

To conclude, the way that Sony Ericsson is working has a lot of similarities to different portfolio models. This section has dealt with the similarities that came up during the interview with Fredrik Ohlin. It has explained for example how parts of the portfolio models of Kraljic, (1983) and Olsen & Ellram, (1997) could be related to the way that Sony Ericsson works when identifying the right supplier.

## Conclusion

Purchasing portfolio models have received a great deal of attention during the last decades Kraljic, (1983), Håkansson & Persson, (2006), and Dubois & Pedersen, (2002). This chapter of the book has provided a theoretical insight into some of the suggested models. The theoretical chapter shows that the Kraljic model (Kraljic, 1983), which can be considered to be the mother of all purchasing portfolios, has been widely developed to fit different supply situations. Further on, this chapter has provided an empirical study which has shown how Volvo Logistics and Sony Ericsson adapts and uses deriving from different portfolio model in their purchasing organizations.

The analysis has shown that Sony Ericsson doesn't use any purchasing portfolio model in their purchasing activities of plastic products. However, several of the theories behind the models are adopted in the purchasing activities such as exploitation of power. However, the empirical study on Volvo Logistics, which was on a more strategic level, clearly demonstrated how purchasing portfolio models are used when setting up supply strategies. Volvo Logistics use deriving from several articles such as Olsen & Ellram, (1997), Bensaou, (1999) , and Lilliecreutz & Ydreskog, (1999) when creating their own three step portfolio model.

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## [6] Corporate Social Responsibility in Purchasing Management

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This chapter studies how the concept of Corporate Social Responsibility (CSR) is related to Purchasing Management and how CSR affects a purchaser's way of working when sourcing products. The chapter will discuss ethics in terms of trends, strategies and frameworks and it will also present why companies can benefit of acting ethical, but also why they often fail in doing that. Furthermore, social responsibility, the benefits and drivers of this, and how to reach a supply chain complying with CSR standards will be discussed.

## Introduction

As describe in the coming chapter regarding supplier evaluation, it can be seen that it is easy to be tempted to only focus on finding suppliers that can provide high quality to a low price and to forget other issues. But nowadays, as mentioned in the chapter “*Definition and trends within Purchasing Management*”, it has become more and more common that companies also contribute to the development towards a better society by including issues as a sustainable environment and equal rights for all people into their operations. These companies consider their Corporate Social Responsibility as a part of their core business strategy.

Corporate Social Responsibility (CSR) is essentially a concept whereby companies integrate social and environmental concerns into their business operations on a voluntary basis (European Commission, 2001). The European Commission (2001) claims that although the prime responsibility of a company is to generate profit, companies could at the same time contribute to the society, through integrating the concept of CSR into their core business strategy. Carter (2000) agrees in this and means that the idea of social responsibility is that a company does not only have economic and legal obligations, but also certain responsibilities to society which extends beyond these obligations. If companies shall survive today’s competition at the market Carter (2000) claims that they must be socially responsible by not only abiding by laws and economically producing goods and services demanded by society, but also by meeting ethical responsibilities which that are expected by society yet not explicitly stated by law.

According to Scholtens (2008), CSR is mainly divided into three different areas: ethics, social responsibility and environmental responsibility. This chapter will present and analyze how these areas are handled within the purchasing process in companies and the focus will primarily be on ethics and social responsibility. As stated above claims the European Commission (2001) that the main focus for most companies is to make more money so they can increase their profit. This strategy will improve the companies’ economics but it can also result in that issues as ethics, the environment and the society will be put aside.

This chapter will present what companies should consider important from a CSR point of view when they are performing their supplier evaluations and their purchases. A discussion on why companies tend to focus on other issues, e.g. price and quality, instead of ethics and environmental issues when choosing suppliers and how this can affect a company’s name will also be made. The discussion will be exemplified with the help of actual case studies.



## Ethics in Purchasing Management

Ethics can be defined as the basic principles of correct behaviour, with reference to a specific person, profession or activity (Thomas, 1984). In this chapter the person, the profession and the activity will be represented by the purchaser, the purchasing profession and the purchasing function.

When most people think of ethics in Purchasing Management, they think of bribes and gift-giving from suppliers to purchasers, but there are several other issues that need to be considered when discussing ethical issues connected to a company's sourcing strategy. When it comes to a company's ethical responsibility regarding its purchases it is mainly the requirements on its suppliers and how the company act to assure that the suppliers act ethical in its operations that comes into focus.

Requirements that a company could put on their suppliers involves demands on legal requirements, child labour, workers' rights regarding illegal work, wages and working hours, factory conditions and safety, environment, but also requirements that the products not shall affect the users' health negatively (European Commission (2001) and Egels-Zandén (2007)). Most companies aggregate all these requirements into a framework called "Code of Conduct", which will be presented and discussed later in this chapter.

The chapter will start with explaining why ethics has become more important to consider within Purchasing Management, followed by the presentation of the concept of Code of Conduct. After this will benefits and advantages that a company can achieve from an ethical behaviour be presented followed by an explanation and a case study on why companies fail to make ethical purchases.

### A trend towards Ethical Purchasing

The purchasing function has for many years been a forgotten function of business. It has been disregarded and undervalued, which have been reflected in for example low status and low salaries. Badenhorst (1994) means that this has been a contributing factor to an unethical behaviour within a company's purchasing organization. The purchasers were not satisfied with their situation and started therefore to conduct unethical activities in their job assignments; the purchases. But over the last years has the purchasing function become more important in companies and Quayle (2006) claims that this is a reason for the trend towards increasing importance of ethics in Purchasing Management. Besides the increasing importance of the purchasing function, there are also other trends and factors that have influenced the ethical behaviour at companies' purchasing departments.

Globalization and global sourcing are two trends that have affected the way companies work with ethical issues when purchasing products and services. Before, companies did most of their purchases

locally and they were mostly working in the same business cultures as their suppliers. Nowadays, as an effect from the globalization and as mentioned in the chapter about sourcing strategies, purchasers work with suppliers spread over the entire world since they want to take advantage of lower labour costs in developing countries (Pretious, et al., 2006). This results in that different business cultures meet, something that Wood (1995) means can cause confusion for the purchasers, e.g. something that is ethical right at one market might be unethical at other markets (Wood, 1995). According to Wood (1995) this confusion can in the end result in an unethical behaviour and he means that bribery is a good example of an unethical activity that often appears when different business cultures meet. It is this confusion that has resulted in that companies now put a higher focus on their purchasing activities so they can avoid an unethical behaviour.

Wood (1995) claims that bribery is the largest ethical problem within the purchasing function and he means that a major reason for this is that business people from the Western world, which have successfully industrialized their economies, assume that non- or semi-industrialized countries work in lower ethical standards than their own and that bribery is common in these cultures. Bribery, gift-giving and entertainment are used to make the purchasers favour specific suppliers during the supplier selection instead of only base it entirely on price, quality and delivery (Wood, 1995).

As mentioned above bribery is in some parts of the world regarded as illegal and also unmoral, while it in other parts of the world is seen as a part of the business culture. Pretious and Love (2006) mean that it would be rude to not accept bribes in some countries since it is a part of how business is made in these countries. The purchasers are often stuck between different business cultures and this will affect how the ethical issues are handled. This since it is hard for a purchaser to decide when a supplier's hospitality becomes excessive (Pretious, et al., 2006) and the purchaser will then start to ponder if it is acceptable to accept the gifts and the invitations that the suppliers offer. This has resulted into a larger focus on ethical issues within the companies' purchasing departments since the companies want their purchasers to be absolutely clear on how the purchases shall be made. They do not want to risk that their company should be associated with an unethical behaviour as bribery. The chapter will later on explain why companies fear this negative publicity.

Another proof for that ethics becomes more important is that companies nowadays are developing policies and strategies that are adapted to the new trends and the new situation that the purchasers meet at the global market. The companies want both to create a business environment that encourage ethical purchasing but also create a framework that the suppliers must follow if they shall be allowed to supply goods and services to the companies. This framework is often called "Codes of Conduct".

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## Codes of Conduct

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To be able to monitor the ethical issues mentioned above when purchasing goods from a supplier, the purchasing company is often using a framework called “Codes of Conduct” (Egels-Zandén, 2007). The codes are used to ensure that the working condition at suppliers’ factories meet or exceed international labour standards (Pretious, et al., 2006) and Badenhorst (1994) means that an ethical Code of Conduct is the most effective tool which can be used against unethical behaviour since it spell out a company’s ethical policy as well as guidelines for day-to-day activities. Evans et al. (2008) agree in this and also claim that the Code of Conduct also can be used to extend a company’s values to suppliers and obtain support for its CSR objectives.

Example of criteria that are included in companies’ Codes of Conduct is:

- ✗ Working hours
- ✗ Working days per week
- ✗ Guaranteed minimum wage
- ✗ Overtime compensation
- ✗ Health and safety education
- ✗ Physical examinations
- ✗ Child labour
- ✗ Copy of employments contract
- ✗ Accident and pension insurance

(Egels-Zandén, 2007)

When developing a Code of Conduct it is according to Evans et al (2008) important to ensure that it reflects issues that are of importance for the company, e.g. human rights, the environment or corruption. Mark Powderham, European head of procurement at KPMG LLP, agrees and also means that the codes, if possible, shall be based on an established framework such as the United Nations (UN) Global Compact (Evans, et al., 2008). This since it gives the codes influence and credibility. Another example of framework that many well-know companies uses when developing their own codes are the Ethical Trading Initiative Code, which is based on international standards, UN Convention on Human Rights and International Labour Organization (ILO) Standards. Liz Cross works with CSR strategy and policy for procurement for the British Telecom and she means that companies shall try to use well-known frameworks that are intended to have a global application when developing their Codes of Conduct. This will facilitate the implementation of them (Evans, et al., 2008).

Before launching the codes to the suppliers the purchasing company must make sure that the codes are, as mentioned above, consistent with its own values and that they are relevant to the business sector the company work in. This since it is the market sectors and the locations where the company and its suppliers work that will dictate the relative importance of the different issues in the codes (Evans, et al., 2008). Before introducing the codes to the suppliers the company must also be really

sure that they know why the codes are important for themselves. Evans et al. (2008) mean that this is a prerequisite if the suppliers shall adopt the codes to their operations in a serious way. Further, Badenhorst (1994) claims that a Code of Conduct must also spell out the punitive measures if the code would be breached by the suppliers. This should not be done with the intention to frighten suppliers but to state that the company considers an ethical behaviour as very important.

It is not only the buying company that carries the responsibility for the codes; the responsibility shall instead be shared between the buying company and the suppliers. But in the end is it the buying company that carries the highest risk, since it is their name that is affected negatively if their products are not produced in an ethical way (Pretious, et al., 2006). That is why it is important to monitor that the suppliers follow the codes, something that is very hard to do. But companies struggles hard to ensure that their purchases are made in an ethical way, since they know what benefits and advantages they can achieve by doing that.

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### **Benefits with an Ethical Behaviour**

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Carter (2000) means that an ethical behaviour can, besides the support to the society, have a positive effect on a company's image and reputation. For example, Ben and Jerry's contributions to society have helped the company to increase its annual sales more than they expected (Carter, 2000). This shows that an ethical behaviour can affect a company's results in a positive way and not only be an extra cost as many people believe. Another argument for why a company shall encourage ethical activities is that there are large costs associated with unethical activities, e.g. fines, liability and negative publicity (Carter, 2000). An ethical behaviour will in this way also reduce these avoidable costs.

Companies have realized that an ethical behaviour can have a positive effect on their images and they have therefore put a larger focus on this issue (Carter, 2000). Companies do not want to be associated with unethical activities and they therefore disaffiliate from suppliers that do not follow the Codes of Conduct. This can be seen frequently in the media, for example in Dagens Industri (2008):

*“H&M accused for using a supplier in Bangladesh with unethical activities”*

The same day H&M's management said that they consider quitting their collaboration with this supplier (Dagens Industri, 2008). This shows that companies act fast if their names and brands are associated with unethical activities in the media, since they are aware of the impacts they can cause.

A conclusion from this is that unethical activities will not only affect the society in a negative way, they will also affect a company's business and economics by losing customers and increase costs and thereby reduce profits. These are strong arguments for why companies shall consider ethics important when making their purchases. An ethical behaviour will result in that a company will be a part of the process towards a better society and at the same time increase their profits. That is why it is important

to monitor that the suppliers follow the Codes of Conduct, something that is very hard to do. Even if the buying company believes that a supplier follows the codes, the reality may prove to be different.

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### **Why companies fail in making Ethical Purchases**

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Bayles (1983) means that ethics in Purchasing Management are largely determined by the structure of the work situation and he claims that if ethical behaviour is encouraged, it is likely to occur. Bayles (1983) further means that the major need for ethical conduct in Purchasing Management is a clear organizational policy. This policy will provide the purchaser a firm basis for ethical conduct. But Wood (1995) claims that subordinates will do what their superiors do rather than what they shall do according to the policy. Wood (1995) means that if the business environment within which the purchasers' work is focusing more on performance than an ethical behaviour then that is also what the purchasers will focus their work towards.

Egels-Zandén (2007) has conducted a study that shows that some purchasing managers seemed occasionally to disregard demands for greater compliance with Codes of Conduct in favour of other criteria. The Codes of Conduct seemed at times to be treated as a non-economic purchasing criterion that could be traded for other non-economic criteria, as delivery time and quality, or economic purchasing criteria, for example price. By focusing on these issues instead of an ethical behaviour, the company will fail in making ethical purchase and this will, as mentioned above, harm the company.

Purchasing managers in particular can according to Carter (2000) significantly affect a company's reputation. This since the purchasing function controls over 60% of a company's costs in some industries and that this can create a temptation by the purchasing managers to put business in front of ethics and thereby consider low costs more important than ethics when choosing suppliers (Carter, 2000). From the start, it seems that this approach is the right one to use to cut costs, but it is not. Since the purchasers are the ones that controls the major part of the companies' costs it is also they who face the largest temptation to perform unethical activities.

Carter (2000) agrees in this and he claims that purchasers are the ones that are under highest pressure to depart from accepted norms of behaviour and ethics set by the company. This mainly since they, as stated above, controls large parts of the companies' costs but also since purchasing is a boundary spanning function that interacts with other members of the supply chain. The purchasers will inevitably have to face situations where they need to make decisions on what is right and what is wrong (Wood, 1995). There is a high risk that the purchasers are influenced by people outside the own company, e.g. suppliers, with for examples bribes. These are influences that can result in that ethics are put aside in front of other issues (Carter, 2000). As mentioned before, Wood (1995) means that companies that are working on international markets carry a higher risk to deviate from the

organizational policies or rules that are defining acceptable behaviour. This since the cultural differences will be added to the normal pressures.

Another reason for that a company fails to make ethical purchases is that they believe that their suppliers follow the Codes of Conduct, but in reality they do not. An explanation to this is that it is hard to gather accurate information concerning working conditions during announced inspections (Egels-Zandén, 2007) and it is even harder to assure that the sub suppliers are acting ethical. A major reason for this is that companies often are handing over the responsibility of monitoring a supplier's subcontractors to the supplier itself, since it is impossible for the buying company to monitor all its suppliers. But this will decrease the reliability even more. So even if a company is monitoring their suppliers as good as possible, it is difficult to ensure that all suppliers act ethical. Egels-Zandén (2007) study on how Swedish toy retailers monitor their Chinese suppliers will prove this. This case will also end the chapter about ethics in Purchasing Management.

### Case Study: How Swedish toy retailers misjudged their Chinese suppliers

Egels-Zandén (2007) has conducted several interviews with managers in the Swedish toy industry to be able to analyze how Swedish retailers are working with Corporate Social Responsibility issues and ethics when purchasing products from their suppliers in China. The study shows that all interviewed toy retailers in Sweden have adopted Codes of Conduct for their suppliers' operations to control that the production of the toys are done in a ethical way. The Swedish retailers have monitored the production in China for a long time and they claimed that the suppliers' operations are carried out in the correct way regarding the Codes of Conduct, but they were wrong.

Although that the retailers have worked with the suppliers for a long time to ensure compliance with the codes, most of the suppliers do not comply with the codes. Egels-Zandén (2007) studied nine different suppliers of toys to Swedish retailers and none of these complied with all the standards and requirements specified in the codes. The Swedish retailers claimed that they make regular inspections of the suppliers' factories to confirm that they follow the Codes of Conduct and they meant that they never find any problems; it seemed that the suppliers' operations were following the codes.

Egels-Zandén (2007) means that one explanation to the ineffectiveness of, and suppliers' lack of compliance with, retailer's Codes of Conduct is that the retailers' monitoring organizations are unable to detect supplier's breaches of code standards. This would, according to Egels-Zandén (2007), create an illusion that the working conditions in suppliers' factories are in accordance with the codes. Since the retailers would not find any problems regarding the Codes of Conduct they will not demand any changes in the suppliers' operations.

So even if the retailers are working in the correct way regarding ethics when purchasing products from China, the products are produced in an unethical way and according to

Egels-Zandén (2007) this unawareness can result in that the retailers will receive unpleasant surprises in the future. This proves that companies must be even more critical to the suppliers' operations when purchasing products so that they will be one hundred percent sure that the production is carried out in an ethical way. The method that the companies use to monitor their suppliers needs to be updated since the suppliers constantly will invent new ways on how they can mislead the inspectors.

A buying company must always be ahead of its suppliers to be able to assure that the suppliers are following the Codes of Conduct and that the products produced in the suppliers' factories are made in an ethical way. It is important that companies can monitor their suppliers in an effective way so that they can be sure that their purchases are made in an ethical way. This will benefit the society but also the company itself.

## Social Responsibility

Social responsibility implies that companies need to take into account the impact company decisions have on society. It reaches beyond the usual economical, legal and technical requirements of a company. As the purchasing organisation to a large extent decides which suppliers to use, they have a great impact on the Corporate Social Responsibility performance of a company. Being the link between the internal functions and external stakeholders, the people managing the purchasing activities in a company have large effect on socially responsible activities. (Carter, et al., 2004)

Carter et al. (2004) identified the main social responsibilities for the purchasing organisation to include: diversity, human rights, safety and philanthropy. The following text will briefly touch upon aspects of taking into consideration the diversity and philanthropy at the purchasing department of an organisation. Human rights and safety are connected to the codes of conduct and will therefore be brought up in the part about ethical purchasing.

This part of the book will first, explain the concepts of including diversity and philanthropy into the purchasing organization; second, follows a discussion of the benefits and drivers of comprising social responsibility into the purchasing part of the business; and third, how to reach a supply chain complying with social responsibility.

## Diversity

When purchasing managers select a supplier it is often based on the fact that the supplier has the product in stock and that the price is acceptable, whether the supplier is a member in a minority group is usually not a factor considered. However, according to Dollinger et al. (1991) both community groups as well as the government have grown an increasing demand for company's support of minority owned businesses. This has lead companies to focus more on strategies to purchase from

minority- and women-owned businesses, strategies known as Minority Business Enterprise Programs or having a diversity in the supplier base. (Dollinger, et al., 1991) These programs may in fact work as a link to the minority community.

In a study performed by Carter et al. (1999) it is demonstrated that there is more to sourcing from minority suppliers than just the goodwill and satisfying the demand of the community and the government. If the purchasing company can help minority businesses, these businesses will grow, hiring more people and at the end create new buyers of end products. In fact, the minority business community may work as a link to the whole minority community. By increasing the business with those suppliers it will help the company's growth in the community. It is also stated that the minority suppliers bring value and innovation to the purchasing company. So by making long-term relationships with minority based suppliers, a win-win relationship can be created. (Carter, et al., 1999)

Carter et al. (1999) continue by defining the key success factors in creating such win-win relationships with minority business suppliers. These are Top Management Support and Commitment of Purchasing Personnel. The Top Management Support demonstrates their support by both set of resources for programs for purchasing from minority businesses and by personal presence at support activities for purchasing from minority suppliers. Committed personnel are retrieved by good leadership, but this can also be enhanced by creating a system rewarding purchasing personnel working with minority owned suppliers.

In brief, the concept of diversity in the purchasing social responsibility refers to having diversity among suppliers, making sure minority- and women-owned business are represented in the supplier base. There is an increasing demand for this diversity, both from the community and the government. In excess of satisfying the demand from those stakeholders, there is also an economic gain in focusing on using minority suppliers. And to succeed in this area the most important focus should be put on top management support and commitment of purchasing personnel. These two factors are key success factors also when incorporating philanthropic values into the purchasing organisation.

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## Philanthropy

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Philanthropy is the interest in human welfare and advancement, and this is shown in form of creating work or institutions of learning to areas or persons in need of this, or by simply donating money (Dictionary.com, 2008). In other words, philanthropy covers actions that are expected of them by society, i.e. corporations being good business citizens. With this definition the resemblance to ethical purchasing seems obvious; however, there is a distinct difference between the two.

Compared to ethical responsibilities, philanthropy is not expected in an ethical sense. The society will not regard business as unethical just because they don't contribute to programs encouraging human and community welfare, although desiring them to do so (Carroll, 1991). In this sense philanthropy is more of a voluntary choice of the business, creating good will if fulfilled and with the great advantage that it doesn't create bad will if not fulfilled. There are also other benefits associated with



philanthropic actions than the fulfilment of the genuine interest in promoting human welfare and good will of being a good corporate citizen.

Simms (2008) brings up the company Pack-IT that offer jobs to people with learning disabilities. This company display extra advantages with having a philanthropic culture. The employees at the company have proved to be loyal to the company, and this commitment has enabled the company to have a workforce with good knowledge and great motivation to provide first-class customer service. (Simms, 2008)

The purchasing department in a company may comply with the philanthropic way by supporting and purchasing from companies that focus on a philanthropic business, creating training and employment opportunities for groups of people in need of this. These suppliers are chosen for their support to society and not on the basis of having the lowest price and best service, although they very well may have this.

In addition to the specific advantages mentioned for diversity and philanthropy there are also general benefits of comprising the social responsibility concept into the purchasing organisation.

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## **Benefits and Drivers of Social Responsible Purchasing**

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For the cynical the investment of resources put on social responsibility may seem only as a marketing trick, but there are other advantages as well as drivers to gain when the companies focus on social responsibility. This text will provide some more benefits with comprising social responsibility into the organization than the earlier mentioned arguments.

Studies have shown that there are other benefits with comprising social responsibility into the purchasing organization of a company than just the “flirting” with the market. Carter (2005) state that a high level of social responsibility at the purchasing department has a positive effect on the organizational learning in the company, and this is motivated by the fact that companies with high level of social responsibility have an organization encouraging free decision. Further, high organizational learning improves the performance of the suppliers, and in the end reduces costs for the company (Carter, 2005).

According to Pava (2008) the concept of social responsibility in businesses is, by contributing to organizational improvement, an important resource in itself. According to Pava (2008) it promotes transparency in the supply chain, encourage better communication, set high ideals in the corporate culture, and result in exchange between companies that are useful for both sides. In addition to creating advantages in the organisation the concept may also be useful in meeting stakeholder demands.

Worthington et al. (2008) bring additional reasons for incorporating social responsible purchasing into the company presenting drivers as: legislation/public policy and stakeholder expectations. The

government have inspired, even demanded, companies to invest and develop supplier diversity programs, this to qualify and gain access to public purchasing agreements. As an example can be mentioned the law created in US in 1978. Where so called prime contractors, including all public contracts above \$500,000, were forced to use and include smaller underprivileged companies into the federal contracts. In excess of the pressure put by the government there are also the private sector customers. There are proofs of companies that have started a supplier development program only because the parent company strongly encouraged them to. (Worthington, et al., 2008)

The conclusion is that incorporating social responsibility into the purchasing department will bring organizational advantages beyond fulfilling the demands of stakeholders and being a better corporate citizen. These advantages will reduce the costs for the company. This together with the improved market profile of contributing to the welfare of society will bring higher income, in the end increasing the revenue of the company. With all presented advantages the reader may be eager to implement the ideas to the supply chain of the own company's belonging. Doing this it is important to know the main considerations when getting the supply chain to comply with CSR standards.

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### **Reaching a supply chain complying with CSR standards**

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After the above discussion of the advantages of including social responsibility into the purchasing company, this text will address how to incorporate social responsibility into the organization, and reach out to and make sure the standards are used in the whole supply chain.

With the increasing globalisation, using suppliers in another part of the world, and growing interest in production environment there are three main steps for companies to address when managing the suppliers. The company must create codes of practice or codes of conduct and all members of supply chain must get information of these. Then a monitoring system must be set up to make sure suppliers stick to agree upon standards. Last, a clear view of the effect of not complying with the standards must be made. (Adams, et al., 1999)

As mentioned above, many companies introduce codes of practices that suppliers need to comply with or fulfil in order to qualify as a supplier. This establishment of a Corporate Social Responsibility is easy, compared to realize the consequences of implementing the new policy (Arminas, 2003). Ending a contract with a supplier that doesn't meet the standards, e.g. by using child labour, this supplier might go out of business, with the consequence that the children might have to live on the streets instead. What should the company do in this kind of situation?

It might be better to try to manage the conditions in the supplier's factories, before withdrawing a supplier contract. This management of working conditions at suppliers requires transparency in the supply chain, sharing more information among the different parties in the supply chain (Arminas,

2003). There are also other alternatives on how to influence suppliers and partner companies to fulfil the set up standards for social responsibility.

In excess of creating codes of conducts Amaeshi (2008) bring up corporate culture and personnel development as ways of exerting influence over the suppliers. By having an organizational culture permeated by social responsibility the company can serve as a role model, allowing suppliers and other companies in the company network to mimic their culture. Studies have shown that: the higher the company success, the greater the likelihood of other companies to imitate. Individual issues are harder to affect through corporate culture, and instead personnel training and development may be used by the company. Also including supplier personnel into such activities would enhance the understanding and performance on social responsibilities even more. (Amaeshi, 2008)

The most important factors when incorporating social responsibility into the purchasing organization is top management support and commitment of the personnel. Having this, the next step is to make visible what the standards for social responsibilities are, usually by creating codes of conduct. But, focusing only on suppliers to fulfil the codes of conducts, ending contracts if not living up to preset standards, may cause large societal damage. The company must see to the consequences beyond just ending a contract with a supplier. Instead of ending the contract the company can influence the suppliers by having an organizational culture permeated by social responsibility and committed personnel. Training with supplier personnel can increase the awareness at suppliers even more, at the end leading to a supply chain fully complying with the thoughts of Corporate Social Responsibility.

## Environmentally Sustainable Purchasing

Environmental responsibility is the third and last part of the concept Corporate Social Responsibility. The growing awareness of the consequences for polluting the environment has lead to a larger focus on green purchasing.

The increased concern for the environment in the society of today has lead to a greater awareness of the consumers, and they keep track on companies making sure they're performing in an environmentally friendly manner. In addition no matter how good a company performs, if the suppliers don't comply with the environmental standards the customer will soon hold the company responsible. (Tyler, 1997)

Purchasing environmentally is equal to procuring reusable and recyclable goods, taking part and supporting the development of environmentally friendly items, and take actions to reduce the utilized resources. (Carter, 1996)

Since there is a whole chapter in this book dedicated to sustainable or green purchasing, no deeper explanations or analysis will be done in this section. A more extensive presentation about green purchasing will instead be offered in the next chapter; Environmentally Preferable Purchasing.

### Can companies be competitive when acting according to CSR standards?

As explained earlier the increased awareness and demand from consumers, the government and other stakeholders have contributed to comprise Corporate Social Responsibility into the purchasing organization, implying e.g. using only ethically sound companies as suppliers. This trend is from a social view obviously a very good thing, but observing it from an economical aspect; is it even possible for companies to survive using only ethically sound companies? Or can competing companies draw a too large advantage of using suppliers with unethical standards, and because of this be able to offer a lower price or higher quality to customers? Are the benefits of an ethical behaviour and showing social responsibility enough, or will the costs of implementing this thinking into the purchasing organization outweigh the advantages?

Not everyone believes it is feasible to survive in the market of today using only ethically sound companies and spending money on philanthropic issues. Peter Smith, consultant and former president of Chartered Institute of Purchasing says:

*“If any organisation decides to work entirely to a CSR strategy and only work with ethically sound companies, they would cease to exist in two years time.”* (Blackburn, 2004)

Others have a different view on the subject. According to a survey carried out on behalf of Marks & Spencer, almost 90 percent of the consumers think that companies should only use suppliers which have good working standards in their factories. Some companies even make it a big part of their marketing to have a strong focus on social responsibility. Companies as Gap, Giorgio Armani and Converse are some of the companies that have identified the customers need for an ethical alternative and are using this strategy. And therefore it is not only possible for companies to survive when using only ethically sound companies and showing interest in human welfare and advancement; it can even provide an economical advantage. (Hurst, 2006)

Using a future perspective, adding more arguments to the discussion may speak for incorporating Corporate Social Responsibility even more. As the developing countries continue to develop, the laws in those countries may change and adapt more to western standards. This will make it impossible for suppliers in those countries to use unethical behaviour. The consequence of this, if not able to adapt to new legislation, is that the factory need to be shut down. Then the companies using unethical

suppliers may incur large cost because of need to find new suppliers, while the businesses with only ethically sound companies in their supply chain will then avoid these costs.

The increased interest put in the manner by both consumers and the government imply that although it is costly to make sure supplier perform accordingly to Corporate Social Responsibility standards, it is still worth it. The risk of losing a substantial part of the company customers because not having a supply chain complying with customer social responsibility, will probably lead to such a decrease in sold products or services that the cost of implementing Corporate Social Responsibility into the company will be considered low in comparison.

### Case Study: How H&M integrates CSR into their Business Strategy

H&M was established in Västerås, Sweden in 1947 and is a company that sells clothes and cosmetics. H&M has about 1,700 stores around the world and they employ about 68,000 people, but they do not own any factories. They instead buy their goods from around 800 independent suppliers, primarily in Asia and Europe. In 2007 was the turnover SEK 92,123 million and the company is constantly growing, establishing new stores all around the world. Since they started to focus more on CSR in 1997 their global CSR organization has grown constantly and it now comprises 62 persons (H&M, 2008).

Innovest Strategic Value Advisors, a company specialized in analyzing companies' performance on environmental, social, and strategic governance issues recently released a new ranking-list that identified the 100 most sustainable companies in the world regarding Corporate Social Responsibility; one of those companies was H&M (Innovest Group, 2008). This proves that H&M is a good example of a company, working globally, that integrates social and environmental concerns into their business operations.

H&M has developed a strategy for CSR when purchasing goods since they claim that it is important to not only focus on the profit the company makes but also to take its responsibility as a large, global company and be a part of the development towards a better society. H&M state on their homepage that:

“H&M's business concept is to offer our customers fashion and quality at the best price. At H&M, quality is about more than making sure that our products meet or exceed our customers' expectations. It also means that they have to be manufactured under good conditions and that our customers must be satisfied with us as a company. Taking responsibility for how our operations affect people and the environment is also an essential prerequisite for H&M's continued profitability and growth.” (H&M, 2008)

These kind of statements become more and more common at companies' homepages but what makes H&M to a top of the line company when it comes to CSR is that they have developed a complete framework on how these issues shall be handled. H&M

presents their current status in their Corporate Social Responsibility Report for 2007 (H&M, 2007).

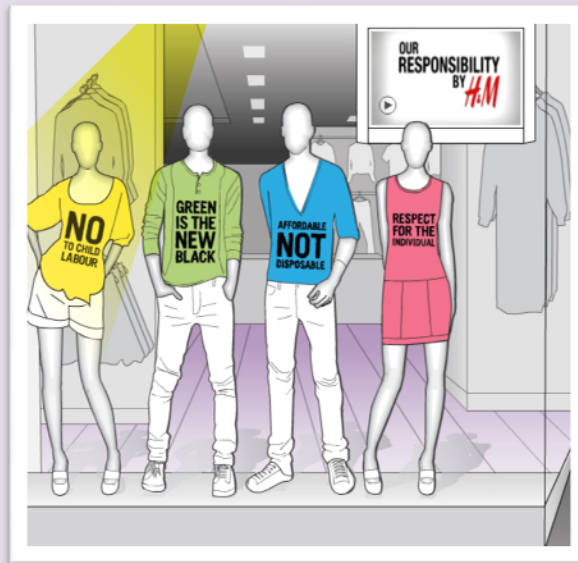


Figure 22 - H&M has a well-designed CSR strategy (H&M, 2008)

To be able to improve working and environmental conditions in the supply chain H&M has developed a policy regarding CSR and long-term goals that are common for all the company's departments around the whole world. Ingrid Schullström, CSR Manager at H&M, means that since H&M has worked on their CSR for a long time they have also managed to implement the policies into their daily routines, especially in the field of sourcing. For example, the computer systems that the purchasers at H&M use for sourcing are built so that CSR policies cannot be neglected when making purchases.

Rolf Eriksen, H&M's CEO, means that the integration of CSR issues into the corporate values and day-to-day business activities is a crucial element of the success of their CSR strategy. He also claims that it is important that all employees within H&M apply the same values in all operation throughout their global supply chain. H&M has therefore developed a CSR strategy that involves both its own employees but also suppliers and other business partners.

Within the CSR strategy H&M have developed Codes of Ethics for the business, Code of Conduct for their suppliers and also an audit programme to monitor their suppliers. The Code of Ethics has existed since 2003 and the main purpose of it is to show H&M's belief that business relations should be strictly professional and that there should not exist any kind of gifts or other advantages for H&M employees or any business partners.

In order to make their position clear to their suppliers H&M has set up a Code of Conduct that is a non-negotiable requirement from H&M's side that all their suppliers and sub suppliers must follow. H&M's Code of Conduct (H&M, 2008) comprise following issues.

Compliance with the Code of Conduct is assessed by H&M's Full Audit Programme (FAP). A thorough FAP audit is carried out when either H&M starts to work with a new supplier or when an existing supplier takes on a new subcontractor. The purpose of this process is for H&M to get a good picture of the current conditions at the factories. The audit includes more than 300 items of clarification and it can take up to six working days to complete. The suppliers are then rated depending on how well they fulfil the Code of Conduct. In 2007 H&M conducted 1983 Code of Conduct compliance visits.

**H&M's Code of Conduct:**

1. Legal Requirements
  - a. All suppliers must follow the national laws in the countries they operate.
2. Child Labour
  - a. H&M does not accept child labour. Their policy is based on the UN Convention on The Rights of the Child.
3. Safety
  - a. H&M require from their suppliers that the workers' safety should be prioritized and no hazardous equipment or unsafe buildings are accepted. First aid equipment must be available.
4. Workers' rights
  - a. No bonded workers, prisoners or illegal works are allowed in the production.
  - b. No punishment is allowed.
  - c. No discrimination regarding race, gender or religion is allowed.
  - d. Every employee shall get an employment contract.
  - e. Minimum wages and maximum working hours.
5. Factory conditions
6. Housing conditions
7. Environment
8. Monitoring and enforcement
  - a. H&M expects all its suppliers to respect the above Code of Conduct and to actively do their utmost to achieve our standards.

As the above table shows H&M's Code of Conduct also includes environmental requirements for the suppliers regarding chemical handling and chemical storage, waste water treatment and waste management. Besides the requirements on its suppliers H&M is also including environmental issues into their buying process. They are for example looking on a new way for their order placement routines to decrease the effect

on the environment, mainly to try to decrease the climate change from carbon dioxide emissions.

Summing up, H&M has a well-developed strategy when it comes to CSR. H&M is a company that takes its responsibility towards the society when making their purchases and H&M's CEO Rolf Eriksen means that:

“We all need to share the responsibilities within our industry to create a level playing field. Both our industry and society have everything to gain. The challenge is of course to make that happen. Overall, we know that CSR is not a passing trend. I am convinced that CSR can minimise our risk and create long-term value, both for society and our shareholders, and is important for our long-term success.”

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## [7] Environmentally Preferable Purchasing

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This chapter will discuss the topic Environmentally Preferable Purchasing (EPP). A description of EPP and the consequences of applying it, the trends that lead to implementation of EPP and a guide to finding and evaluating green products and services are presented. Finally, a case study, containing the accomplishments achieved by implementing EPP practices within an organization, will be presented.

## Introduction

As stated in the previous chapters, environmental responsibility is the third and last part of the concept of Corporate Social Responsibility. In conformity with the whole concept of CSR, the subpart about green purchasing has gained an increased attention during the last years. This can be seen through the renewed sensitivity towards the environment and social consciousness. With “sustainable development” being pressed as the dominating theme in twenty-first century commerce, two trends are predicted as inevitable in the near future of green marketing (Kaman, 2008).

First, the concept of an eco-friendly/going-green approach to doing business will be pushed into the mainstream (Hanas, 2007). Second, corporations from developed countries will initiate international green purchasing in order to expand their market, increase their sales and take advantage of the positive image of their green brands established in their domestic markets (Gurău, et al., 2005); (Johri, et al., 1998); (Pugh, et al., 2002).

The purpose of this chapter is to show why Environmentally Preferable Purchasing is something that should be in the thoughts of every organization, how it would impact them, and what products and which attributes have to be considered when applying it in some business areas.

## Environmentally Preferable Purchasing

Environmentally Preferable Purchasing (EPP), commonly called Green Purchasing, is defined as an environmentally-conscious purchasing practice that reduces sources of waste and promotes recycling and reclamation of purchased materials without adversely affecting performance requirements of such materials (Min, et al., 2001). It is important to consider that it covers both, products and services, and they have to successfully minimize negative environmental impacts throughout the Supply Chain until the disposal of such materials.

EPP can be used either for internal or external purchasing. The elements are different in each of them but the aim is the same when reflecting on acting in an environmental friendly manner. Meeting internal customer requirements in a green, costly and time-effective manner is as significant as in the relationships with external suppliers. This chapter will describe EPP when considering this kind of relationships; a deeper review regarding internal purchasing will not be reflected throughout this chapter.

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## **Impact of implementing Environmentally Preferable Purchasing**

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When applying EPP, a corporation can improve the working environment by using healthy and safe alternatives for materials such as miscellaneous, raw materials, semi-finished and finished products among others.

The organization will be able to meet the environmental regulations and comply with the legal responsibilities requested by the different institutions and the countries where they are located, as well as reaching their particular goals. Furthermore, it will help to avoid all the expenses that have to be reflected on when considering security issues within the company (i.e. healthy predicaments, absenteeism, incurred costs, legal problems). All of this, recognizing that the availability of green products in the market is increasing even more day by day.

As Min and Galle (1997) stated, the high cost of environmental programs is the most serious obstacle to effective Green Purchasing. Because of this, EPP is often hampered by the thoughts that purchasing environmental friendly products or doing so in an environmentally preferable way, will incur in higher costs and it will transform the company into a less competitive actor in the market.

Although this can be true, the company must be evaluated in terms of inclusive sustainability. Sustainability is not only referred to economical wealthiest, but also to innovation, transformation, ecological principles, global-local partnering and collaborative research that embraces knowledge-flow (Motloch, et al., 2007). All of these features, as well as the trends that lead to implement an EPP that are explained further on in this chapter, must be considered in order to cope with the current global situation.

### **Trends that lead to implement an Environmentally Preferable Purchasing**

Emerging markets for green products, technologies and services mean promising chances for international EPP. In these times, it is easier to carry out an EPP due to the consciousness encountered in the young consumers –and the consumers in general- about the environmental aspects. This is a situation that could push the companies to be interested in applying EPP using the marketing of green products and services directed specifically to the sectors that consider environmental features as one of their key points to perform a purchasing.

Continuous environmental deterioration over the last few decades has drastically increased the consumer's awareness of environmental problems (Min, et al., 2001). The majority (70 percent) of US consumers are sympathetic to environmental concerns (Boeck, et al., 1997).

According to Min and Galle (2001), stronger consumer sentiment for environmental statutes has pressured a growing number of companies to develop "proactive" environmental programs. Some of the principal trends that lead companies to apply an EPP strategy are (United States Environmental Protection Agency, 2008):

- ✗ Fear of liability litigation and fines, and subsequent negative publicity.
- ✗ Civil and criminal penalties against pollutants.
- ✗ Federal and state environmental regulations.
- ✗ Potential liability and cost for disposal of hazardous materials.
- ✗ Supplier's advances in developing environmentally friendly goods and providing environmental friendly packages.
- ✗ Environmental partnership with suppliers.
- ✗ Buying firm's environmental policy.

These, and some other fundamental issues such as the concern for safety and health, and the global warming, are two major areas of evaluation on the environmental initiatives for Green Purchasing and Procurement (Elpida Memory, Inc., 2008). These topics will be considered briefly following the explanation of why the corporations are thinking on "buying green" nowadays.

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## Safety and health

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When referring to safety and health, there are a lot of interesting and already known information that can be stated. Safety and health are two significant topics that every organization that is thinking on applying EPP has to have in mind (United States Department of Health & Human Services, 2008). They have to appear always in the values of a company, be present in the mind of each employee at every time, and be promoted in order to keep it up to date and use them not as something that people are forced to do, but as a way of living.

EPP comprises safety and health as some of its main goals (United States Environmental Protection Agency, 2008). This situation strengthens the company to place special effort on producing safe and healthy products as well. All kind of products must reach the quality standards and surpass the legislation requirements in order to be safe throughout the Supply Chain and when being used by the final costumer. This means that especially companies who deal with products that will be ingested by the costumers (i.e. food) and will be in direct contact with the user (i.e. cosmetics, toys) must be made with non-toxic materials and high quality standards in order to mind the health of the consumer. Those that content toxic materials such as dangerous goods have to be handled with special care in order to avoid safety problems for the people that are in contact with them.

Safety and health are two topics that are considered as vital when performing EPP. They are perceived to be instrumental in the development of a positive corporate image and, when considering them on the execution of an EPP strategy, the business will be guided to success. As Forte and Lamont (1998) state, it appears that it is good business practice to be “green” as its main elements, safety and health, have a tendency to promote profitability, improve employee motivation and commitment in addition to customer loyalty.

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## Global warming

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Another situation that must be considered when studying the sources of applying an EPP strategy is the global warming, caused, among others, by the pollution and greenhouse effect.

According to Tolba et al. (1998), various international treaties and agreements among different organizations have been negotiated and signed in order to cooperate in supporting the reduction of greenhouse gases emission so that hopefully further global warming can be slowed down.

The issue of global warming has triggered dispute in several countries evaluating the benefits of limiting companies to apply EPP in some of the products that are procured against the costs that such limitation would entail. Organizations have been analyzing the costs and benefits of using alternative environmental products in order to reduce wastes and emission of pollutants when disposing them.

These solutions seem adequate and would be the best way to promote EPP among different companies; furthermore, they will support the actual tendency of awareness about the global environment.

## Finding and evaluating Green Products and Services

This part will be presented as a practical guide for the reader in order to illustrate what products, and which attributes must be considered when performing the procurement process within one of the fields shown.

This guide could be a way to ensure and evaluate, in an interesting and accurate way, that an organization is conducting EPP; analyzing if their current raw, manufacturing, packaging, distribution, use, reuse, operation, maintenance and disposal materials are present in one of the different categories and take into consideration these attributes.

In the first part, a record of the products that can be found within some different areas will be presented. Secondly, a catalogue of the different features that should be considered within these and other products and services is shown.

## Green Products and Services

In order to help the purchaser to know which are the products that can be found currently in the market when applying an EPP strategy, a categories-products list is presented in this section.

Some of the products that can be currently found in the market are included in the following tables (United States Department of Health & Human Services, 2008):

Construction products	Non-paper Office products
Building insulation products	Binders (paper, plastic covered)
Carpet backing	Office recycling containers
Carpet cushion	Office waste receptacles
Cement and concrete containing coal fly ash	Plastic binders (solid)
Cement and concrete containing ground granulated blast furnace slag	Plastic clip portfolios
Consolidated and reprocessed latex paint	Plastic clipboards
Floor tiles	Plastic desktop accessories
Flow-able fill Polyester Carpet	Plastic envelopes
Laminated paperboard	Plastic file folders
Patio blocks	Plastic presentation folders
Railroad grade crossings/surfaces	Plastic trash bags
Shower and restroom dividers/partitions	Printer ribbons
Structural fibreboard	Toner cartridges

Table 8 – Products that comprehend EPP: Construction products and Non-paper Office products

Landscaping	Pack and recreation products
Food waste compost	Park and recreational furniture
Garden and soaker hoses	Plastic fencing
Hydraulic mulch	Playground equipment
Landscaping timbers and posts (plastic lumber)	Playground surfaces
Lawn and garden edging	Running tracks
Yard trimmings compost	Paper and paper products

Table 9 - Products that comprehend EPP: Landscaping, and Pack and recreation products

Miscellaneous products	Transportation products
Awards and plaques	Channelizes
Industrial drums	Delineators
Mats	Flexible delineators
Pallets	Parking stops
Signage	Traffic barricades
Sorbents	Traffic cones
Strapping and stretch wrap	

Table 10 - Products that comprehend EPP: Miscellaneous products and Transportation products

Commercial/industrial sanitary tissue products	Vehicular products
Miscellaneous papers	Engine coolants
Newsprint	Re-refined lubricating oils
Paperboard and packaging products	Retread tires
Printing and writing papers	

Table 11 - Products that comprehend EPP: Commercial/industrial sanitary tissue products and Vehicular products

It is important to mention that these products are presently subject to mandatory EPP requirements by different governmental organization around the world, which should put pressure on corporations to consider an EPP policy for the areas mentioned in the list.

## Environmental attributes to look for

It is often common for purchasing departments or for individual purchasers to be unsure about which are the principal attributes to judge when procuring an item or a group of items within a certain area.

The following tables specify these attributes considering an EPP strategy (United States Environmental Protection Agency, 2008). It provides an interesting selection of attributes structured and classified according to a categorization of different products- and services areas.

Buildings and Construction	Cleaning
Bio-based content	Minimizes exposure to concentrates
Energy efficient	No ozone depleting substances
Enhanced indoor environmental quality	Recyclable packaging
Low embodied energy	Recycled-content in packaging
Recyclable or reusable components	Reduced bio-concentration factor
Recycled-content	Reduced flammability

Reduced environmental impact over the lifecycle	Reduced or no added dyes, except when added for safety purposes
Reduced or eliminated toxic substances	Reduced or no added fragrances
Reduced waste	Reduced or no skin irritants
Responsible storm water management	Reduced or no volatile organic compounds (VOCs)
Sustainable development, smart growth	Reduced packaging
Uses renewable energy	
Water efficient	
Water reuse and recycling	

Table 12 - Environmental attributes: Buildings and Construction, and Cleaning

Meetings and conferences	Electronics
Accommodations with efficient transportation routes	Designed for recycling
Accommodations with energy and water conservation programs	Energy efficient
Accommodations with mass transit-accessible location	Environmentally sound take-back and recycling options
Accommodations with recycling and waste minimization programs	Extended product life, upgradeable
Electronic distribution of materials	Recyclable packaging
Minimize packing and shipping materials, disposable products	Recycled-content
Minimize travel distance for attendees	Reduced materials use
Online registration	Reduced or no toxic constituents
Recycle handouts and badges, signage, paper products	Reduced packaging
Reusable badges, signage	
Reusable food service-ware	

Table 13 - Environmental attributes: Meetings and conferences, and Electronics

Landscaping	Fleets
Integrated pest management	Alternatively fuelled
Low-impact development	Cleaner fuel
Recycled-content materials	Electric
Reduced or no pesticide use	Fuel cell
Storm water management	Fuel-efficient
Use of native plants	Hybrid-electric
Waste reduction and recycling, including composting	Low emissions
Water conservation	No or low hazardous materials

Table 14 - Environmental attributes: Landscaping and Fleets



Carpets	Food services
Low or no volatile organic compounds (VOCs)	Biodegradable
No toxic dyes	Energy efficient
Recyclable	Recyclable
Recycled-content	Recycled-content
Reduced energy use (from manufacturing)	Reusable
Reduced or improved air emissions (from manufacturing)	Water efficient

Table 15 - Environmental attributes: Carpets and Food Services

Office supplies	Paper
Non-toxic	Postconsumer recycled content
Recyclable	Processed chlorine-free
Recycled-content	Recyclable
Remanufactured	Soy-based inks
Reusable	

Table 16 - Environmental attributes: Office supplies and Paper

The information contained in these tables can be used as recommendations for procurement of the popular environmentally preferable listed products.

## Case study

The following case is a general study case showing the accomplishments achieved by implementing environmentally preferable purchasing practices.

It considers how The Body Shop®, the second largest cosmetic franchise in the world and the one that emphasizes the most its support for a wide range of issues around the world (The Body Shop International plc., 2008), performs their procurement processes. This study case was extracted from the contributions of Alistair Jackson –employee of The Body Shop®, who shared information on their company’s environmental purchasing initiatives (United States Environmental Protection Agency, 1999).

### Case study: The Body Shop® – Social and Environmental concerns, the only way to do business

Several companies, including The Body Shop® are purchasing lighter weight or reduced packaging to contain their products, which significantly reduces product packaging volume, saves money, and reduces impacts on solid waste disposal systems.

As other manufacturers focus efforts on avoiding or reducing smaller sets of specific chemicals, The Body Shop®, avoids the use of polyvinyl chloride (PVC), a common plastic resin, out of concern for the dioxins produced as part of the manufacturing process and for the potential adverse health effects from chemicals routinely added to the plastic to improve performance.

As part of its social and environmental objectives, The Body Shop® attempts to avoid the use of animal-derived ingredients and petroleum-based and synthetic chemicals whenever possible. Every product, however, must meet stringent performance requirements, which sometimes requires the use of chemicals it would otherwise avoid. For example, The Body Shop® uses synthetic musk and whale oils because it believes the synthetic alternatives are more environmentally preferable than the natural alternatives, which would involve destroying the animals from which the oils would be collected.

The Body Shop® also compared the environmental impacts associated with biodegradable and recyclable product packaging. While biodegradable packaging sounded environmentally preferable, the company determined that most biodegradable products will only degrade in very specific conditions and that those conditions are not likely to occur in modern landfills. Other biodegradable products degrade into potentially hazardous constituents. After examining the available biodegradable packaging alternatives, the company decided not to use biodegradable packaging but to continue providing its products in refillable and recyclable containers.

The Body Shop®'s Ethical Audit and Environmental Departments developed a ratings system to evaluate existing and potential suppliers. Suppliers are evaluated on a number of environmental and social justice criteria and rated on a scale from one to five stars. Vendors with higher ratings receive a larger percentage of The Body Shop's business.

While doing all of this, The Body Shop® also strives to protect the planet and the people who depend on it — not because it's fashionable, but based on the belief that it's the only way to do business.



The Body Shop International plc® is a global manufacturer and retailer of naturally inspired, ethically produced beauty and cosmetics products. It was founded in the UK in 1976 by Dame Anita Roddick, having now over 2,400 stores in 61 countries, with a range of over 1,200 products. For additional information, visit < [www.thebodyshop.com](http://www.thebodyshop.com) >.

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## [8] Information Systems in Purchasing Management

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*In this chapter the use of information systems (IS) in the field of Purchasing Management is presented. The chapter focuses on methods and analysis tools used within IS. The methods described are EDI and Internet, where the latter one is further presented in the areas of B2B-hubs, other methods using the Internet and e-market mechanisms. Lastly the chapter elaborates upon the problems that have to be considered when using IS in purchasing.*

## Introduction

The use of Information Systems (IS) within the purchasing activities has increased rapidly since mid to late 90s (Simchi-Levi, et al., 2003). Benefits of integration through different IS solutions are many e.g. improved business performance, increased revenues and reduced costs (Garcia-Dastugue, et al., 2003). One of the most common benefits is that the traditional activities that moved goods from seller to buyer such as transactional, facilitation and logistical activities can be performed with higher efficiency and with a better time approach (Morris, et al., 2002). Further, when companies use integration through IS they can be able to act more globally since the IS shrinks the world of the market and improves the access of information. Another important benefit is that the costs involved in procurement can be lowered. This since the prices can be lowered through auctions (Morris, et al., 2002), customers can use one-stop shopping, reduce the transaction cost (Shevchenko, et al., 2005) and have a paperless transaction (Simchi-Levi, et al., 2003). Further, multiple buyers and sellers brings together by the use of integrated IS (Morris, et al., 2002) (Shevchenko, et al., 2005) (Simchi-Levi, et al., 2003) (Garcia-Dastugue, et al., 2003).

According to Morris et al. (2002) additional benefits, for the purchasing activities, of IS based integration compared to the traditional channel system are:

- ✗ Reduction in the number of traditional middlemen
- ✗ Lower inventory and shorter inventory cycles
- ✗ Tighter relationships between seller and buyer
- ✗ Power shifts from producer and retailers to the customer
- ✗ Lower prices and greater variety for consumers
- ✗ Greater responsiveness to the customer

Shevchenko (2005) also addresses the value of information sharing that becomes greater with the use of IS in the collaboration. IS provides opportunities for collaboration in e.g. web-based teamwork, projects preparations and collaboration of complementary businesses. Further, IS can be seen as the glue that efficiently binds organizations or departments together (Weinberg, et al., 2007).

As seen there are several benefits and reasons for the companies to use IS in their purchasing activities. The following section will present common methods that are used for integration by IS.

## Methods

In order to establish the connection or integration between a company and its suppliers a system (or a group of systems) should play the interface role. In the world of IS, several methods have been

introduced for this purpose, ranging from business-to-business direct relationships via EDI<sup>2</sup> to other broader mostly internet-based solutions. In this chapter, due to the increasing trend over IS-based relationship solutions, the focus will be on these methods rather than older ones.

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## EDI

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A generic form of electronic relationship between two companies is EDI. Hill & Ferguson (1989) define EDI as the structured and computer-readable business data transfer among and inside companies, needless of rekeying between different business software applications. Historically, EDI was the means of data transfer between two parties, avoiding a large share of paperwork as well as mistakes. During the years, the spreading use of EDI amongst firms led to the introduction of data interchange standards, primarily between trading pairs and later on as industry-wide and EDIFAC and ANSI X12 standards, bringing flexibility and breadth to the method. An important notion in the world of EDI is VAN<sup>3</sup>. VANs are interchange mediums for firms to access in order to establish more efficient EDI connections. However, these mediums are more and more transferring their tasks to the Internet (Albrecht, et al., 2005).

Albrecht, et al. (2005) suggests EDI for efficient pair-wise relationships, where automatic replenishment can be used. The main advantage of this method is having standard frameworks that play the role of a basis for easy transaction of practical business data, linking two firms. EDI helps to reduce time delays, wages and employee costs, errors, safety stocks (total inventory levels), as well as uncertainties in order transfer time, processing and payment (Hill, et al., 1989). On the negative side, EDI transactions are not designed to easily thus does not without difficulty allow new actors into their relationships. This leads to a decreased chance of being used in e-markets, and less product and producer variety possibilities (Albrecht, et al., 2005).

### Case Study: BASA Co. - An experienced ERP implementer

BASA Co. was named the first ever ERP implementer in the Iranian industry when it transformed one of its MIS<sup>4</sup> projects into an ORACLE ERP implementation in a large-sized steel manufacturer in Iran. Although having proficiency in IT as their core competence, BASA Co. has so far used its skill in developing several solutions for e-commerce and e-government, hence standing among the leading transaction and infrastructure solution providers in both sectors. An interview with a systems analysis expert in purchasing systems resulted in the following practicalities.

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<sup>2</sup> Electronic Data Interchange

<sup>3</sup> Value-Added Network

<sup>4</sup> Management Information System

First and foremost, companies are interested in adopting IT-based purchasing management systems in order to

- Have their purchasing cycle and activities organized;
- Omit manual communication, all redundant work, and their inevitable errors;
- Ensure about the effectiveness of company guidelines on all purchases;
- Find purchasing bottlenecks;
- Obtain a comprehensive database of suppliers, and suitable tools to evaluate them;
- Increase the purchasing visibility for managers; enhance the collaboration between purchasing and other departments;
- Unify the documentation; and
- Reducing total purchasing costs.

On the negative side, there are always problems and hardships with implementing such a system. Among all are tendency for keeping business data private, rather than sharing it; fear from being monitored amongst operational levels; natural resistance to change; lack of knowledge about the outcomes; suppliers' resistance to change; and human factors related to strict obedience of the IT-based purchasing systems' working methods (Mousavikhah, 2008).

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## Internet

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The second major method for linking different firms is the Internet. Being a value-adding channel for distribution title flow (Rosenbloom, 1995), Internet is a vital driver for the organizational strategic prospect in improving purchasing/distribution activities. Internet is able to encompass all channels of distribution and bring about the best possible timely solutions for different occasions (Weinberg, et al., 2007). Several methods are based on and work within the platform of the Internet, including B2B hubs, company websites, e-procurement systems, web services, and so on.

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### B2B hubs

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One of the emerging electronic methods for selling/purchasing goods and services among firms is B2B e-hub. These hubs, just like network hubs, work as 3<sup>rd</sup>-party intermediaries that enable electronic exhibition, search, data interchange (Shevchenko, et al., 2005), and transaction activities such as negotiation and signing contracts (Albrecht, et al., 2005). Opposite to EDI, these systems allow any-to-any business deals. But in order to avoid too huge processes and facilitate searching and indexing, two categories of vertical hubs (industry/market –specific) and functional hubs (function/business process –specific) are introduced. VEBs (Virtual Enterprise Brokers) are also categorized within e-hubs and

aims at solving arbitration problems among virtual enterprises and their clients (Shevchenko, et al., 2005).

Users of e-Hubs can take advantage of single-point purchase, as well as enhanced product search based on the desired criteria and broader range of options. The purchasing processes handled by this method also result in higher marketplace liquidity and quality of purchasing services with lower total transaction costs. Furthermore, e-hubs offer a wide range of possibilities, for instance distribution of knowledge, mechanized purchases, and value-added services (Shevchenko, et al., 2005).

On the contrary, e-hubs are pretty much reliant on the size of their supplier/customer base and their connectivity to other hubs. Therefore, in many cases they fail to deliver ranges of products and suppliers/customers that are expansive enough to be worthwhile to be referred to. Another problem is with price search and comparison feature of e-hubs. This feature in some cases neutralizes the purchase-amount-based price differentiation strategy. Further drawbacks can also be named as deficiency in channel coordination capabilities (especially in cases of already-established relationships), as well as costs and functionality obstacles related to the variety of integration standards each of which mainly has credit within a hub, not in hub-to-hub relationships (Albrecht, et al., 2005).

Simchi-Levi, et al. (2003) identifies four different types of e-markets; value-added independent (public) e-markets, private e-markets, consortia-based e-markets and content-based e-markets. The main difference between these is the private or public/consortia approach of the market, see Table 17.

	Private marketplace	Public/consortia marketplace
Owner	A single buyer	Independent owner or a group of companies from the same industry
Objectives	<ol style="list-style-type: none"> <li>1. Share proprietary data including product design, demand forecast and production plans</li> <li>2. Allow for logistics and supply chain collaboration</li> </ol>	<ol style="list-style-type: none"> <li>1. Buying and selling commodities by focusing on price</li> <li>2. Finding new suppliers</li> <li>3. Buying and selling excess inventory and capacity</li> </ol>
Participants	Selected group of suppliers	Open market
Buyer cost	Building and maintaining the site	<ol style="list-style-type: none"> <li>1. Subscription fee</li> <li>2. Licensing fee</li> <li>3. Transaction fee</li> </ol>
Supplier cost	No fee	<ol style="list-style-type: none"> <li>1. Transaction fee</li> <li>2. Subscription fee</li> </ol>
Main problems	<ol style="list-style-type: none"> <li>1. Initial investments</li> <li>2. Data normalization and Uploading</li> </ol>	<ol style="list-style-type: none"> <li>1. Recent collapse of many marketplaces</li> <li>2. Objections by referred suppliers because of price focus</li> <li>3. Sharing of proprietary information</li> <li>4. Data normalization and uploading</li> </ol>

Table 17 - Difference between the private and public marketplaces, (Simchi-Levi, et al., 2003)

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### Other methods using Internet

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For the purpose of building the commercial connection between the purchasing activities of a company with its suppliers, several other methods are used in the industry. Among all, two of these methods are being discussed here.

Supplier websites form a very common category of these methods. This way, companies present themselves in island-shaped websites, not easily letting automatic integration of purchasing/selling activities, and consequently requiring human partaking in such activities. This problem is majorly a result of websites not having standardized formats for exhibition of products and services, contracting and transactions, etc. Accordingly, these tools cannot be widely used for mass-purchasing activities. (Albrecht, et al., 2005)

Another widespread purchase/supply communication method is e-procurement system. This method is best utilized in decentralized purchasing activities, where several points in an organization are able to decide on purchase orders of their needs (Albrecht, et al., 2005). Through electronic links, these orders are transmitted to specified suppliers and transactions are formed, mostly, on the basis of centralized agreements and contracts. Although these methods are subject to closeness and limitation in variety of suppliers, it is mostly used for the procurement of indirect materials and MRO goods and services, where no strategic purchasing decision-making is required. (Albrecht, et al., 2005)

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### The use of e-market mechanisms

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In order to be able to reach the larger amount of suppliers and material available the buying firm can use different types of e-markets (Simchi-Levi, et al., 2003). This section will describe the characteristics of e-market and their mechanisms such as auctions, electronic purchasing aids and electronic agents.

The e-market serves as an intermediary between the supplier and the buyer, which helps the buyer to increase, identify, qualifying the number of suppliers engaged in the bidding event and to conduct the bidding event. Further, the internet-enabled coordination helps the company in several aspects for instance information sharing, auctions and to connect members of the supply chain through electronic agents (Garcia-Dastugue, et al., 2003).

For the use of e-market transactions information sharing is needed. The information that is required is limited to the transaction (e.g. product description and other information needed for the buyer and seller to understand what object that is up for the transaction) and do also include information about delivery and payment (Garcia-Dastugue, et al., 2003).

The primary use of e-markets for the buyer has been to reduce the transaction cost and the price of the purchased item (Simchi-Levi, et al., 2003). However, the sustainability of the competitive advantage of the market mechanisms is not likely to occur; more likely is the occasion of reaching some items at lower price (Garcia-Dastugue, et al., 2003). E-markets are useful for the company when the importance of the involvement and in the relationship with the supplier is low and therefore a



risky tool if the relationship between the supplier and buyer is valuable. Due to the characteristics of low involvement in the relationship the transaction cost is important to consider when selecting e-market mechanism. (Simchi-Levi, et al., 2003).

### *Auctions*

Auctions are a market mechanism where the buyer and seller agree upon the item and the purchase price. The auction can be seen as a one-time transaction since the bidding process can select difference winner each time. There are several types of auctions but the most common are the progressive or standard auctions where the bids are freely placed and the auction stops when there is no purchaser that wants to place a higher bid (Garcia-Dastugue, et al., 2003).

Another example of auctions is the reverse auction. This one is common in the business-to-business area. For reverse auctions, it is the purchaser that sells a contract of a predefined item. The objective in reverse auctions is to place the lowest bid in order to get the contract. One of the conditions of the reverse auctions is that the seller is unknown for the buyer until the bidding is over. This makes it important that the description needed to describe the item is low in order to decrease the risk of the process e.g. that a supplier get the bid but is not capable to supply the specific item. (Garcia-Dastugue, et al., 2003) (Tassabehji, et al., 2006) (Kenczyk, 2001)

A more complex type of auction is the multidimensional auction. As the name indicates, several aspects are considered in the bidding e.g. the price and the quantity could be used in a two-dimensional auction. Other dimension such as the price and delivery could be used in order to secure demand in peak seasons. Multidimensional auctions might be good to use in order to match the buyers' need with the sellers' availability and capacity. (Garcia-Dastugue, et al., 2003) (Branco, 1997)

A fourth type of auction is the closed auction. In closed auction the transaction is prepared in the way that the suppliers are prequalified. Since the closed auction requires that the transaction is prepared with detailed descriptions and to write a contract the auctioneer have to be more active than in a standard auction. Closed auctions are typically carried out for the purpose of reversed auctions, and it is also suitable for more complex items due to the preparation of the auction. (Garcia-Dastugue, et al., 2003)

Regardless of the type of auctions they are seen as a onetime transaction. If the company wishes to decrease the number of transaction the buyer could (for reverse auction) auction an entire contract that covers supply for a certain period in time or quantity. (Garcia-Dastugue, et al., 2003)

Finally, a problem with auctions is that the relationship between the buyer and seller decreases. Also, the benefits are mostly connected to the buyer side. Besides, the buyer in standard auctions and the supplier in the reverse auctions get stressed when they have to place a bid during time pressure (Tassabehji, et al., 2006). Another issue with auction is that they are most suitable for commodity items such as raw material or standardized catalogue items (Kenczyk, 2001).

### *Other mechanisms for e-markets*

The group of electronic purchasing aids is an e-market mechanism that helps the company to find the best supplier with the lowest cost. It is a set of software that e.g. use different set ups of matrices in order to detect items that are overpriced or have a better alternative (Garcia-Dastugue, et al., 2003). The electronic purchasing aids can be divided into two groups; individual based agents and collaborative filter agents. The individual based approach use the specifications and directions that the user has added to the system and use them as search criteria. The collaborative filter approach uses the same information as the individual based approach but it also compare to other customers' criteria on similar products and conduct a list of alternatives for the user (Ariely, et al., 2002). Other examples of purchasing aids are electronic catalogues, recommendations agents and price search engines. The use of electronic purchasing aids could be time consuming since the purchaser has to compare his decision with the decision aid and evaluate the outcome. Further, the tools as price search engines and electronic catalogues require a high level of detail and standardization in order to provide a valid result (Garcia-Dastugue, et al., 2003).

Another mechanism for e-markets is the electronic agents. That is software that continuously searches for business opportunities, which is done in the way that the software links the business goals with the customer interest. Electronic agents perform business with all possible suppliers and buyers and the transaction occurs as one-time. In order for the electronic agents to work properly the accuracy of the information is important as clear terms of delivery date and that the purchasing decisions rules are set. (Garcia-Dastugue, et al., 2003)

## Analysis tools

In several occasions a company might need to perform an analysis upon its purchasing activities. This might be triggered by the need for deciding which supplier to purchase from, having an insight on the feasibility of current contracts, better services, for example reduction in lead times, and so on. Since the amount on information is increasing IS are useful in order to get the analysis done more efficient and accurate. Below some analysis tools for purchasing will be presented which mainly focuses on cutting costs and lead-time reduction.

One of the most important aims of purchasing analysis is cost-reduction. For this purpose, several tools have been introduced, among which the *Costed Bill*, *Purchase Price Variances*, and *Purchasing cost management tools* are of significance. A *Costed Bill* is a tool for spotting the purchased goods and services in which the total product cost is affected the most. In the same respect, *Purchase Price Variances* act as a tool, which shows the points in purchasing activities where excessive costs are being initiated (Hamilton, 2003). Using the above information, purchasing managers will be aware of what positions in their activities they will have to focus on in order to cut costs.

Moreover, Ellram (1996) provides a comprehensive framework for employing different cost management tools to a purchasing classification matrix, close to the Kraljic matrix (Kraljic, 1983). First of all, several questions are asked in order to locate each purchased item in the matrix, consisting of two dimensions: Nature of purchase, and relationship type; resulting in four categories: Low impact, Leverage, Critical projects, and Strategic. After the positioning of all purchases, various tools and techniques are used to analyze the data of each category purchases.

Another intention for purchasing analysis is to measure other aspects important for purchase decision. For example, *Lead-time analysis* tool helps the group of purchasing and production managers reduce total product lead times by pointing out the most influential steps of purchasing and production on lead time. Additionally, *Problem vendor* tools provide purchasing managers with the ability to track quality and delivery related to each member of the supplier base and evaluates them in terms of their service. There are also some further movements, in the world of science, for bringing the high-tech knowledge into the practice of purchasing. Among them, the work by Lau, et al. (2005) can be named as a significant one, trying to introduce the AI<sup>5</sup> concept into the knowledge sharing and decision-making for purchasing activities of the firm. They tried to combine the OLAP<sup>6</sup> technology, in order to take advantage of its processing and analysis competencies, with neural networks model, for benchmarking the suppliers, resulting in a suggestion for the best supplier for each purchase.

## IT-driven problems in purchasing

Even though information technology has improved the performance of the purchasing organization, the use of IS does have some challenges both internally (Hamilton, 2003) and externally (Garcia-Dastugue, et al., 2003) that the company have to manage. The challenges below are related to the choice of the different methods and what the company has to consider in the selection process.

Internally the main challenge for the purchasing department is to decide for what purpose the IS should be used. There are several benefits and drawbacks with the different methods and it is important that the organization understands what consequences they will have. For example, the type of products purchased and the supplier relationship have to be considered in the selection of IS method. The auctions are as seen best suited for commodity products and where the involvement in the supplier relationship is low and this limitation of the mechanism has to weight against the price reduction and lowered transactional cost that can be achieved (Garcia-Dastugue, et al., 2003). Moreover, the initial cost that EDI requires for the set up of the system is another limitation the customer has to consider when selecting method for IS and that EDI is not designed to easily let new

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<sup>5</sup> Artificial Intelligence

<sup>6</sup> Online Analytical Processing

actors into the system (Albrecht, et al., 2005). As seen there are several strategic decisions that has to be made regarding the IS and its methods and the goals and visions that the company has.

Another important issue, regarding the strategy of the use of IS and its methods, is how the purchasing department's strategy is in line with the whole organization. As seen in the study case of BASA Co they have faced the challenges in there IS implementation. Here, the companies have problems with the IS since they do not know what to expect from the systems (Mousavikhah, 2008). Also, for the purchasing employees to evaluate the action messages correctly the IS have be connected with the companies delivery frequency and production pace (Hamilton, 2003). This indicates that the companies needs to have a plan of the IS that is worked out in detail. Even if it is the purchasing department that should be improved it cannot be done in the way where sub optimizations are made.

The internal challenges that are on a more operational level are often connected to the lead times, impracticable lot-sizing logic and inaccurate buyer action messages (Hamilton, 2003). This could be caused by several reasons e.g. the company using inflated lead-times that creates increased number of recommendations in buyer actions or the customer use unrealistic lot-sizing logic that make the system ignore action messages.

One of the external challenges, connected to the information sharing with their suppliers, is the access of information e.g. in e-hubs the information is only available for some actors and not to others in the supply chain (Garcia-Dastugue, et al., 2003). An additional aspect with the information sharing was seen in the BASA Co case where they have faced an unwillingness of sharing information that are seen as important for the company (Mousavikhah, 2008). It can therefore be seen as critical that the companies understand what type of information that is needed to be exchanged and that they can trust the other actors involved. Also, it is important that the company understand that there is a trade off with the level of commitment and level of involvement in the relationship with the willingness of sharing information (Gadde, et al., 2001). Another asymmetry that can occur is the power structure. The power can be moved between the actors in the system. Moreover, since the involvement in the relationship decrease with the use of IS the risk for that is that a supplier can endanger confidentiality with competitor increases. This also indicates that the supply chain gets more complex with the use of IS. A third aspect is concerned the management willingness to share information to other members of the supply chain. Further, for the integration with external members to work, it is required that the internal integration of the IS is correct e.g. that the purchasing department information is liked with the use of material in production and inventories levels or with market in order to get information regarding planned campaigns. However, this is not always the case. Lastly, the use of standards in the methods is a challenge that the companies need to consider (Garcia-Dastugue, et al., 2003).

Finally, as seen in this chapter there are several benefits that companies could get by using IS in their purchasing activities. By considering the wanted and expected outcome of the system and the challenges that the company could face with the IS and the different methods the company has to select the system that best meets their demands.

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## [9] Supplier Selection with focus on choice of evaluation criteria

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*Supplier selection is one of the most crucial decisions buyers make. This is mainly due to the complexity of supplier selection decisions. The supplier selection influences the strategy of a corporation and its supply chain. To facilitate this strategic decision, many models and methods are introduced by researchers. Some of them try to solve this problem mathematically and some of them approach it from a qualitative point of view. This chapter copes with the importance of the supplier selection step in the purchasing process.*

## Introduction: Why is supplier selection important?

The purchasing process, according to Van Weele (2005), consists of six main steps (figure below) and supplier selection is one of these six main steps. Supplier selection is often a strategic multi criteria decision, since that way of working often seems to be the best way of a lining the supplier selection process with a cretin company strategy or with a company’s overall goals. Finding the right supplier can bring cost efficiency in to both goods and service purchasing, which often leads to that a company increases their competitiveness (Wu, 2007) (Bo van der Rheea, 2008) (Ng, 2008). According to Ramanathan (2007) the selection of the right suppliers also has a significant role regarding quality assurance of a corporate organization outputs.



Figure 23 - Purchasing process (Van Weele, 2005)

To go down one level in the process hierarchy it is noticeable that the process of supplier selection can be described or divided into five steps (de Boer, 2001) (Sonmez, 2006). The steps that have been chosen to describe the supplier selection process in this chapter are these four: defining the supplier selection criteria, narrowing down the supplier alternatives, final selection and continuous evaluation. The focus of this chapter are on the first and the third steps, “define the supplier criteria” and the “final selection”.



Figure 24 - Supplier selection process

## What criteria should decision makers focus on?

To be able to pick the right supplier, a selection criteria needs to be defined and after that the supplier selection decision needs to be based on these criteria. Many researchers have defined different types of criteria which also often are used in practice. Dickson (1966) made a comprehensive research and

has defined 23 types of criteria that buyers use for decision regarding supplier selection. Other authors like Roa (1980), Ellram (1990), and Stamm (1993) introduced and defined other types of more detailed criteria based on their researches. However, Katsikeas (2004) grouped them in four broad areas; i.e. Competitive pricing, Reliability, Service, and Technological capability. It is here worth mentioning that these supplier criteria often are both of qualitative and quantitative approaches which sometimes lead to different types of conflicts. Other more specific main criteria that companies often focus on are: quality, price, delivery lead time, performance history and technical capabilities. The supplier criteria do not have the same weight for all kinds of companies. Other types of criteria have also come into this arena because of increasing attention on global purchasing and supply chain management. One example of new criteria in this area are those based on factors regarding environmental impact. Companies do often now for example consider the emission level of their suppliers in the selection process. Also Agility and Total Quality Management (TQM) factors are new criteria that have been added to the agenda within this field. It is important to remember that depending on the area of company's competence and on the company's overall strategy some of these just mentioned criteria play a more important role than others.

## Supplier selection methods

Since supplier selection is a complex multi-criteria decision which has a dominant impact on the corporate strategy, a systematic method is required to accomplish the critical action of supplier selection. The complexity of a whole supply chain or the complexity of a wide global network of suppliers do also contribute to the complexity within this area.

To assist the decision makers many methods and tools have been introduced and applied. Investigations performed by for example De Boer (2001), Sonmez (2006) and Gece (2007) are all three presenting examples of relevant methods and tools within this topic. Sonmez categorized them in six method clusters and the clusters consist of methods which are: conventional multi-criteria decision making (MCDM) methods, mathematical programming approaches, artificial intelligent and expert systems, and multivariable statistical analysis. Two other examples of method clusters are group decision making and multiple methods which. The main methods which are emphasized in these publications are listed in Table 18.

Huang (2007) mean that the supplier selection process is more a strategic decision-making problem rather than an optimization problem, since the nature of these problems is full of conflicting criteria and complexity. Facing these problems with optimization methods needs an objective function, mainly cost minimization. Mathematical optimization approaches are only suited for quantitative criteria, but in practice supplier selection problems are full of qualitative criteria as well. Dulmin (2003), also suggested using multi criteria decision making, since he believes that the optimal situation is infeasible and the criteria's weights have to be balanced.

Multi criteria decision making	Mathematical programming	Multivariate statistical analysis	Artificial intelligence
AHP, Outranking method, Judgmental modelling, Multiple attribute utility theory	Total cost based approaches, Non-linear programming, Mixed integer programming, Linear programming, Goal programming	Structural equation modelling, Principle concept analysis, Confidence interval approach	Neural network, Case based reasoning, Bayesian belief network

Table 18 – Example of different supplier selection methods

As discussed earlier, supplier selection is a strategic decision-making problem and treating it as an optimization approach may not be helpful. Among these methods, the application of AHP (Analytic Hierarchy Process) is more elaborated in articles and has been a popular approach for supplier selection among industries and practitioners. AHP is a robust multi-criteria decision making application developed by Saaty in the 1970s (Saaty, 2001). AHP is a method developed to help decision makers to handle complex decisions. The hierarchy consists of 3 elements; goal, criteria and alternatives. Criteria are selected upon the decision maker's preferences and to facilitate the decision can be grouped and have sub criteria. Bevilacqua (2006) stated that the majority of decision makers does not consider more than 8 or 9 criteria in their problem to ease the complexity of the problem. On the other hand, Saaty (2001) suggests that the number of criteria should be  $7 \pm 2$ . Therefore decision makers must select a limited number of criteria which they believe fits their task best. This could be handled by grouping decision makers in discussion teams. The AHP method tries to solve the problem mathematically. It transforms the respondents' perception to numerical values by pair wise comparison of two criteria; i.e. each criterion is compared to other criteria in its importance compared to others in a 1 to 9 scale. Later on these numerical values can be converted to weights or priority for each criterion by matrix operation. These priorities help to choose the best alternative; i.e. the best supplier which best suits the selected criteria.

Figure 25 - Criteria and subcriteria in supplier selection



But how do managers decide in reality when they face conflicting objectives in decision making among cost, availability, flexibility and quality; the four main criteria? According to Verma (1998) managers see quality as the most important criterion. However, the weights of criteria show that when they make decisions in reality, they prioritize cost and flexibility beat quality. Verma used conjoint analysis to conclude this. However AHP can come to the same result. Since the method uses a pair wise comparison of two criteria and the possibility of actual weighting is high. Also at the end prioritization of criteria, decision makers can balance the ranking to make unbiased decisions.

## Service supplier selection

The approaches towards purchasing of goods are completely different compared with purchasing of services. According to Degraeve (2004) these two broad categories have three main differences. Their main difference is tangibility. Services are intangible and their performance can't be perceived as well as goods, thus making supplier evaluation and selection more difficult. Secondly, the production and consumption of services are usually at the same place and time. Thirdly the services can't be stored as products. Many supplier selection methods have been introduced for the purchasing of goods. However there are only a small number of publications available for supplier selection in service purchasing. Also, Fitzsimmons (1998) noted a difference between purchasing of service and goods and it was that services are experiences which cannot be duplicated.

To describe what a service really is these examples are worth mentioning: office and production equipment maintenance, computer maintenance, building repair, waste disposal, product testing, temporary personnel, security, food services and consultancy.

As noted by Fitzsimmons (1998) in a survey in the mid 1990s by the National Association of Purchasing Management uncovered that more than half of the purchasing money was spent for services and not for goods. Also, services have a broad impact on corporations and people working there, but a product in form of goods usually does not. Besides services, in most of the cases, the supplier selection process needed to be adjusted and customized to better fit the service and the own organization. These reasons show the importance of service supplier selection in purchasing processes. Unfortunately the only available service supplier selection method found in this research is a method developed by Degraeve (2004) which tries to solve this service supplier issue mathematically by the using the concept of total cost of ownership (TCO). Because of this lack of relevant literature there are many gaps within this area which also mean that it exist many opportunities for future research.

### Case study: Indoor climate

**IMI plc** is a worldwide company which delivers innovative engineering solutions to global customers. Their headquarter is located in the Birmingham Business Park. They have 5

main business areas: Severe service, Fluid power, Indoor climate, Beverage dispense, and Merchandising. The core characteristics of IMI businesses are product differentiations, customer relationship and a leading position especially in Europe. **Indoor Climate** is a well-known company with 2,000 employees, 300 billion euro sales and 50 million euro profit. The focus of the company is to perfecting Indoor Climates throughout the world with main focus on comfort of the people inside the building and the energy efficiency. The customer target is the heating and cooling systems for commercial buildings. Also it focuses on balancing systems and temperature control. The production plants are in Sweden, Germany, USA and recently in Switzerland. The sales offices and agents are situated around the whole world.

The IMI's purchasing organization is shown by the figure below. Each Business unit is independent but coordinated by a Global Supply Chain Director who is responsible for setting up local Global Supply Offices in low cost countries like China, India, Vietnam and Mexico. Each Business is led by a Procurement Director to whom all companies Purchasing Managers (within the Business unit) report to.

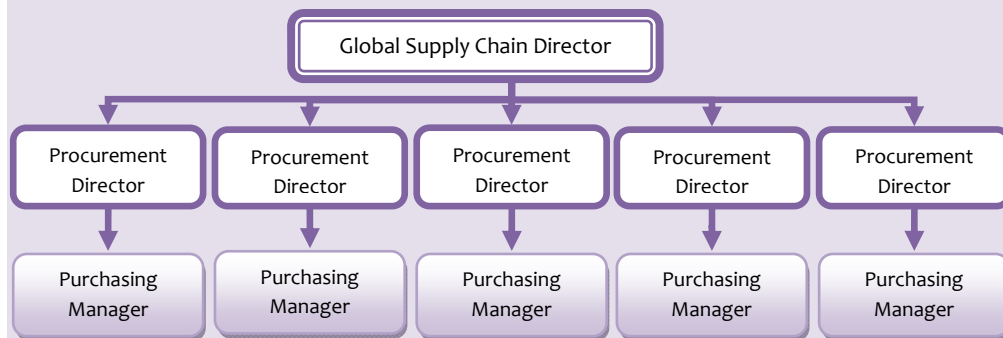


Figure 26 - Purchasing organization at IMI

Indoor Climate purchasing spent is 100 Million euro of which 70% is in Europe and 30% is in US, China, and recently in India. Although it has its main production in its own plant in Sweden, but for non-core products it has a large supply base and continuously searches for and investigates new potential suppliers. The IMI's supply base contains around 6000 suppliers of which 650 suppliers deal with Indoor Climate. The global sourcing goal was to reduce the cost of purchased goods. The purchasing department defined 5 main criteria which are Purchase Price (P), Quality (Q), Lead-time (L), Cost (C), and satisfaction of basic specification of the product (S). But since two years before, its main focus was only on cost rather than other criteria when selecting the supplier. Faced by many drawbacks such as quality, lead-time and logistical problems, it introduced a new method for supplier selection with a new approach. It focuses on other criteria to make a balance between them, i.e. not focusing alone on the price. Therefore the purchasing organization considers purchasing as a strategic decision.

First for a new product the purchasing department searches for potential suppliers in their database, since the intention is to have a long term relationship with previous suppliers. At least one new supplier will be selected, in order to stay in touch with changes in the market. Therefore, the department makes a rough assessment to select 5-10 suppliers only based on the 5 main criteria (POLCS). Following this step, they request suppliers for quotation (RFQ). In this step, the most important criterion is price. This means that even if the best supplier offers a higher price, the department drops them from the list. At the end of this step, 3-5 suppliers can reach the next step. The next step is the most critical one and it is the most time and energy consuming one. Based on 10 broad criteria, the purchasing department digs into each supplier. Each criterion has many detailed questions which can be seen as sub-criteria. The department asks the supplier to answer each question with consideration. Usually each questionnaire has more than 50 pages. Each question has a weight and in the end each broad criteria and each supplier will be ranked by the department. Thereafter the department selects 1-3 suppliers. Sometimes it is necessary to visit the supplier before the decision and the purchasing manager or director visits them personally. However it is not the case that if a supplier has a higher rank, it will definitely be selected. Many times the department selects based on other factors such as that a supplier plans to introduce a new laboratory or machine in a few months. The selected supplier in this step will be screened once more. This step is going on by a cross functional team with a purchaser as a leader. The team usually consists of employees from production, logistics, product development and other managers if needed. By a discussion and consideration of all areas and criteria, the team finally decides on one or two suppliers. This means that the highest ranked supplier is not necessarily selected; the team decides after discussion. In most cases parallel sourcing is preferred to reduce the risk. The supplier selection process of the Indoor Climate is shown by the figure below.

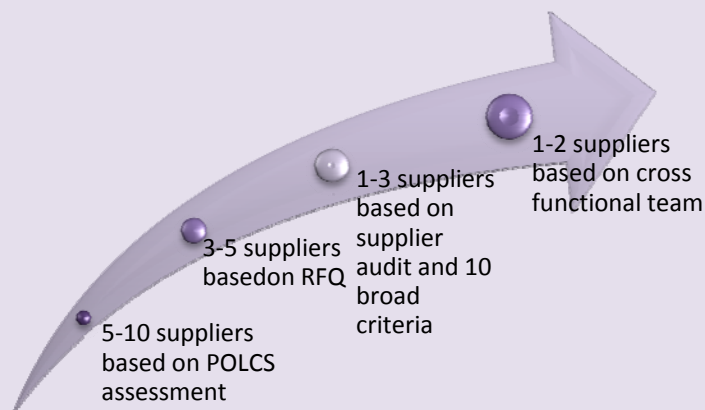


Figure 27 - Supplier selection process at Indoor Climate

The 10 broad criteria that the department introduced are stated below.

*Component requirement and compliance, Experience and reference, Process development and project planning, Quality methods and techniques, Raw materials and purchased parts, Customer care and satisfaction, Process stages, Process specifications and quality, Material flow, Health, safety and environment, and Financial.*

One main criterion that is recently focused on a lot is “health, safety and environment”. It is an emerging issue for the company and they care a lot about it and it has almost the highest impact on supplier selection. Besides, the department drops any company where there are not at least 2-3 persons speaking English because of previous experiences with different languages and cultures.

The proposed method is only for product supplier selection and the company does not use any special method for service supplier selection. The purchasing department selects the service supplier based on “gutt feelings”. That means the only criterion that the company considers is price. Other criteria must be at least at the desired level.

## Summary

Supplier selection is a critical part of the purchasing process and has a very significant impact on the company. Therefore, many literature sources try to suggest a lot of methods and criteria to consider for supplier selection. As shown in the case, the most practical and used approach is multi criteria decision making. Since in many situations, companies can't or do not want to select the best suggested supplier based on a mathematical approach. Although Indoor Climate does not use any special method of MCDM, they use a customized method for the company that considers many criteria at the same time. Finally with the aid of the guidelines of the method they choose the supplier.

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## [10] Supplier selection using a fuzzy linear programming model

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*This chapter gives an understanding of the complexity of the supplier selection process. The supplier selection process often includes some kind of screening of potential suppliers. Selection criteria are also decided and often weighted by the buyer. This chapter will present a development of an AHP supplier selection model which is combined with a linear programming model. Finally, the chapter also will presents a case study in order to provide a better understanding of the literature and described supplier selection model.*

## Introduction

The evaluation and supplier selection has become an important part of the Purchasing Management in companies. The manufacturing department needs to have a supplier who is reliable and keeps promises in order to maintain an efficient production. Supplier selection by using a linear model that is described in this chapter is one of many ways when it comes to finding the best suitable supplier available on the market (Sevkli, et al., 2008).

However, the model could seem to be very difficult to understand and to implement, but once it has been implemented by a company, they will realize that the time and effort it took for them in order to select the best supplier available on the market was worth the implementation (Sevkli, et al., 2008).

This chapter gives the reader an overview of how the selection is done from the beginning with an emphasis on the hybrid approach where the fuzzy linear model in the end selects the appropriate supplier. The method is applied on a real case within the appliance industry, based on a situation where a Turkish company called BEKO needed to find supplier in order to produce TVs. The final section of the chapter concerns conclusion of the approach.

## The screening process

The evaluation and selection process is a multi stage process which involves several steps and is illustrated in Figure 28. The screening of the suppliers starts with a sourcing request from the company that initiates a finding process in order to find potential suppliers. The sourcing request could contain finding a supplier that could provide the sourcing company with material in order to produce a special product. Another initiator could be that the manufacturer is dissatisfied with the current supplier and needs to find another one to cover the needs (Robert, o.a., 1996).

The next step contains two preliminary evaluations for the potential supplier. The first one is a general and preliminary screening process. In this step the supplier is evaluated in terms of financial statements and other factors that might disqualify them in terms of recent performance as supplier, environmental issues etc. At this point the decision is to decide if the potential supplier is suitable or not. If the supplier fails on this stage it will be disqualified and is no longer appropriate of being part of the vendors business (Robert, o.a., 1996).

The following step, if the suppliers have passed the first one, is to make tests of the potential material that is going to be used. In order to do this the material is being tested and evaluated in order to find out if the physical product is suitable for the production or not (Weber, et al., 1991).

The last step in the screening process is to evaluate more specifically on the passed supplier by using specific criteria. The potential supplier will be evaluated more detailed and will be given scores

depending on how the criteria is managed. The supplier with the best overall scores will be selected and will supply the sourcing company in the future.

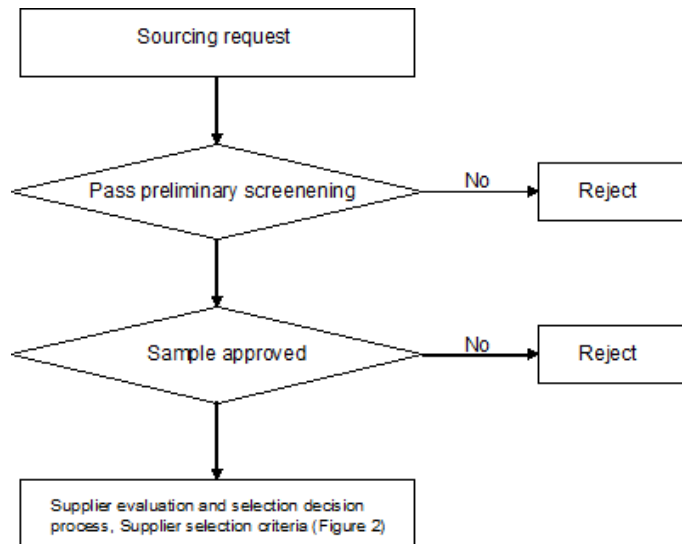


Figure 28 - Preliminary supplier screening process

## Supplier selection criteria

When the screening process has been made the potential supplier who remains has to go through a criterion step where it is analysed in terms of suitability. The criterion which is determined depends on the reason and background of the outsourcing decision of a company.

During many years now the criteria have been changed due to better communication systems and a more lean way of thinking. Due to the concept of just-in-time (JIT) companies need to have a broader view and not focus only at the price or lead time. Hence, the objective is to find the best one and not the one who has the lowest cost or the best lead times. Because of this the buying company needs to look at a supplier with a wider perspective (Weber, et al., 1991).

Figure 29 below shows the supplier evaluation structure of the BEKO case in order to illustrate how the structure looks like. The structure is divided into four levels where the top level is the ultimate goal of the problem. The next level is the six supplier criteria. These are the ones who give the sourcing company a picture of how the supplier is working and what the general contributions the supplier could offer. The third level is the second criteria composed into more specific sub-criteria. These are the ones that demonstrate to the buyer the particular contributions of a supplier and how they manage their business. These are the ones that could affect the buyers when it comes to the selection of the

supplier. The fourth and last criteria represent the alternative suppliers that are available for the vendor (Sevкли, et al., 2008).

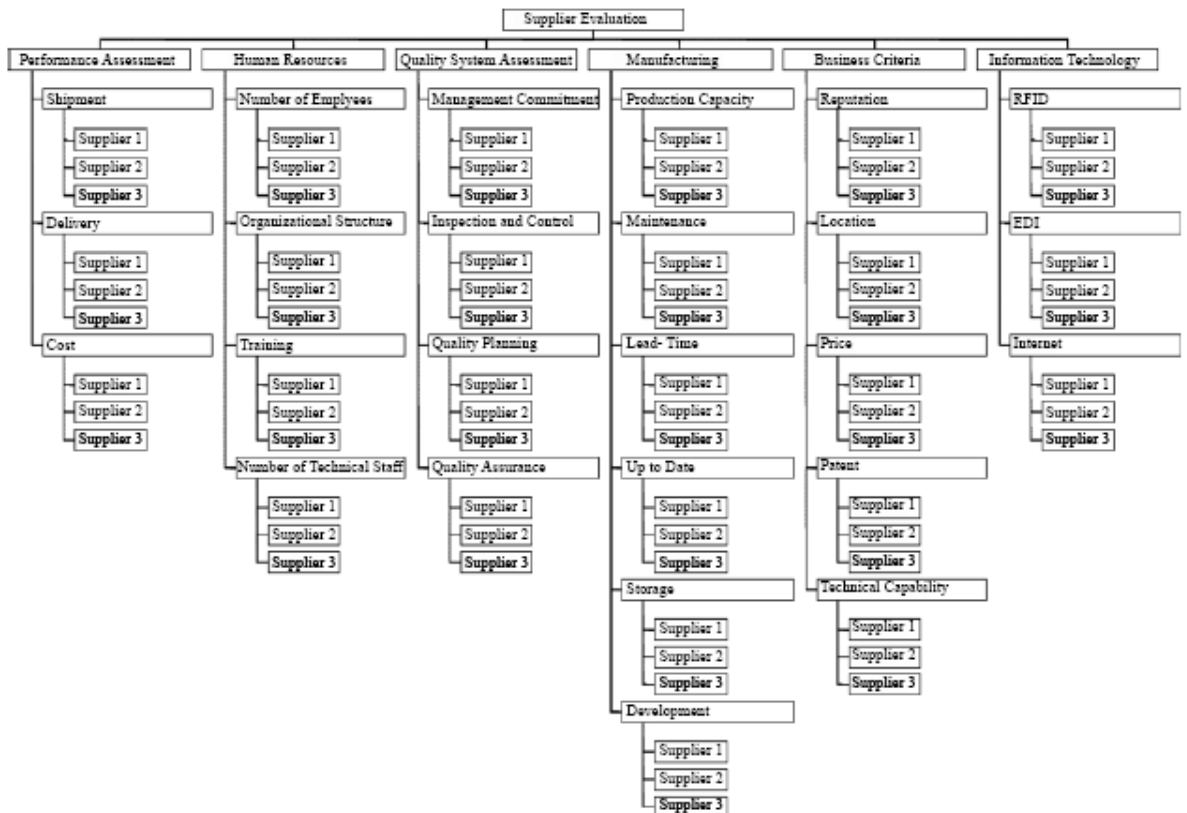


Figure 29 - Structure of supplier selection, (Sevкли, et al., 2007)

### Performance assessment

This criterion gives the buyer a hint of the potential performance of the different suppliers that are available on the market. It is divided into the performance of the shipment, the delivery and the cost of the suppliers (Sevкли, et al., 2007).

### Human resources

The human resource criteria will provide the buyer with information about the number of employees, the organizational structure, the training of the employees and finally the number of technical staff. The important sub criteria within this criterion are the training of the employees. This will determine the knowledge of the staff in the supplier’s organization and the willingness of improving and maintain good quality of the provided contribution to the buyer. The number of technical staff is



important if the buyer is looking for a commodity that required a highly technical knowledge. If the number is higher than for other suppliers it is an advantage for the one with the most technical staff (Sevкли, et al., 2007).

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### Quality System Assessment

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This criterion gives an overview of the supplier's quality planning, quality assurance, management commitment, inspection and control. The quality issues are important when it comes to both the buyer and the supplier's production. If the quality is poor at the supplier it will also affect the buyer in a negative way. It could be in terms of lack of commodities or dissatisfied end customers (Sevкли, et al., 2007).

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### Manufacturing

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The manufacturing criteria are important when it comes to the knowledge of the production capacity. The buyer needs to know if the potential supplier could manage a peak in demand for example. Furthermore the maintenance of the lead time, storage, development of the production and if the suppliers are up to date when it comes to production is the other sub criteria (Sevкли, et al., 2007).

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### Business Criteria

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The sourcing company will get an overview of the suppliers business in this criterion. The criteria will provide information about the supplier's reputation, location, patents, technology capabilities and finally price. However as stated before, the price is not the most important criteria when it comes to the decision of selecting a supplier (Sevкли, et al., 2007).

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### Information Technology

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Information sharing amongst companies is becoming a more important issue. This criterion determines the ability of the supplier to communicate with the buyer. The sub criteria within this criterion are Radio-frequency identification (RFID), Electronic Data Interchange (EDI) and the use of internet in order to communicate with each other (Sevкли, et al., 2007).

## The analytic hierarchy process

The analytical hierarchy process (AHP) has been developed by Saaty (2001) and is a powerful tool when it comes to the solution of selecting the best supplier. The AHP can be structured as shown in Figure 29 as a hierarchically structure containing 4 levels as stated in the previous chapter (Sevкли, et al., 2008).

As stated the first step in the process is to structure the hierarchy and decide the importance of each criterion. Further on it is up to the decision maker to give each of the sub criteria a ranking between 1 to 9 where 1 is the lowest and stands for equally preferred and 9 is extremely preferred. The second step is to make pair wise comparisons, concerning the weight and scores. The comparison of two criteria needs to be done at the same level and will be given a numeral value regarding their importance (Look at [16] Appendices for example). The last step is to calculate a weighted sum of all the comparisons as shown below in order to give the main criteria a score that the decision maker can work from. The result of the global priorities  $R_j$  is based on weights,  $v_i$  and the scores,  $r_{ij}$ . The outcome of the AHP approach is illustrated in Appendices and is later used in the fuzzy linear model in terms of selection of possible supplier (Partovi, 1994).

$$R_j = \sum v_i * r_{ij}$$

Equation 1 - The weighted sum of all comparisons

## The fuzzy linear model

The fuzzy linear programming (FLP) model gives the sourcing company another picture than the one delivered from an AHP model, which would have selected another supplier rather than supplier 2 as it is stated in the following case study. The model will generate a better understanding of the important issues regarding A class component which in the end will generate better outcomes for the sourcing company. The model is made in order to provide a selection tool when it comes to the fuzzy environments that exist on the existing markets. Or as Sevкли M. (2008) state in their journal: *“Since there is a fuzziness and ambiguity in human judgment, conventional cooperation scale with the crisp number as proposed in Saaty’s AHP fails to address the fuzziness”*

Based on the weights of the local weights of the supplier stated in appendix 1 the linear model can be made. The calculation of the model is as shown in Equation 2, where the inputs are taken into consideration and provide each main criterion with a figure based on the outcome in the AHP. Further on is the linear model calculated by the usage of the Xpress MP software which is a programming software tool used in order to calculate and select the best supplier (Sevкли, et al., 2008).

Max  $0.244\lambda_1 + 0.055\lambda_2 + 0.096\lambda_3 + 0.153\lambda_4 + 0.420\lambda_5 + 0.033\lambda_6$   
 subject to:

$$\lambda_1 \leq \frac{0.482 - (0.482x_1 + 0.279x_2 + 0.239x_3)}{0.482 - 0.239}$$

$$\lambda_2 \leq \frac{0.587 - (0.587x_1 + 0.285x_2 + 0.128x_3)}{0.587 - 0.128}$$

$$\lambda_3 \leq \frac{0.738 - (0.738x_1 + 0.179x_2 + 0.083x_3)}{0.738 - 0.083}$$

$$\lambda_4 \leq \frac{0.507 - (0.311x_1 + 0.507x_2 + 0.181x_3)}{0.507 - 0.181}$$

$$\lambda_5 \leq \frac{0.411 - (0.231x_1 + 0.411x_2 + 0.358x_3)}{0.411 - 0.231}$$

$$\lambda_6 \leq \frac{0.429 - (0.429x_1 + 0.429x_2 + 0.143x_3)}{0.429 - 0.143}$$

Equation 2 - Linear calculation using inputs from the AHP approach, (Sevкли, et al., 2007)

### Case study: BEKO, an appliance company who used the fuzzy linear model

The case is based on a supplier selection by BEKO which is a major appliance manufacturer based in Turkey. The company needed to select a supplier when it came to the manufacturing of TV tubes. After the screening process they found three potential suppliers which could deliver and supply the required tubes. The main criterion for selecting the suppliers is the long lead time of the tubes. In fact they have the longest lead time within the manufacturing process of all the supplied items. Furthermore the tubes are high-value components and are classified as class A components (Sevкли, et al., 2008).

Further on, BEKO decided which of the criteria was the most important to them and the one which was of no importance. They decided because of the high classification of the component and the long lead time that the manufacturing criteria was of more importance which contains lead time, production capacity, maintenance, up to date technology and transportation. The one they found as the least important criteria was the quality system assessment which consists of inspection and control, management commitment, quality planning and quality assurance. Next step for BEKO was to calculate the weights of the criteria by giving all 25 sub criteria a score between 1 and 9 and then implement them into the calculation reviewed in previous chapters. Appendices illustrate the local weights of the different suppliers in the main criteria. A detailed review of the weights is also shown in there. Further on the fuzzy linear model was implemented based on the inputs from the AHP. The outcome stated that supplier 2 was the most appropriated supplier when this model is used and the manufacturing

criteria are the most important one of the six main ones. However, if the selection of supplier was only based on the AHP approach, supplier 1 would have been the selected one. This statement illustrates the different outcomes when evaluating suppliers and that the fuzzy linear model does supply the company with a different outcome (Sevkli, et al., 2008).

## Conclusion

The model is most preferable when it comes to A class commodities which have high value. The fuzzy linear programming (FLP) will provide the right supplier in these environments and is a complement to the AHP model, whereby the two approaches will together work as a hybrid supplier selection model. Because of the FLP the selection will be more reliable, since the model will take the fuzziness into consideration and the uncertainty when it comes to the judgment of the ones who decide the supplier.

Furthermore it is important to divide the criteria into the most important criteria and the least important criteria in order to find the best supplier. The case study in this chapter has the manufacturing criteria as the most important supplier criterion which includes maintenance, lead time, production capacity, up to date technology and transportation. This criteria is recommended to be the most important criteria due to the high value and long lead time the A class commodities have. The lead time for example and transportation that is sub criterion of the manufacture criteria is of great importance due to the long lead time the commodities have. Furthermore is the production capacity of importance since the commodities have a high value and the supplier needs to deliver them even if there is a peak in demand. If they can't deliver the commodities because of limited production capacity, it will cause the sourcing company serious problems in terms of production delays and missed sales opportunities.

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## [11] Supplier selection using ISO standards

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*This chapter discusses how the ISO standards, specifically ISO-9000 and ISO-14000, can be used in a supplier selection process. This is done by comparing the most commonly used supplier selection criteria with the principles of ISO guidelines and standards. In other words this chapter will compare the practical way of selecting supplier criteria with the content of ISO documents. ISO standards are international recognized standards which are created to suit all kinds of industries and companies.*

## Standards and certifications

In this chapter the ISO-9000 and the ISO-14000 standards will be presented followed by a description of the certification process. The ISO standards are international standards created to suit all kinds of industries and companies. Although there are many other standards, as for example the industry specific standards, there is a trend towards a decreasing number of standards and an adaption to the ISO standards for more and more companies (Bergman, et al., 2004) and therefore the ISO standards are the most interesting standards to investigate in this context.

### ISO-9000

The ISO-9000 series was issued by the International Organization of Standards (ISO), a non-governmental organization established to promote the development of standardization, in 1987. It has since then become an international recognized quality standard (Wilson, 1994). The standard is revised in regular intervals. There was a big revision in 2000 transferring it from an object-oriented approach to a process-oriented approach (Bergman, et al., 2004).

The ISO-9000 series (hereafter referred to as ISO-9000) consists of four parts: ISO-9000, ISO-9001, ISO-9004 and ISO-90011. ISO-9000 covers the basics of quality management systems and also contains the definitions of concepts and terms for the ISO-9000 series. ISO-9001 contains the requirements in the standard for a quality management system. ISO-9004 provides the guidelines for implementation of a quality management system as well as processes for continuous improvements and work towards customer satisfaction. ISO-90011 provides guidelines for carrying out audits related to quality and environmental issues. (Bergman, et al., 2004)

ISO-9000 is based upon eight quality management principles that companies implementing ISO-9000 should follow (International Organisation of Standardisation 2000):

1. Customer focus: focus on customers and strive to meet and exceed customer expectations and requirements.
2. Leadership: the management should establish a unity of purpose and direction in the whole organization and create an environment that encourages people to be involved.
3. Involvement of people: all personnel should be involved and use their full abilities for the company's benefit.
4. Process approach: all activities and resources should be managed as a process.
5. System approach to management: the management should have a holistic view of the company to reach its goals effective and efficient.
6. Continual improvements: continuous improvements should be a permanent objective.
7. Factual approach to decision making: base all decisions of facts
8. Mutually beneficial supplier relationship: the company should have a mutually beneficial relationship with its suppliers

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## ISO-14000

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The ISO-14000 series was developed by ISO in 1996 and is a standard to improve environmental performance. ISO-14000 builds on the same principles as ISO-9000 (Melnyk, et al., 2000). The ISO-14000 environmental standards specify the structure of information technology, in the form of an environmental management system that an organization must have in place if it seeks to obtain ISO-certification. The ISO-14000 standards describe the basic elements of an effective environmental management system. These elements include creating an environmental policy, setting objectives and targets, implementing a program to achieve those objectives, monitoring and measuring its effectiveness, correcting problems, and reviewing the system to improve it and overall environmental performance (Feldman, et al., 1996). It is common that a company's management systems related to quality and environment, e.g. ISO-9000 and ISO-14000, are integrated into one system (Bergman, et al., 2004).

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## Certification

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A large part related to the ISO series is certification by third party auditors. ISO certification is not a one-time occasion; it must to be renewed at regular intervals, usually around three years (Curkovic, et al., 1996).

ISO certification requires a series of steps. First, the company determines which standards in the series are applicable to its situation. Next, a company-specific quality manual is developed, which provides a specific set of policies related to the implementation of the standards. Finally, a full assessment follows, executed by an on-site team that verifies that there is a procedure in place to measure quality or environmental performance, there is a review process to monitor it and that there is a qualified staff to carry out the policies (Curkovic, et al., 1996).

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## Effects of implementation

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In this chapter the effect of implementation of the ISO 9000 and ISO 14000 standards that companies have experienced, will be presented. The effects of implementation of an ISO standard are widely debated and there are many qualitative and quantitative studies available scrutinizing the immediate and long-term effects on companies.

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## ISO-9000

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The majority of available studies show that implementation of ISO has positive effects for a company (e.g. (Curikov, et al., 1999); (Melnyk, et al., 2000) (Gotzamani, et al., 2002)) and the fact that an increasing number of companies all over the world are using the standards indicates this as well (Casadesús, et al., 2005).

Even more widely debated than whether there are possible effects or not, are what these positive effects are and to what extent they appear in the companies. There are many studies, both qualitative and quantities, dedicated to this. The effects of implementing the ISO 9000:1994 and the ISO 9000:2000 standard are very similar despite the differences between them but the long-term benefits from ISO9000:2000 are expected to be greater (Casadesús, et al., 2006) but since the later version of the ISO standards have only been available for a few years the long-term benefits have not yet been reached.

The positive effects of implementing ISO standards are presented in Figure 30. The ISO standards are process-oriented and as a result companies pursuing ISO certification are likely to fundamentally change the underlying processes resulting in essential changes (Melnyk, et al., 2000). Certification forces the company to use measures, methodologies and tools that can help the company to create new opportunities for improvement across many competitive dimensions (Curikov, et al., 1999).

The most important benefits from implementation of ISO standards is related to the company's operations and customer relations. The most common positive effect is that ISO certified companies have better quality often followed by better delivery precision (e.g. (Poksinska, et al., 2003); (Curikov, et al., 1999); (Casadesús, et al., 2006)). They are more flexible and responsive to customers' requests ( (Poksinska, et al., 2003); (Curikov, et al., 1999)). Improved productivity is identified by (Curikov, et al., 1999) as a positive effect of implementation. There is evidence that implementation of the ISO standard can contribute significantly to superior financial performance and specifically improvements in return on asset (a commonly used indicator of a company's performance in comparison to others in the same industry) primarily through increased productivity. In comparison to an otherwise similar company and ISO certified company have a much higher increase on return on asset three years after the certification (Corbett, et al., 2004).

There is a strong positive link between a continuous improvement strategy and improved business performance (Terziovski, et al., 2007). The ISO standards encourage to continuous improvements. Internal audits on regular intervals ensure that the company is continuously improving their procedures and make sure that all changes are justified and documented (Curikov, et al., 1999).

The ISO certification process forces the company to examine all its processes in detail and in this processes new opportunities to reduce waste or cut costs often turn up (Curikov, et al., 1999). Over time, certified companies go through a process of organizational learning that has a positive effect waste reduction (Terziovski, et al., 2007).



The documentation process forces companies to formally establish procedures and the mere act of documentation has enabled companies to uncover problems in processes and to improve their competitiveness. The formalization of the processes and the requirement for ISO certification forces the company train all employees resulting in better-trained personnel, increasing the value of one of the most important resources in a company (Curikov, et al., 1999).

As a result of improvements due to the implementation of the standard the customer satisfaction is often improved ( (Yahya, et al., 2001); (Bhuiyan, et al., 2005) (Brown, et al., 1995); (Brown, et al., 1995)).



Figure 30 Possible effects of implementation of ISO standards

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## ISO-14000

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The traditional way of looking at environmental performance in relation to industrial competitiveness is that there is a trade-off between social benefits of a better environment and the economic burden on the company for improved environmental performance. But there are many examples of cases where environmental performance and competitive advantage goes hand in hand because of new innovative solutions. In many cases bad environmental performance are signs of inefficiencies in the company, for example bad resource utilization, emissions and poor process control resulting in waste and quality defects. Improving the environmental performance by reducing these inefficiencies does unhesitatingly reduce cost. In addition to cost savings many companies can use innovation to demand price premiums for green products and open up new market segments (Porter, et al., 1995).

The implementation of ISO-14000 can have a great positive effect of the environmental performance as well as overall corporate performance on operational, managerial and competitive level (e.g. (Rondinelli, et al., 2000); (Kirkpatrick, et al., 1996) (Porter, et al., 1995)). A study by (Poksinska, et al., 2003) showed that all companies that had implemented ISO 14000 was agreeing that it had brought

some benefits and over half of the companies stated that very substantial or substantial benefits were achieved from the implementation (Poksinska, et al., 2003). ISO-14000 has a large, positive impact on the environmental performance (Melnyk, et al., 2000); (Poksinska, et al., 2003)). ISO 14000 certification also improves the company image (Poksinska, et al., 2003). The implementation of the standard have great positive effect on the company performance and improve internal procedures (Poksinska, et al., 2003), reduced waste as for example reduction of material use and lower energy consumption (Christensen, o.a., 1998), decreased costs and improved quality (Melnyk, et al., 2000) (see Figure 31). As companies become more environmental friendly they uncover new sources of improvements. The result is that enhanced environmental responsibility results in improved corporate performance (Porter, et al., 1995).

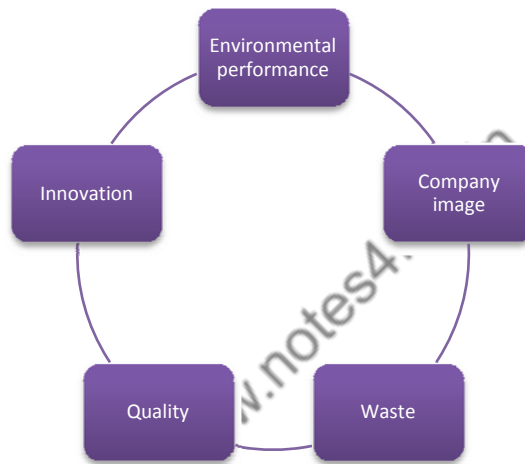


Figure 31 Possible effects of implementation of ISO 14000

## Supplier selection

In this chapter the most popular factors for supplier selection is discussed and thereafter the conclusions about how the ISO standards can be used in the supplier selection process are presented followed by a short discussion about the dangers of relying too much on the standards during the supplier selection process.

### Key factors for supplier selection

In the supplier selection process companies use a selection of criteria in order to determine whether the supplier lives up to the standard or not. The most important supplier selections criteria's is quality that consistently is on the top of the list of important supplier assessment criteria. Delivery precision is

often mentioned as another important. Price is often considered to be an important selection criteria (Kannan, et al., 2002) although some studies indicates that it is becoming less important because of, among other reasons, closer supplier-customer relationships and less multiple sourcing (Simpson, et al., 2002). Other selection criteria that are considered important are capability, commitment to continuous improvements, customer service and flexibility (see Figure 32).



Figure 32 Key factors for supplier evaluation

Tan and Wisner (2000) highlights the importance of the suppliers performance with regards to quality work and aligns five issues that are essential in this area: conformance to the specifications, immediate response to quality problems taking corrective measures, implementation of quality policies, documentation and adequate inspection and testing. Simpson, Siguaw and White (2002) agree with all the above-mentioned issues and add quality and process control as an additional issue. A study by Purdy, Astand and Safayeni (1993) shows similar results, when the supplier was asked what the customers emphasized as most important: documentation and communication and participation of the workers.

Environmental performance is emerging as a factor to consider in supplier selection (Humphreys, et al., 2003) but so far it seldom is among the top criteria's for supplier selection when these are presented.

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### **Standards for supplier selection**

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The use of standards and certifications in the supplier selection process is widespread (Curkovic, et al., 1996). In a study by Wisner and Tan (2000) a considerable majority of the companies stated that they required their suppliers to be certified either by ISO, the company's own standard or another recognized standard. Certification is often used as an order qualifier for the potential suppliers (e.g. (Curkov, et al., 1999); (Wilson, 1994); (Simpson, et al., 2002) (Corbett, et al., 2004)). The without competition most popular standard to use for supplier selection is ISO, with 65 percent of the companies in the study by Wisner and Tan (2000) demanding ISO certification of their suppliers. ISO 14000 is less common in the supplier selection process and few company require their suppliers to have ISO 14000 certification (Poksinska, et al., 2003).

The ISO standard can be useful in the supplier evaluation process. The key factors for supplier evaluation: quality, delivery precision, price, continuous improvements, customer service and flexibility, and the key factors for supplier performance regarding their quality work: conformance to specification, immediate response to quality problems, implementation of quality policy, documentation, participation of workers, process control, corresponds well to the effects that the ISO standards can result in: quality, delivery precision, efficiency, cost reduction, productivity, continuous improvements, flexibility, waste reduction and customer satisfaction and the eight management principles that are the cornerstones of the ISO standard (see Figure 33).

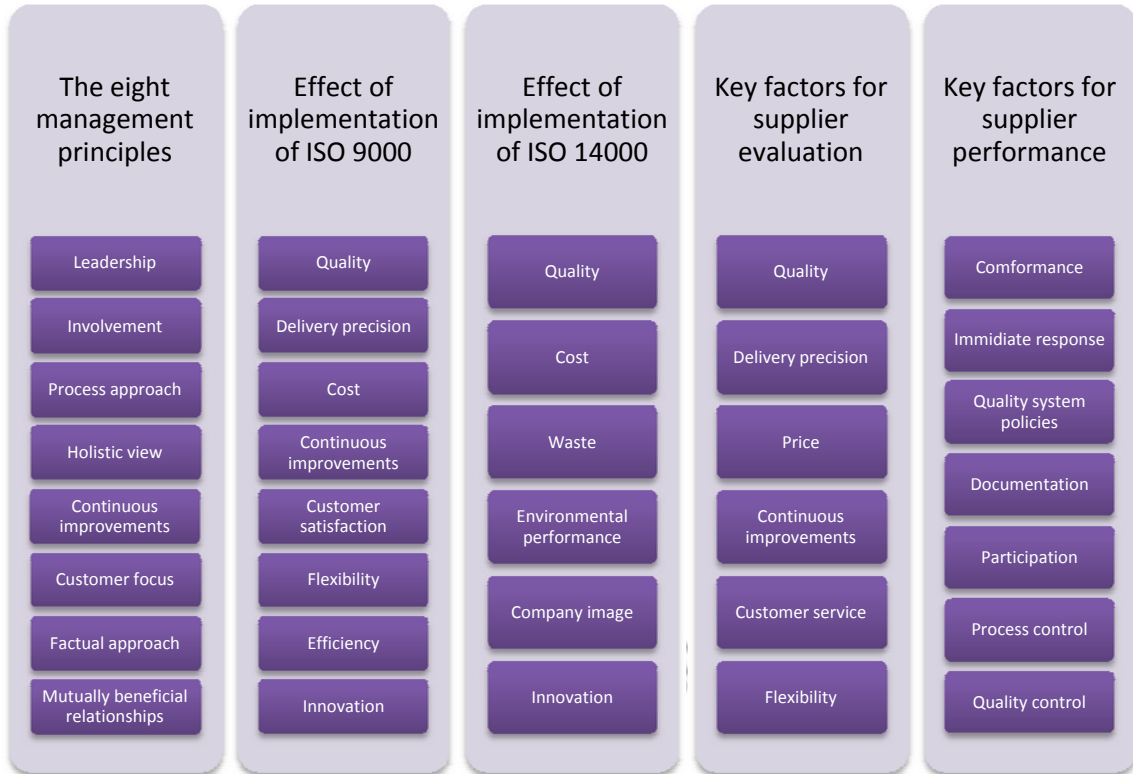


Figure 33 Comparison between key factors for supplier evaluation and effects of implementation and certification of ISO standards

ISO certification is suitable to use as an order qualifier, as it is used today, since it guarantees that the supplier have a quality or environmental system in place and are working with continuous improvements and process control etc. Choosing a certified supplier makes in more likely that it is performing well in many of the areas of interest and is likely more financially stable. Because of the continuous improvement programs that are a part of ISO certification and the benefits derived from organizational learning, a company that have been ISO certified for a long time are expected to perform better than a newly certified company.

There are dangers with using the ISO standards as a tool for supplier selection. An ISO certification only ensures that there is a system in place and does not provide any guarantee on its functionality (e.g. (Curkovic, et al., 1996); (Peach, 1990)) and ISO certification cannot be used for any deeper analysis of the suppliers performance since it doesn't specify the degree of improvements in the different areas. Even though a third party auditor visit the supplier during the certification process there is much information that is missed. During the evaluation visit the auditors generally detects less than half of the business and manufacturing problems (Purdy, et al., 1993).

Another problem that arises as customer demand ISO certification by their customers and ISO certification becomes more and more popular is that as more suppliers obtain the certification and achieve the same standard of quality ISO certification will not be a sufficient way to distinguish one certified supplier from another (Simpson, et al., 2002).

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## Introduction

This chapter will start with describing the importance of supplier development, and then display and discuss the definition of supplier development based on literature study. After that supplier performance review is conducted to certificate the prerequisites of a supplier that is worth procuring firm's further efforts of supplier development. The generic supplier development activities are introduced in the form of three groups, and direct firm involvement represents the proactive actions compared to incentives and competitive pressure. A case study will be conducted to find out what happened in practice in terms of the three types of supplier development activities. The direct involvement will further be elaborated as three categories and knowledge transfer is the essence one out of the three. The focus will be placed on the diffusion of tacit knowledge in the supplier firms.

The purpose of the chapter is to provide the theoretical view of supplier development and its activities, with the emphasis on tacit knowledge transfer, and to define which development strategies are of the greatest importance for the buying firm in practice, with the support of the case study. The study areas covered in this chapter are illustrated in the figure below:

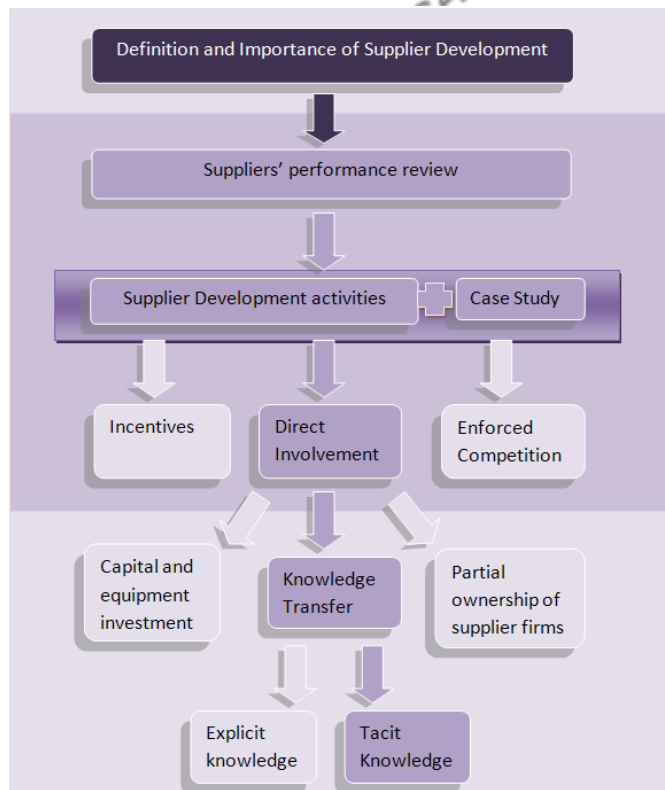


Figure 34 - Chapter structure

According to the explanations above and the chapter structure (Figure 34), the topics in dark-collared boxes are the essence of this chapter and will be elaborated more while the light-collared boxes will only be mentioned briefly. Tracking the stream of dark-collared boxes would make it easier to follow the content of this chapter.

## Definition and Importance of supplier development

It is widely reckoned that companies purchase their non-core products and services from external suppliers, while keep the production of essential parts in-house (Krause, 1997; Krause, et al., 1998). However, as people started to look at a company's competitiveness from a more comprehensive point of view, the suppliers' performance is regarded as of great importance for their customers' core competences.

In the perspective of total quality management, a company has to know how to control and manage all of its resources and operations. As the providers of raw material, services and other resources, suppliers themselves are interpreted as a kind of resources as well. All their inputs such as their product quality, operational processes and the interfaces with procuring firms would lead to direct impacts on the procuring firms' product quality and service level. (Humphreys, et al., 2004)

Under the supply chain circumstance a company can be considered either as a supplier or as a customer, depending on who it does business with. Each actor plays its important role in the whole supply chain and affects the overall performance. Briefly speaking, no supply chain can surpass its weakest point and a laggard supplier won't be able to cooperate well with its customer and will become the weak point of the supply chain. Thus the procuring firms are obliged to make efforts to support their suppliers. (Krause, et al., 1998)

Usually, companies carry out supplier development driven by two types of motivations (Krause, et al., 1998). The first one is an urgent need in the face of laggard suppliers. In other words, it is the reactive effort when suppliers' unsatisfactory performance indeed resulted in negative impacts on procuring firms' operations. In comparison to reactive movement, the strategic supplier development concerns procuring firm's long-term consideration of increasing suppliers' capabilities to meet its future demand, and in turn to enhance its constant competitive advantage. This strategic concept requires procuring firms' continuous assessment of suppliers' performance and future situation, so that to take actions before problems really arise.

Regarding the definition of supplier development, different authors present various ways to describe it. A selection of "Supply Development" definitions is displayed below.



*“Supplier development is defined as any set of activities undertaken by a buying firm to identify, measure and improve supplier performance and facilitate the continuous improvement of the overall value of goods and services supplied to the buying company’s business unit.” (Krause, et al., 1998)*

*“..... supplier development is as any activity that a buyer undertakes to improve a supplier’s performance and/or capabilities to meet the buyer’s short-term or long-term supply needs.” (Handfield, et al., 2002)*

*Supplier development is a procedure by a company to help improve its suppliers’ capabilities. More specifically, it may be interpreted as a firm’s attempt to transfer (or replicate) some aspects of its in-house organizational capability across firm boundaries. (Sako, 2003)*

According to the studies presented in this chapter, the supplier development generally refers to efforts made by procuring firms to improve their suppliers’ performance and capabilities, which focus on the strategies and activities the procuring firms adopt. The starting point will be reviewing suppliers’ performance in order to identify which ones need to be improved, and to ensure that the investment and efforts are worthwhile.

## Suppliers’ performance review

When an enterprise has already set up its supplier’s base and has been working with them for a while, there arises an option, either to keep the existing suppliers or to look for an alternative source of supply. When a company decides to search for new suppliers, there can be a number of challenges and expenses it will face, such as costs for evaluating new suppliers, location delimitations, etc. Therefore, firms often choose to work with present suppliers, whereas evaluating and improving their performance. (Krause, 1997)

Suppliers directly impact, either positively or negatively, or both, many procuring firms’ competitive dimensions such as cost, quality, technology, delivery, flexibility and profit. Hence, in order to develop supplier’s performance, firms are to evaluate existing relationships and its influence on their businesses.

Reviewing existing suppliers’ performance, companies focus on several criteria, depending on their needs and core businesses. According to Krause (1997), companies’ emphasis is mainly placed on item’s quality, its cost, delivery capabilities in terms of lead times and flexibility, level of innovations, and product design. Therefore, procuring firms facilitate suppliers’ performances and capability improvements through supplier development.

Therefore, the supplier's performance review can be seen as a bridge between supplier's evaluation and its further development. Moreover, reviewing a buying firm uses similar criteria to assess its suppliers with the ones, used when performing evaluation before choosing them. Different companies emphasize different criteria. Thus, after review is performed, purchasing firm sets up its supplier development strategies.

## Generic supplier development activities

In practice, supplier development activities vary significantly and depend on the level of procuring firms' and suppliers' involvement in the process. Procuring firms' efforts may include only, for example, informal request for improved performance or extensive efforts with considerable investments in relationships, trainings, etc. (Krause, 1997) The supplier development literature describes numerous of development activities with its classification and outcomes. Moreover, literature consists of a lot of case studies focusing on the automotive industry. Hence, several examples, regarding buying firm's different development activities towards their supplier performance are presented further. Additionally, in order to get a practical view on what activities to improve suppliers' performance and capabilities a procuring firm considers and emphasizes, the case study is presented.

Furthermore, while a variety of development activities are described in the literature, its categorization is also presented. Thus, the grouping methods differ and can contain different development strategies. According to Krause, et al., (2000), the supplier development strategies can be categorized as internalized or externalized activities. The firm's internalized activities are critical to success, whereas externalized ones are not related to their core capabilities. Therefore, the internalized group of activities requires firm's direct involvement and contains such strategies as supplier review, trainings, reward programs, etc. Contrarily, the following development strategies represent externalized activities: competitive pressure, supplier assessment and supplier incentives.

Thus, there are other ways of grouping described by literature, however, the way how to classify development activities into several approaches, described by Krause (1997), is chosen as a robust framework, because it presents a clear segmentation and can include all activities. Thus, to assist in summarizing possible development activities, which are brought up from different literature resources, the framework is followed. The structure of the framework combines three approaches: direct firm involvement, incentives and enforced competition; which are described further.

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## Direct firm involvement

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Having this kind of relationships, a buying firm is actively involved in its suppliers' development processes, which entail investments and affords in order to achieve improvements. Therefore, a company and its suppliers create particular development activities which are further implemented for suppliers' performance improvement. Moreover, those activities are characterized by interaction between parties involved and selected, depending on the expected results and available resources.

The direct firm's involvement is emphasized by the literature because of its specific relationships between parties, including investments and risks to the buying firm. Thus, formal supplier evaluation is one of this group's activities, performed by the purchasing company in order to assess its suppliers. (Krause, et al., 1998) Moreover, supplier evaluation can help to identify where supplier development activities should be concentrated and can provide a benchmark to review the outcomes derived from supplier development strategies. In addition, providing supplier with feedback about results of its evaluation is another development activity frequently used by buying firms, guiding a supplier to "how to improve" (Krause, 1997).

Furthermore, supplier site visit by purchasing firm premises to help supplier to improve its performance, when viewing the process and estimating its advantages and disadvantages. (Krause, et al., 1998) Moreover, informal evaluation is another activity which can be used to improve supplier performance, when, for example, inviting supplier personnel to the company's site to increase its awareness of how its product is used. In order to motivate supplier, a firm can consider different award programs, which provide recognition for outstanding achievements (Krause, 1997).

In addition, use of supplier certification programs in order to certify supplier's quality, making incoming inspection unnecessary is implemented by many buying firms. Moreover, to improve its performance, a supplier can be questioned in verbal or written forms. Another development activity emphasized by literature describes importance of the top management involvement. (Krause, et al., 1998)

Finally, the purchasing firm can contribute to its supplier' development by providing trainings and education. Thus, more know ledged supplier's personnel can reconsider its way of thinking and attitude towards supplying products and its performance (Krause, 1997).

Summarized, the direct firm involvement activities include formal supplier evaluation, feedbacks, supplier site visit, inviting supplier personnel, certification programs, award programs, supplier verbal or written request, top management involvement, trainings and education programs.

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## Incentives

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In this type of relationships, a supplier and a procuring firm agree upon particular current and future benefits, which they both expect from being involved in these relationships. Hence, a buying firm commits only if a supplier improves, motivating supplier to improve performance.

In order to encourage suppliers to develop, the firm may give such promises as to purchase high volumes from particular suppliers; prioritize them, when other suppliers provide with the same kind of the product; consider them for future business activities, etc. However, it is essential to emphasize that, while having this kind of relationships, a purchasing firm is committed to give particular benefits to suppliers only if they improve their performance (Krause, 1997).

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## Enforced competition

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Enforced competition may be described as a particular kind of relationship, which doesn't involve any firms' commitment. Parties, buying firm and suppliers, are having so-called Arm's length relationships where no trust, commitment, support or risk sharing exists and is needed. Therefore, the main advantage of such relationships is to motivate suppliers through the competition (Krause, 1997).

To benefit from such competition, a buying firm may choose several suppliers and play them off in order to reduce price for the purchased products. It is important to mention, that the use of market competition is mainly applicable when purchasing commodities and the price is a target criterion. However, the focus on the price reduction can influence the quality issue negatively (Krause, 1997).

To summarize, right suppliers are to be chosen, which will be involved in the competition, in order to avoid serious quality defects. There is no commitment with those suppliers and a purchasing firm is not directly involved in the supplier's effort to improve its performance. Moreover, in this type of relationships, when a buying firm is not satisfied with the supplier, regarding its price, location, behaviour, it may switch the supplier. Thus, the supplier improves or fails its performance on its own.

### Case study: Volvo 3p (1)

The purpose of the case study is to determine whether the development activities, described in the literature resources, are used by the buying firms in practice and which of those strategies are of the most importance. Therefore, previously described framework, which provides with development activities categorization, is followed in order to compare the theoretical and real improvements by the buying firm towards its suppliers.

**Method**

In order to collect data, the interviewing tool was used. An interview can be generally described as a conversation between two or more people (the interviewer and the interviewee) where questions are asked by the interviewer to obtain information from the interviewee. Typically, interviewing methods contain interviews with opened or closed questions. Opened questions provide with wide, detailed and more qualitative answers, contrarily to closed ones where such answers as “Yes” and “No” are expected (Rubin, et al., 2005).

To be able to get better result from the interview, the so-called qualitative interview method can be used. Thus, qualitative interview is a conversation in which the researcher guides a conversational partner in an extended discussion. The researcher elicits depth and details about the research topic by following up on answers given by the interviewee during the discussion. Therefore, the qualitative interview contains a responsiveness issue, where a researcher is responding and then asking further questions rather than relying on predetermined questions only (Rubin, et al., 2005).

Hence, the qualitative interviewing approach was decided to be used for the case study. The questions were prepared in advance and structured in the opened form, following the development activities framework, in order to encourage the conversation and get a deeper understanding of the interviewee’s opinion. Moreover, the answers provide with examples and descriptions of interviewees’ experiences. Additionally, the company was asked to indicate to which extent it is engaged in the various supplier development activities, which are generated from the literature study. The scale 1-5 was used, where 1 ranking was given when an activity is the least important, whereas those activities which are the most essential for the company were ranked with 5.

**Limitations**

The interview was performed with one company – Volvo 3P – , and the answers were generated from one interviewed employee, who has been working as a purchasing project manager for approximately ten years, and has proper knowledge and experience. Moreover, all types of suppliers were considered when answering the questions and giving comments by the respondent.

**The respondent**

The interviewee for this study was the “Volvo 3P” (V3P) company, and particularly Peter Thomasson, who holds a title of the Project SQA at Volvo 3P International Purchasing. As for the company’s background, Volvo 3P company’s core businesses are product planning, product development and purchasing for such truck companies as Volvo Trucks, Mack trucks, Nissan Diesel and Renault Trucks.

Globally, Volvo 3P has around 3000 employees and a number of offices which are located in Japan, Sweden, France, the USA, Brazil, India, China and Australia. Talking about supplier base, the company is working with 1800 suppliers worldwide. Moreover, the company is actively doing its businesses with about 500 of those suppliers.

### Results

The respondent was provided with the theoretical framework and its activities, which is described in the theoretical part of the chapter. Moreover, the interview form was sent to the interviewee one day in advance, in order to get more deep and descriptive answers. Therefore, the results from the interview with the development activities' rankings are summarized and presented below in Table 19.

Hence, formal supplier evaluation/reviewing is ranked with 5, illustrating the great importance for V3P. According to the comments, given by Peter Thomasson, the company is following up its suppliers performances, whilst monthly updating suppliers' score cards in the special computer system. Every supplier has his own score card which includes such criteria as supplier's sales status, duality performance, delivery position, etc. Therefore, every supplier is being monitored; however, those ones who don't fulfil the criteria are being reviewed more often.

As for giving feedbacks, after reviewing suppliers' performance, V3P assessed this activity as a vital and necessary one. The company has an access to its suppliers' portals. Thus, the feedback is placed on the portal or, in case when particular suppliers don't provide with satisfactory evaluation results, they are contacted personally.

The next V3P's performed development activity is the supplier's site visit, which is one of the priority ones. The company is actively practicing their suppliers site visits, however, it is to be emphasized that the company visits suppliers only if they are involved in recently developed product, participate in current project or if suppliers are having problems.

Furthermore, in order to be the company's business partner, suppliers are obliged to have special certificates. The required certificates are ISO TS 16949 and ISO 14001 (the environmental certificate). In addition, to reward company's suppliers, the award programs exist and implemented by V3P for premium suppliers, which are selected according to the company's requirements and future company's focuses. Volvo 3P organizes such activity annually. Thus, for example, in 2006, 8 suppliers out of 50 were awarded.

Education and trainings were not emphasized by Volvo 3P as activities which are practiced in order to develop its suppliers. However, in the past, the trainings were organized by the company but not any longer. Therefore, to educate their suppliers, the company doesn't use any official methods, but provides them with the updated information on common business area through presentations and meetings.

In addition, V3P is inviting suppliers' personnel to the company and organizes a so-called "Suppliers Day". To draw an example from 2005, one hundred suppliers were invited to the company's office in Turkey, and were provided with a number of company's presentations. However, this activity is not of a great importance for the company, when comparing, for example, with such activities as formal supplier review, feedbacks, certificate programs, etc.

Talking about those activities, which include verbal and written requests, it is organized systematically by Volvo 3P. In order to make verbal request, the company is delivering presentations and organizing meetings. The written request is performed via internet, with the help of Electronic data Interchange (EDI) tools.

In addition to all before described activities, V3P emphasized top management involvement as another essential activity, which is in focus for the company. Officially, there is no suppliers' segmentation into A, B and C groups or using other ways to segment them. However, the premium suppliers are of priority for the company, considering its contribution to the V3P turnover. Thus, top managers organize meeting with the premium suppliers and actively participate and monitor its relationships.

Moving to the second group of the development activities framework – incentives – the company is considering both "promise of current benefits" and "promise of future benefits" as essential strategies. However, it is interesting to mention that volume criterion is the main incentive for V3P in order to become a premium supplier. The providing of new markets for suppliers, when the company is expanding, is an example on how V3P gives future benefits to its suppliers.

Finally, the company was questioned whether it uses enforced competition towards suppliers or not. Hence, typically, V3P has at least two alternative suppliers, which are competing for the company's volume. However, the cost is not the only consideration of the company, but also such criteria as quality, logistics conditions and product development capabilities are assessed. In order to choose the most suitable supplier, the firm needs to compromise and weighs all supplier's strength and weaknesses, according to the company's focuses.

Development activities	Rank (1-5)
<b>Direct firm's involvement</b>	
Official supplier evaluation/review	5
Feedbacks	5
Supplier site visits	5
Certification programs	5
Top managers involvement	5
Award programs	3
Trainings	0
Education	0
Inviting supplier personnel	3
Verbal or written request	4
<b>Incentives</b>	
Promise of current benefits	5
Promise of future benefits	5
<b>Enforced competition</b>	
Play off several suppliers	5

Table 19 - Supplier's development activities

### Conclusions

The results of the qualitative interview with the purchasing manager Peter Thomasson from V3P illustrate that the chosen theoretical framework was easily followed by the respondent and contained all development activities, which were considered by the company.

It can be summarized that the priority activities used by the company to develop its suppliers are official supplier evaluation/review, feedbacks, supplier site visits,



certification programs, top management involvement, promising of current and future benefits and enforced competition. In addition, top management involvement, award programs and verbal and written requests are of a secondary importance for the company. Finally, V3P doesn't officially organize any trainings or educational programs, referring to its high cost, however it was considered in past, but not any longer.

## Tacit knowledge transfer

As mentioned before, the supplier development activities are characterized into three groups: incentive, direct involvement and enforced competition. The incentives created for the suppliers' self-improvement would only provide limited help to solve the substantial problems when suppliers get no access to those capabilities they lack for. In other words, incentives are necessary but not sufficient for supplier development (Sako, 2003). Besides, the competitive pressures and reward systems may give rise to some side effects such as negative impacts on the buyer-seller relationship. On the other hand, direct firm involvement offers direct support to improve supplier' capabilities or to enable suppliers' new possibilities to either fulfil the commitments or meet procuring firms' future competitive demand.

The direct firm involvement generally consists of several different ways (Modi, et al., 2007). The simplest way is to invest capital and equipment into suppliers' operations while the second one suggests partially ownership of suppliers' firms (Monczka, et al., 1993; Krause, et al., 2000; Dyer, et al.). Both methods imply high intervention into supplier firms' financial and operational decisions, since the procuring firms have invested a considerable amount of money. The third way refers to knowledge transfer which calls for the input of procuring firms' human and organizational resources.

Basically, knowledge is distinguished into explicit knowledge and tacit knowledge depending on the possibility to structure and codify the knowledge (Herrgard, 2000). Regarding this principle, explicit knowledge is the information and capabilities that are easily recognized, codified, replicated and shared (Duanmu, et al., 2007; Modi, et al., 2007; Kogut, et al., 1996). In this sense, the transfer of explicit knowledge is a matter of information sharing which has been discussed in previous chapter. Tacit knowledge is perceived as the antithesis of tacit knowledge, which is difficult to be articulated and codified (Nonaka, 1991; Argote, et al., 2000; Kogut, et al., 1992; Foos, et al., 2006). And the most famous statement about tacit knowledge: "We know more than we can tell" (Polanyi, 1966). This knowledge usually resides within individuals and is quite subjective in some cases (Grant, 1996; Lord, et al., 2002; Nonaka, et al., 2000).

When looking at those studies of knowledge transfer, a trend can be observed that there is an increasing interest in dealing with tacit knowledge (Augier, et al., 1999; Herrgard, 2000). But compared to explicit knowledge, this field is still barely explored (Zack, 1999; Herrgard, 2000). From the knowledge management point of view, the transfer activities can be carried out either at the inter-firm

level or at the intra-firm level (Duanmu, et al., 2007). Therefore, in the supplier development context, knowledge transfer activities refer to the implementation of activities at the inter-firm level (Modi, et al., 2007). And in this section, the discussion is about tacit knowledge transfer across firms' boundary as an important way of performing supplier development.

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### **The characteristics and essential factors of tacit knowledge transfer**

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Many literatures indicate that tacit knowledge relies on individuals as the repository in the form of skills, know-how, and experience accumulated through practical operations etc. (Modi, et al., 2007; Grant, 1996). People who master the tacit knowledge may not know how to describe and formalize it. Meanwhile people who want to acquire the tacit knowledge cannot obtain it merely by reading instructions. The access to tacit knowledge is through application and practice with those people who already comprehend it. Accordingly, tacit knowledge transfer is a process of teaching and learning which need participation of bilateral firms.

This teaching and learning process concerns intensive communications and direct interaction among the personnel of procuring firm and their suppliers (Bresman, et al., 1999; Modi, et al., 2007; Nonaka, et al., 1995). Consequently, tacit knowledge transfer requires intensive time, money, personnel and trust investment (Szulanski, 2002; Modi, et al., 2007). This intrinsic feature of tacit knowledge makes the transfer work more based on long-term and high-involvement partnership between procuring firms and suppliers hence enables the communication and interaction (Handfield, et al., 2002). This is the precondition of performing tacit knowledge transfer.

According to Foos T. et al., (2006), in many cases, rather than being regarded as an individual issue, tacit knowledge transfer is just attached to projects. It is not even addressed during the project process, but just occurred in an informal and as needed manner. Moreover, being a part of project results in another problem. People in different levels of an organization are driven by distinctive goals and expectation. Senior managers always give a priority to the organization's long-term strategy while project managers only want to focus on present project.

In this case, breaking conventional routines i.e. taking tacit knowledge transfer as an independent project is recommended. A project team regarding knowledge transfer between procuring firm and suppliers should be established (Foos, et al., 2006). This is quite time-consuming and as mentioned before, should be based on trustful relationship. Besides, an independent supplier development project also brings forth problems. Sako (2003) stated this problem as the interdependence among a firm's supplier development process and other processes in the organization. Therefore, a trade-off between those two extremes are has to be seek carefully.

When implementing tacit knowledge transfer beyond the company boundary, the goals, involved resources, actors, activities, processes have to be clarified. The criteria for reviewing and assessing the transfer performance is said to be needed. However, there's few theory about how to build such a set of criteria, since it would be based very much on the both companies' agreement and perception of tacit knowledge.

As described by Sako (2003), knowledge transfer also gives rise to organization and governance problems. The input of procuring firms will intervene supplier's operations and decisions, thus *"the notion of the supplier company as an autonomous unit of organizational control is potentially undermined"*. In this sense, a right organizational structure which have the positive influence on tacit knowledge transfer is needed (Lord, et al., 2002).

So far, there's no systematic method in implementing tacit knowledge transfer which is widely exploited (Szulanski, 2002). Most literature conduct their study in the form of analyzing data acquiring form company survey and giving recommendations that mainly used by companies who are considered as being successful in terms of supplier development. But still, a company should build its own knowledge transfer process based on its culture and practical demand.

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### Tacit knowledge transfer activities

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The methods of tacit knowledge transfer itself can also be conceived as a tacit knowledge which is difficult to be replicated (Sako, 2003). A transfer process is hard to be developed only based on theories without real problem analysis, practice and application. Besides, the transfer activities are various regarding different companies and relationships. In most cases, the tacit knowledge transfer activities that companies engaged in include many visits, training and meetings etc. All those activities can be categorized into passive, proactive and collaborative as shown in Figure 35.

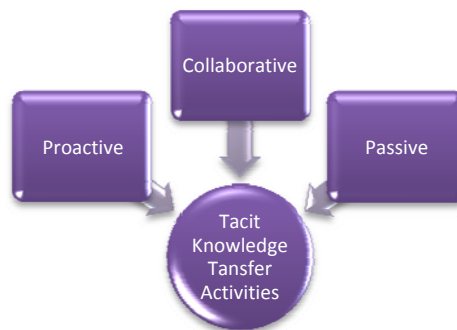


Figure 35 Category of tacit knowledge transfer activities

Some procuring firms send their personnel to supplier sites to perform improving activities (Modi, et al., 2007). For instance, *"in the automobile industry, automakers may send their own engineers to the*

supplier's shop floor to help solve a problem with a specific component in order to meet the product launch date" (Sako, 2003). This on-site assist can be perceived as passive tacit knowledge transfer effort since the knowledge still resides in procuring firm. In other words, the supplier's performance may be improved while its capability still remains unchanged.

Proactive activities refer to the "genuine knowledge transfer" (i.e. Tacit knowledge is really transferred from procuring firm's individuals to suppliers' individuals). To achieve this, the procuring firms usually provide training courses, seminars and site visits for suppliers' employees in techniques, operation process, and problem solving etc (Sako, 2003; Modi, et al., 2007). Compared to passive activities, apart from personnel devotion the procuring company has to spend more time and money on working out the proper way to carry out those activities.

Collaborative activities are more about involving suppliers into procuring firm's production or operations, increasing suppliers' awareness the company's products and in turn always keeping suppliers as the same quality level as the procuring firm (Sako, 2003). The early involvement of supplier represents a typical collaborative effort to diffuse tacit knowledge into suppliers, so that to achieve cost reduction and quality improvement by the efforts of both sides, which means the supplier development has been achieved from beginning and the avoidance of future problems.

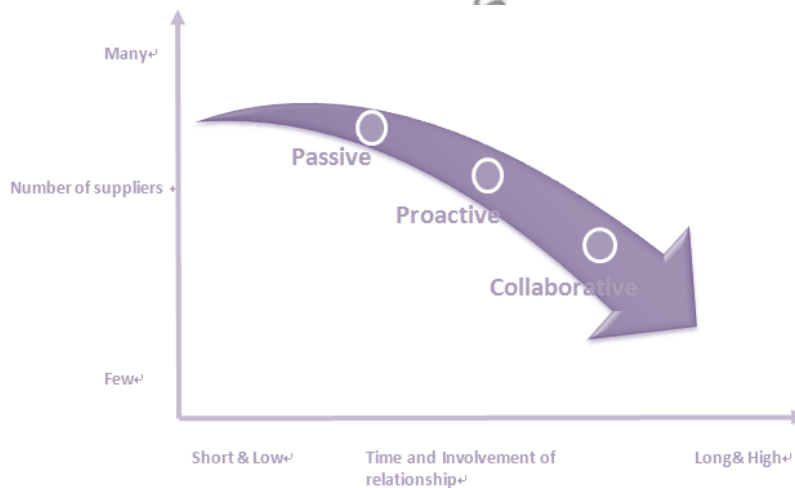


Figure 36 Selection of tacit knowledge transfer activities

Whether choose passive activities or proactive ones or collaborative ways to transfer tacit knowledge depends on the company's perception of supplier development and realistic demand. Figure 36 shows an example of selecting tacit knowledge transfer activities with two dimensions which are the closeness of relationship and number of suppliers. For instance, the collaborative activities should be undertaken with intensive efforts of bilateral firms. Apart from labors, capital, time and technique investment, collaborative will lead to organization and governance problems as mentioned before. The procuring firms and suppliers have to agree on a shared vision of value and routines (Li, 2005).

Consequently, all the features indicate a considerably deep relationship with suppliers, which explain why collaborative activities require the closest partnership among all the three types of activities. And those intensive efforts also limit the number of suppliers with which the procuring firm can carry out the collaborative activities. For instance, some companies only share their tacit knowledge with inner core which ranges from 25 companies at Nissan and 52 at Toyota, up to 63 at Honda (Sako, 2003).

Furthermore, passive methods are preferable when the procuring company concerns more about reserving their knowledge as a secret and preventing leakage to competitors or when the teaching-learning process is extremely complicated and time-consuming. Proactive ones are adopted by companies with the willingness to share its knowledge. The training course is especially practical when many suppliers need to be improved simultaneously. Collaborative efforts are most efficient in terms of strategic improvement of suppliers' capability i.e. enable the suppliers' possibility to meet future demand.

Besides, Sako (2003) introduced another way to classify tacit knowledge transfer activities. It is a model called organizational framework with two dimensions can be helpful in categorizing organizational capability (i.e. tacit knowledge), hence in identifying proper methods to develop suppliers. The first dimension is the type of capability (i.e. the procuring firms' ability to develop suppliers) which consists of maintenance capability, improvement capability and evolution capability (Fujimoto, 2002; Fujimoto, 1997).

1. Maintenance capability : the capability to maintain suppliers' performance to always meet the current demand constantly;
2. Improvement capability : the capability to improve suppliers' current performance to meet future demand;
3. Evolution capability: the capability for capability building.

The second dimension is the scope of development activity. The knowledge transfer or other development activities can be conducted for a single component production line, or within a factory, or beyond production (such as early involvement of suppliers), or in a companywide (Sako, 2003). With the help of this framework, the procuring firms can identify, categorize and select all those supplier development activities regarding their practical demand and limitations. And the same activity such as on-site visit, personnel training etc. can also be performed in different scope and according to different capabilities.

Another important point is, Knowledge transfer is inevitably connected with other supplier development methods and factors. For instance, incentives have significant impact on the effectiveness of knowledge transfer (Gupta, et al., 2000; Lord, et al., 2002). In Japan, suppliers' actions of acquiring capability from procuring firms are stimulated by incentives (Sako, 2003). Modi, et al., (2007) also stated that the three supplier development activities should be linked together with collaborative communication and bilateral top management involvement.

In conclusion, communication, trust and some other “soft side” factors together with transfer methods decide whether the procuring firms succeeded in tacit knowledge transfer. In this sense, assessing if one specific transfer method is useful would be an intricate process. However, these factors should be always kept in mind when carrying out tacit knowledge transfer i.e. mutual trust and intensive efforts which are constructed on long-term and high-involvement partnership.

## Conclusion

The chapter aimed at illustrating supplier development importance, its various activities and tacit knowledge transfer, which was emphasized by numerous of literature resources and case studies. Therefore, the importance of supplier development was analyzed in the perspective of total quality management and supply chain management. The first one focus on the impact of supplier development on procuring company itself, whilst the latter one concerns the overall performance of the supply chain. Then based on the scope of this chapter, the supplier development was simply defined as “efforts made by procuring firms to improve their suppliers’ performance and capabilities”.

In the following section, different ways how to group development activities was presented. However, the framework which contains segmentation into direct firm’s involvement, incentives and enforced competition was chosen. In addition, in order to provide with the practical example, the case study was presented. The results of the case study show that the interviewed company was emphasizing the following supplier development activities: official supplier evaluation/review, feedbacks, supplier site visits, and certification programs, top management involvement, promising of current and future benefits and enforced competition.

Out of the three supplier development methods, tacit knowledge transfer which belongs to direct involvement was elaborated in the following section. In the characteristics of tacit knowledge transfer part, the implicit nature of tacit knowledge which leads to the barrier of knowledge transfer was first discussed. The precondition of tacit knowledge transfer was then pointed out as long-term and high-involvement relationship. After that, the trade-off between attaching tacit knowledge transfer to other projects and having totally independent supplier development process was brought up. The section also touched upon the organization and governance problems resides within knowledge transfer activities.

A classification of tacit knowledge transfer activities was introduced in the next section, which divide the activities into three groups: passive, proactive, collaborative. Some realistic activities that were already adopted by companies were exemplified to support each type of activities. Additionally, another model called organizational framework which was described in the literature was also mentioned as an optional method to categorize tacit knowledge transfer.

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## [13] Supplier development with quality focus

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*This chapter deals with supplier development with quality focus and also shortly touches upon supplier quality development in developing countries. The chapter will present a definition of supplier development and a conceptual description of quality. This is followed by the main study which consists of a description and analysis of different activities for supplier quality development. The chapter also includes a case study from Volvo 3P related to the topic.*



## Purpose

The quality of a product is not only depending on the buying manufacturers own operations since outsourcing of manufacturing operations and production components have increased. This means that the share of the end products which consist of supplied components has increased significantly. On the other hand, there still exist possible improvements that the buying company can do and new fields regarding supplier quality development can be found in literature.

The purpose of this chapter is to describe the state-of-the-art of supplier quality development and the content is based both on literature and business practice. It aims to give a bilateral view of supplier quality development activities and programs. Furthermore the chapter aims to make a modest contribution to both literature and to business practices.

## Introduction

As network approaches become more commonly practiced within the business world, especially in Europe, it becomes more important for companies, especially big companies with complex supply chain systems, to focus on their supplier base. Manufacturing companies cannot be considered as independent actors on the market anymore since their production output is heavily dependent on their supplier's performances (Waller, 2004). Manufacturing organizations must, therefore, focus their attention on their suppliers' performances to be able to secure that their end customers' requirements will be met and result in total customer satisfaction. (Cormican, et al., 2007)

Not all companies want to handle or deal with their suppliers to improve them. This can be explained by different reasons, just to name a few, the company can lack of interest regarding this, since they might feel it is: unnecessary - especially with suppliers which is located close geographically, and with similar technical development level, unrealistic - reasoning that it would be almost impossible to develop the supplier by externally efforts like pushing them to reach progress, intimidating -being afraid of information sharing for competitive reasons or they might not have time to handle these issues -being already occupied with managing their own businesses.

Still, the reasons above do not lessen the importance of supplier development. As many business organizations see the need of diversifying their supplier base towards developing and lower cost countries, supplier development becomes an inevitable requirement for them to run their business. Suppliers in developing countries might be cheaper and more flexible than their western competitors but it is clear that many of them are lacking in competitiveness when it comes to modern business requirements and in many cases also quality. Therefore, supplier development is an interesting and needful topic to study.

In other words this chapter will focus on supplier development, with some references on supplier relationship development. The chapter will also focus on supplier relations and development with suppliers located in low cost countries on other geographic markets. The basic reasoning to the chapters focus on suppliers located in these low cost countries is that it often is more difficult to have really proper relationships with suppliers from far geographies and with different business culture than the buying firm.

This chapter will also put main focus on supplier quality development and also will specifically touch upon development of non-western suppliers. The case study in the end of this chapter will be based on an interview with a business professional from Volvo 3Ps Business Unit. Findings from the case study will later in this chapter be analyzed based on theory and literature. The analysis will be presented in the summary and conclusion part of this chapter.

## Concept of supplier development and its quality implications

This part will define some terms and concepts useful for this chapter. In other words this part will provide the framework of knowledge that the reader needs to have to fully understand the purpose and the content of this study. Hahn et al (1990) defines supplier development as “*any systematic organizational effort to create and maintain a network of competent suppliers*”. Following, Hahn et al (1990) broke down this definition into two perspectives. One was “*creation of new sources of supply when there are no adequate suppliers to meet firm’s requirements*” and the other one was “*long term cooperation effort between buying firm and its suppliers to upgrade the suppliers’ technical, quality, delivery, and cost capabilities and to foster ongoing improvements*”. (Hahn, et al., 1990)

Quality management is a very important field in business environment and it has received much attention from both literature and business practices. Many different methods to improve quality have been implemented by business organizations such as TQM, FMEA (Failure Modes and Effects Analysis), Six Sigma, Kaizen etc. Furthermore, several international organizations such as ISO, has developed quality standards for companies and different businesses. However, as it has been traditionally an internal focus it did not receive much attention in the supply chain field until recently. So, since this chapter focuses on quality, a description of some known quality dimensions could help to give a better understanding of this topic. Forker (1997) presents the quality dimension as:

- i. *Performance*: the product's primary operating characteristics
- ii. *Features*: attributes that supplement the product's primary operating characteristics
- iii. *Reliability*: the probability of a product failing within a specified time period
- iv. *Conformance*: the extent to which a product's design and operating characteristics meet predetermined standards

- v. *Durability*: the amount of use a product offers a consumer before the product deteriorates
- vi. *Serviceability*: how fast, how easily, and with what degree of courtesy and competence repairs are performed
- vii. *Aesthetics*: how a product appeals to the five senses
- viii. *Perceived quality*: reputation, image, or other inferences regarding the attributes of a product

As seen above quality has a very broad base of dimensions and quality is relevant in many aspects and in every level of quality the supplier's deliveries are important factors regarding the quality of the buying firm's output. Moreover, as can be seen in the definition of supplier development, quality is one of the most important and inevitable aspects of supplier development. It would not be wrong stating that quality development is a very basic and initial level of supplier development. Without ensuring the quality level of a supplier's delivery of goods or services supplier development efforts will not be successful and activities like involving suppliers in product development will be problematic. Quality has also been proven to correlate with productivity and an increased quality leads to an increased productivity (Gitlow, et al., 1983). All these things together are the main reasoning for presenting supplier quality development phases and activities in the next part of this chapter.

## Supplier quality development phases and activities

Figure 37 below is taken from Trent et al (1999) and will be the base literature source for this part. Other complementary or differing perspectives will also be presented, but just briefly. The findings mentioned in this part are based on a broad survey, which is based on questions and answers from executive managers working at different types of companies on the American market. Figure 37 presents a hierarchy of activities that often supports world-class supplier quality performance and which also helps to ensure the achievement of current and future customer quality expectations (Trent, et al., 1999). The hierarchy of suggested activities is as follows:

1. **Optimize supplier base to a manageable level:** Surely, pursuing value added activities with 250 suppliers would be easier than 4000 suppliers. Eliminating incompetent or infeasible suppliers should be the first step to take in this initial action. (Cormican, et al., 2007)
2. **Measure supplier quality performance:** Continuous, dynamic and in some cases even mutual measurement of suppliers' quality performance is vital. It can be done in align with other measurement and evaluation systems such as, overall supplier evaluation. a (Chin, et al., 2006), (Cormican, et al., 2007)
3. **Establish aggressive supplier improvement targets:** This activity is related to the competition between the buying firm and its suppliers. This method is based on that the suppliers need to

increase their quality performance level faster than their competitors; otherwise they will lose their business. It is a demanding approach, from the supplier's point of view, but if the method can be managed actively great positive benefits can be gained.

4. **Reward superior supplier performance and improvement:** Reward is always a tempting offer to motivate suppliers to improve their quality levels. One example of rewards is to share the benefits, resulting from supplier-initiated improvements, by offer the improved supplier a greater share of a buyer's total volume.
5. **Certify supplier processes and methods:** Certification helps to assure that the supplier's processes and operating methods are in control. That often limits the need for inspections of incoming supplier material and components. It should be a challenging to get a certificate and the decision about approving a supplier should be taken mutually by cross-functional teams and perhaps with help of external consultancy. When the supplier is approved and has received the certificate the buyer should remove unnecessary quality securing processes, such as eliminating inspections of incoming material and components.
6. **Commit the necessary resources to supplier development:** This next step comes with more challenges and more resource needs, compared with the earlier steps mentioned in this part of the chapter. This step should only be performed after a rationalization process of the supplier base (see step 1). Nowadays, many companies has realized the importance of this issue and begun to devote more resources to improve supplier quality performance. For instance, Honda commits to supplier quality development 40 full-time engineers in the purchasing department, these engineers work with improving the supplier's productivity and quality. The suppliers receive technical support in form of a Honda "quality up" program, which aim is to work directly verses the executive management team at a poorly performing supplier's production site.
7. **Involve suppliers early in product and process development:** This activity strive to maximize the benefit received from a supplier's engineering, design, testing, manufacturing and tooling resources. Qualified suppliers, which take part directly in a cross-functional product development team at the buyer, can provide early insight into the production processes. Furthermore, by involving and inviting a supplier to take part in these types of R&D projects can lead to better design solutions regarding quality and the need of production resources (Trent, et al., 1999), which often leads to both better quality and a lower purchasing prices. This is an important step of supplier quality development although it improves both the suppliers and the buying firm's quality. As touched upon in the privies step, the level of supplier relationship is extremely important in this activity as well. The buyer and the supplier needs to have a relationship which strives to achieve, an as closely to optimum, win-win solution for both parts.



Figure 37 - Achieving World-Class Supplier Quality (Trent, et al., 1999)

Figure 37 presents activities in 3 dimensions, all three go from basic and simple ones to more advanced and challenging ones, but of course the possible improvements that can be gained also increase. Two important things that must not be overlooked are the fact that, at the same time as the activities escalates in the hierarchy the involvement of top management and mutual efforts becomes more and more necessary. One more solution is that the buying firms also can support suppliers regarding improvements in their quality improvement programs. On the other hand, vertical integration is not a suitable solution since vertical integration may result in loss of focus, there may be diseconomies of scale in managing vertically integrated firms and the bargaining power of the vertically integrated supplier may reappear within corporate divisions after vertical integration. (Helper, et al., 1992)

In his PhD report Krause (1995) presents several activities to develop suppliers' performance, these activities partly overlap with the above mentioned steps. Krause's suggestions are: introducing competition into supplier base, supplier evaluation, raising performance expectations, recognitions and awards, the promise of future benefits, training and education of suppliers' personnel, ongoing and frequent communication, long term relationships, exchange of personnel between buying firm and supplier, and direct investment in the supplier by the buying firm. It should be noted that all findings presented in the report are based on several and serious studies and have been proved their benefit in most cases. Yet, they will not be described in detail in this chapter to avoid repetition.

## Supplier quality development in developing countries

Under the influence of globalization and free-market trends western companies face serious competition from low-cost countries due to strong pressure on cost. This fact has led companies to expand their sourcing operations into developing countries to seek for low cost suppliers. Unsurprisingly, lower prices do not come for free and well-established western companies face problems especially in quality aspects with their sourcing partners. This quality issue has its root cause in existing difference between the buyer and the low-cost suppliers' business environment, culture, and perspectives. Eatkins (2005) claims that quality development of global suppliers is more problematic because of cultural barriers, technical and quality capabilities and hurdles -including the tendency to cheat the system-, systematic concerns, and financial resource issues, such as liquidity, willingness and ability to invest. These facts come as a strong challenge and amplify the importance of supplier quality development in developing countries.

As challenges are different activities to pursue supplier quality development in developing countries also are different to some extent. First of all selection and pre-evaluation of the suppliers is a vital requirement. As it would be difficult to evaluate them objectively because of long geographical distance between the supplier and the buyer, dependence on international quality standard organizations such as ISO must increase. Supporting findings stating that ISO 9000 registered companies exhibit higher levels of quality, leadership, information sharing, analysis skill, strategic quality planning, quality assurance, and quality results has been found in an empirical study done by (Roa, et al., 1997). However, western companies should still be very careful evaluating suppliers which have ISO certificates. This is because there could be some supplier that exaggerate their quality outputs until receiving the certification and going back to old, lacking habitual way of conducting operations.

Another relatively new and interesting approach to supplier quality development in developing countries is to use benchmarking activities. For quality management, benchmarking traditionally is an internally focused activity. Benchmarking is beneficial since many methods already have been developed and described by academic literature and since many methods and concepts already have been successful implemented in the real business world. Transferring the existing knowledge, skills, and experience of highly competent suppliers especially regarding quality to the poorly performing suppliers should be easier than to initiate the development activities from a very early phase.

There exist several studies in the academic literature that describes benchmarking methods, yet firms can -if wanted and needed- create and follow their own way of benchmarking, based on their own needs, regarding supplier development. Two of the methods or tools to be followed when benchmarking supplier is described in studies done by Forker (2001) and Choy (2002).

### Case study: Volvo 3p (2)

The case study is handled as an interview with Mr. Peter Thomasson from the International Purchasing Department of Volvo 3P. Findings will be presented below without stating the questions as they are considered as peripheral compared to the information given.

#### Case description

**Company profile:** Volvo 3P is the business unit (BU) responsible for product planning, product development and purchasing for the four truck companies, Volvo Trucks, Mack Trucks, Nissan Diesel and Renault Trucks and works as consultant in stated areas. BU has around 3000 highly qualified employees in several countries where Volvo Group exists but mainly located in Gothenburg and Lyon. When it comes to purchasing BU is responsible only for procurement of components used in the trucks which contribute more than % 70 of the whole truck's value and together with Volvo Powertrain make purchases for nearly SEK 70 billion and the Volvo Group invests about SEK 8 billion in research and development. As stated, BU is only responsible for component procurement to be able to focus solely on that area. Other types purchasing activities such as services, maintenance, repair, operating supplies and equipments used in facilities are mainly conducted by the NAP (Non-Automotive Purchasing) section of the group.

**Supplier selection criteria and quality perspective of the BU:** Volvo 3P has highly developed and complex supplier selection process as they are known as fussy in supplier selection. It is not going to be presented here because it is out of topic range but it is worth mentioning that 4 key criteria in supplier selection are respectively Quality, Cost, Delivery, and Features. Volvo 3P has its own quality perspective. Firstly, to be considered as a supplier with good quality, not more than 40 of the supplied components out of 1 million should be failed functioning. Secondly, delivery is an important component of the quality. Lastly, a more subjective perception within Volvo 3P is that supplier would be considered to have good quality if their level is above expectations.

**How does Volvo 3P conducts supplier quality development relatively to the model given by Trent and Monczka, (1999)?:** Although, Volvo 3P does not take the presented model as its main guideline, BU has many activities conducted to develop supplier quality that overlap with Trent and Monczka's, (1999) model. Overlaps are shortly stated below.

*Optimize supplier base to a manageable level:* Volvo 3P is already known for its picky supplier selection model. The company has 100 evaluation metrics applied in a pre-selection period which some of them classified as vital –without meeting that specific metric it is impossible to go through the pre-evaluation process- and additionally suppliers have to meet at least 60 of these metrics to be a supplier of the Volvo Group. As it is already difficult to be a supplier of Volvo 3P, BU applies a Global Purchasing

Management (GPM) program towards its suppliers to optimize the current supplier base to a manageable level.

*Measure supplier quality performance:* BU has 2 models implemented for supplier quality performance measurement and evaluation. The first one is called Quality Performance Measurement (QPM). With this program suppliers' quality is periodically measured and feedbacks are given to them accordingly. Second one is called Supplier Evaluation Model (SEM) and has a similar approach but with a broader perspective applying to other areas as well such as costs and deliveries.

*Establish aggressive supplier improvement targets:* Inspired by its best peer suppliers, Volvo 3P implemented aggressive supplier improvement targets called *Premium Supplier* and BU has some incentives that are mentioned below for the ones which are classified in this group. According to Mr. Thomasson the criteria for being classified in this group is tough and complex and not many of the suppliers are able to fulfil that demand.

*Reward superior supplier performance and improvement:* Relevant to putting aggressive improvement targets some of the suppliers who have been classified as *Premium Supplier* are given some kind of rewards mostly as recognition and higher margin. Last only 40 of thousands suppliers are classified as *Premium Supplier* and only 8 out of 40 has been rewarded after the elimination processes based on some subjective criteria.

*Certify supplier processes and methods:* BU did not develop a specific certification program to certify its suppliers however it uses indices prepared for some of the fields that function somehow as certification. Volvo 3P also exploits certifications presented by international organizations. Mr. Thomasson stated that it is difficult and not worth to develop a certification model specific for Volvo Group.

*Commit the necessary resources to supplier development:* BU does not commit any significant resources to improve supplier quality for the reasons given below in the Volvo Way subsection.

*Involve suppliers early in product and process development:* It is technically one of the most important aspects for Volvo 3P to conduct. As majority of the components in the trucks are produced by suppliers and as these areas are not considered as core competence by Volvo, suppliers have been deeply involved in product and process development for 15 years. Indeed, they are almost completely free in developing their own components to Volvo. Suppliers only receive rough drawings and standards required by company and free to continue dominantly involving development of the products. Core competence areas where suppliers are not involved in product development in the Volvo Group are: powertrain, outer design of the truck and sheet metal.



**Volvo way:** Although, many activities of Volvo 3P overlap with the model presented above, BU has its own understanding and methods used in supplier quality development. First of all, the main focus in Volvo 3P is not continuously improving quality level of suppliers as Mr. Thomasson thinks that it would take many efforts that would not give required output. All suppliers are important to Volvo 3P and it is not desired to change suppliers too often that keep quality requirements of selected supplier in a relatively moderate level. If the supplier is good enough and Bu is satisfied, no quality development program is applied and everything proceeds in its usual and low intense level. Quality development programs that are mentioned above mostly applied to suppliers who show decreasing or poor quality. This is especially true for the suppliers who might perform poor but supply vital components to the Group. Mr. Thomasson says that these types of suppliers are the most prioritized suppliers for quality improvement activities. Volvo 3P commits resources solely for this type of suppliers to improve their quality level. For instance, site visits with quality engineers to audit only implemented towards that low performing critical suppliers.

A specific model is applied for low performing critical suppliers. The model consists of 4 steps taken by Volvo 3P. First step taken is a diagnosis of the problem. Within this step the question of "What is the problem?" is answered by necessary analyses conducted to describe the problem in detail. With second step called "Alert" relevant employees of the Volvo 3P are involved to solve suppliers' quality problems. The third step is called "Alarm" and is only conducted if the second step did not provide a positive output. Within this step Volvo 3P simply involves more people to solve the problem. The forth step is called "Critical" and consist of 2 choices: if low performing critical supplier perform better go back to normal and if not quit the supplier and start changing supplier processes. Therefore, it can be concluded for Volvo 3P that they apply both perspectives of supplier development referring the definition with two perspectives given above.

**Supplier quality development in developing countries:** It is evident that Volvo 3P currently does not have any significantly different activities towards suppliers from developing countries in quality development wise. On the other hand, BU has applied specialized and focused quality development programs for suppliers from countries such as Hungary, Poland, and Slovakia. The reason that currently Volvo 3P's quality development is not different in western and main developing countries is that there are no significant differences between suppliers from Sweden and suppliers from Turkey anymore. They basically have the same standards and apply to the same quality methods in production. However, slight differences in Russia –Volvo's new growing market and the country where a new plant will be located- occur. Currently, there are no suppliers supplying components to Volvo 3P in Russia due to quality and communication problems. As Volvo 3P will have to get new suppliers from the country because of trends and requirements, BU is currently conducting education programs for Russian automotive suppliers with the help of international organizations to inform about

Volvo's requirements and expectations and help them to reach the requested quality level.

## Conclusion

This chapter strived to clarify and describe some insights and guidelines within the state-of-the-art regarding supplier quality development. Possible differences in choice of developing activities has been conducted and compared between western suppliers and suppliers in developing countries, although there were no clear findings in the case study compared to what literature suggests.

It is clear that activities suggested for supplier quality development is not rocket science or something mystique. Probably, many of them have been known to business environments for quite some time and it seems that there is no need to use scientifically complex systems to conduct them. On the other hand, the human factor should not be forgotten. As interactions between two different business actors with human factors and different environments affecting them are required, this would be the main obstacle to run aforementioned programs. Still, as studies, surveys, and business cases show supplier quality development is beneficial for buying firms, if they are conducted carefully and devotedly.

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## [14] Supplier-buyer collaboration, one way to reach success

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*Collaboration in supplier-buyer relationships can result in benefits regarding purchasing performance. This chapter outlines performance factors which influences purchasing performance. Furthermore underlying conditions and influencing measures that impacts the performance factors are presented. A small literature study review of four studies is also presented, conducting the performance factors and their impact on purchasing performance, regarding collaboration in relationships.*

## Introduction

Collaboration in buyer-supplier relationships and its impact on purchasing performance has come more into the spotlight and generated increasing interest within recent time. Buyer-supplier interactions have developed from arm-length relationships based on transaction processes to collaborative relationships, which are based on information sharing and trust (Hoyt, et al., 2000).

In addition Horvath (2001) states that collaboration is the driving force of effective and strategic supply chain management. Furthermore collaboration is required among all participants within the whole value chain. Thereby companies can expect benefits and improvements from strategic supply chain management. These benefits can be divided time wise:

- ✘ Immediate benefits: Reduction in terms of inventory risks and costs as well as warehousing, distribution and transportation costs.
- ✘ Long-term benefits: Cost reduction through increased productivity as well as streamlined business processes in procurement and purchasing, order fulfillment, receivable and payable accounts and exception management. (Horvath, 2001)

Furthermore these benefits can be measured in terms of purchasing performance. Morrissey and Pittaway (2004) suggest the following key attributes to measure companies' performance:

- ✘ Quality: The quality of products can be heavily influenced by the quality of its supplied components. Failure in quality has more often a higher negative effect on the manufacturer than on the supplier. However even due financial compensation can be provided, the reputational damage is not transferable through the supply chain.
- ✘ Price: Buying companies need to secure the cost of supplies from the market to be able to control their efficiency. Taking into consideration that usually more than 50 per cent of their organizational turnover is represented by supply costs, the potential impact of price on the company's profitability can't be underrated.
- ✘ Service: The continuous development of products tending towards commodities caused by increased global competition reduces the range of product and price differentiation. Therefore companies focus and compete on service elements. Herein after sales service, delivery and lead time can be improved by focusing on the supplier base.

The purpose of this chapter is to provide an overview of the different performance factors purchasing performance is measurable with. In addition underlying conditions and factors influencing the performance are presented. Therefore a small literature review containing four studies is conducted. The studies are introduced and their key performance factors as well as influencing conditions are pointed out. Thereafter results and findings from these studies are presented, followed by a

conclusion outlining the connection between collaboration in buyer-supplier relationships and purchasing performance.

## The studies: Review

Four empirical studies researched within the last 3 years are presented, all examining different business areas in different parts of the world. The studies all focus on collaboration in buyer-supplier relationships in combination with performance measures.

### Corsten and Felde

Corsten and Felde (2005) investigate performance effects resulting from buyer-supplier collaboration in their study. In addition the conditions are researched under which these effects occur. In order to measure performance effects, they focused on three performance factors to evaluate and compare with the industrial average:

1. Innovation: As a success factor in terms of reduced R&D expenses in combination with the product and process improvement level.
2. Purchasing cost reduction: As a success factor containing communication, transportation and ordering costs.
3. Financial performance: As a success factor including the return on assets and the return on sales.

Furthermore trust and dependency are introduced as underlying conditions for investigating the performance effects. Corsten and Felde (2005) argue that trust and dependence can be seen as influencing conditions for the relationship between collaboration and performance. Hereby among others they follow the argumentation that trust can have a positive effect on innovation (Hamel, 1991) and that dependency can have a negative effect on financial performance (Heide, et al., 1988). Their empirical study is based on a sample of 135 cross sectional buyer-supplier relationships in Switzerland, whereby the focus lays on the collaboration of buyers with their key OEM-suppliers.

### Oh and Rhee

Another study by Oh and Rhee (2008) examines different types of buyer-supplier collaboration and investigates conditions affecting these collaboration types. The study focuses on the Korean automotive industry, where an empirical survey is conducted to analyze the collaborations between the Hyundai-Kia Motors Corporation and 94 of their first tier suppliers. Oh and Rhee defines five different types of collaboration in their study, adjusted to the automotive industry environment:

1. Collaborative communication: In terms of intent and information sharing and exchange.
2. Collaboration in new car development: Involving new car design, quality evaluation and specification discussion.
3. Collaborative problem solving: Routine problem solving regarding cost, utility, delivery and payment.
4. Strategic purchasing: In terms of supplier evaluation and supplier selection.
5. Supplier development: In terms of assisting suppliers' capability development.

Besides collaboration the focus for this study is limited to the last two types, in order to follow the scope of the chapter. Factors influencing the collaboration regarding strategic purchasing and supplier development are stated in the study in terms of module capability, second tier supplier development and coordination capability as well as flexibility capability. As an additional underlying condition technology uncertainty is introduced to investigate its interaction with the influencing factors.

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### **Gonzalez-Benito**

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The study by Gonzalez-Benito (2007) investigates the relationships between information technology (IT) investments and operational performance in purchasing. Hereby the strategic integration of purchasing in companies is considered as an inducing factor for the implementation of advanced purchasing practices. Besides the practices carried out to establish collaborative relationships between buyer and supplier also supplier evaluation, supplier involvement and logistics integration are taken into account. Furthermore the implementation of advanced purchasing practices is considered as an underlying and mediating factor for the relationship between IT investment and operational performance. Hereby operational performance in purchasing is measured regarding the factors cost, quality, dependability and flexibility following the proposition of Hayes and Wheelwright (1988), who describe them as the basic competitive priorities for the production function. The empirical study is based on 141 medium and large Spanish companies from the three industry sectors industrial and commercial machinery, electronic and other electrical equipment and transportation equipment.

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### **Vereecke and Muylle**

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Vereecke and Muylle (2006) examine the relationship between supply chain collaboration and performance improvement in their study. They investigate the effect of information exchange and structural collaboration on performance improvement. Both factors are studied for supplier and buyer separately as well as for companies relating the factors with both supplier and buyer. To measure performance improvement 12 different variables are defined, which can be grouped as follows:

1. Delivery performance: Including delivery speed, customer service and delivery reliability.
2. Cost: Including labor productivity, capacity utilization and inventory turnover.

3. Procurement performance: Including procurement cost and procurement lead time.
4. Flexibility: Including volume flexibility and mix flexibility.
5. Quality: Including product quality and manufacturing conformance.

The empirical study includes 374 companies from the engineering and assembly industry. The companies are situated in 11 European countries: Belgium, Denmark, Germany, Hungary, Italy, Ireland, The Netherlands, Norway, Spain, Sweden and the United Kingdom.

An overview of the four different studies and their key performance factors as well as the conditions and factors influencing them is stated in the following table:

Study:	Research area:	Performance factors:	Underlying conditions, influencing factors
Corsten and Felde (2005)	135 cross sectional OEM-supplier in Switzerland	Innovation Purchasing performance Financial performance	Collaboration Trust Dependence
Oh and Rhee (2008)	94 first tier suppliers of Hyundai-Kia Motors Corporation, Korea	Strategic purchasing Supplier development	Module capability Second tier supplier development Coordination capability Flexibility capability Technological uncertainty
Gonzalez-Benito (2007)	41 medium and large Spanish companies from three industry sectors	Quality Cost Dependency Flexibility	Collaborative relationships Supplier evaluation Supplier involvement Logistics integration
Vereecke and Muylle (2006)	374 companies from the engineering/assembly industry, 11 European countries	Delivery performance Cost Procurement performance Flexibility Quality	Information exchange Structural collaboration

Table 20 – Studies overview.

## The studies: Results and findings

The study of Corsten and Felde (2005) conducts that regarding the innovation level all three factors collaboration, trust and dependence have an influencing effect. Corsten and Felde (2005) argue that even in collaborations involving powerful suppliers the knowledge and information exchange enhances the buying company's innovation level. Regarding purchasing costs only trust can be found having a reducing effect. Furthermore regarding financial performance only collaboration has an increasing effect. The other underlying factors are not significant for these performance factors. By



measuring different levels of trust and dependence often results in that collaboration gets a stronger effect on financial performance, at a low trust level as well as at a low dependency level. Furthermore collaboration is also having a stronger effect on innovation at a low dependency level. It is argued that repealing alternative supply sources by powerful buyers often results in stronger safeguard effect of collaboration at low levels of trust.

Oh and Rhee (2008) present in their study that the strategic purchasing module capability and second tier supplier development often have a positive effect on efficiency. Furthermore the combination of technology uncertainty, flexibility capability, module capability and second tier supplier development often has a negative effect, whereas only cost reduction capability has a positive effect on strategic purchasing. For supplier development only flexibility capability and second tier supplier development are found to have a positive effect. In combination with technology uncertainty no significant effect can be found regarding supplier development. It is argued that the identification of suppliers with strong module capability requires efforts in expanding strategic purchasing and can thereby strengthen collaboration by itself. Also the positive effects from second tier supplier development will enhance not only their own, but in addition to first tier suppliers' capability and thereby strengthen the collaboration regarding strategic purchasing and supplier development.

The results from the study of Gonzalez-Benito (2007) show that a relationship exists between IT investment and operational performance in the purchasing function. Furthermore the implementation of advanced purchasing practices enables the company to improve its operational performance. Especially for improving quality, dependency and flexibility by IT investments, these advanced practices are significant. Furthermore all four mediating factors of the advanced practices contribute with a positive effect on operational performance in purchasing and on their performance factors. It is argued that these effects are caused by IT investments by supporting companies to implement advanced purchasing practices and also alleviating strategic integration in purchasing.

The results in the study of Vereecke and Muylle (2006), state that a positive association of information exchange and structural collaboration with all performance factors exists on a weak bases, both for supplier and buyer separately. Regarding companies relating the factors with both supplier and buyers only partial support can be found for the assumption that these companies have the largest performance improvement, still all performance factors have positive improvement effects for both information exchange and structural collaboration. It is argued that the positive relationship between the performance factors and both of the conditions exists and that improvements go hand in hand for both parts, but it is also important to mention that this improvements can be small and not always considerable.

## Conclusion

The results and findings from the studies have shown that collaboration in buyer-supplier relationships in different settings can lead to improving performance regarding purchasing. However collaboration is not a guaranteed way to success, it requires the right conditions and circumstances which have supporting effects on performance improvements. Therefore a wider focus on the whole supply chain is required. This focus should taking all participants in the value chain into consideration and implementing collaborative processes among them, benefit in terms of performance improvements can then be gained. Some collaborative practices to perform can include information sharing, IT implementation, supplier evaluation, selection and development, which are discussed more detailed in previous chapters as well as in the following chapter of this book.

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## [15] Information sharing, the driver of a proficient buyer-supplier relationship

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*The aim of this chapter is to elaborate the importance of considering information sharing within a buyer-supplier relationship. Focus will be on declaring the beneficial aspects of a frequent level of information sharing between buyers and suppliers. A US-Japanese case study involving the companies Cummins and Toshiba will also be examined and the findings from this case will be presented in the analytical part of this chapter.*

## Introduction

Today information sharing is a key issue when it comes to vertically integration between firms. Hence, to evolve valuable relationships is of major importance when it comes to acquiring a sufficient buyer-supplier relationship. Basically, better technical understanding from the customers will increase the production performance among involved suppliers (Rippa, 2007). Furthermore, increased supplier performance may result in lower prices and better conditions for improved quality. Despite the recognition of value adding by considering information and knowledge sharing, many firms have failed to create such value adding relationships. One problematic factor of this is poor transaction of information within the supply chain. However, lacks of knowledge or reluctance are also considerable factors of failure in this area. An appropriate level of information sharing between a buyer and supplier may result in significant improved integration and thereby enhanced technical performance for both counterparts. By this, supportive relationships must be considered to strengthen the cooperation and the links in a relationship.

Making use of common information is additionally a way to face improvements of uncertainties that occur through the supply chain. In this way, the structure of a company's internal and external activities will play a significant role in order to enable sufficient information sharing. The interaction between human resources, likes employees, and technology needs to be coordinated with information and coordination technologies (Bönte, et al.).

This chapter will encompass the importance of considering information sharing, and the futuristic advantages of maintaining a buyer-supplier relationship. The study is also intended to emphasize the link between information sharing and a proficient buyer-supplier relationship. In addition, the disclosure of knowledge sharing and an efficient value adding relationship will also be elaborated.

This chapter is structured as follows: At first, the conceptual framework will address issues regarding the crucial role of information sharing in a buyer-supplier relationship. Subsequently, the case of Cummins and Toshiba will be illustrated in order to exhibit a present situation between buyer and supplier. The case study will be followed up by an analytical part which aims to elaborate the academic issues in the conceptual framework with the case of Cummins and Toshiba. Finally, a conclusion will compare the chapter of important inputs in regards to the executed study.

## Conceptual framework

This part is intended to consider theoretical information in regards to information sharing in buyer-supplier relationships, which will further on be exploited in the analytical discussion.

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## Information sharing in buyer-supplier relationship

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(Handfield, et al., 1999) State that information sharing is one of the core issues in supply chain management and purchasing excellence. It is possible to categorize information sharing after two common variants as it transpires. The first one is known as “purchasing information sharing”; in this case the buyer reveals operational information, examples, number of purchasing orders etc. The second variant is “supply chain information sharing”, here the buyer has access to tactical information such as inventory levels, order specifications and sales and operation plans etc (Kulchitsky, et al., 2007). Moreover, supply chain relationships may consist of proper information sharing and common development of activity structures (Liker, et al., 2004).

Also the sustainable supply of information, products and services are crucial in supply chain management. In order to achieve the sustainability, relationships should be considered between appropriate partners. This is the way to manage uncertainties and enhance the level of exchange of knowledge and information (Lambert, 2008).

The relationship within the supply chain does not only represent the connection to one specific partner, but also how the firm is connected to other members within the supply chain. The buyer and supplier relationship may be identified after these two connections of a firm in the supply chain, but the two connections should also be considered as interdependent factors in accordance with the relationship and the belonging supply chain design. As conclusion of this, information sharing can be considered as links between supplier relationships.

A successful exchange of information sharing may be distinguished as three beneficial aspects. At first, the business transaction of information will occur throughout the supply chain. Secondly, the buyer and supplier can be more interdependent; due to that information will be available more openly for the both parts. And lastly, the members of the supply chain can work with new information and achieve enhanced integration and exchange of competences such as information and knowledge. In this way, the competences among the partners can be jointly exploited and the individual firm's performance will be significantly improved (Hsu, et al., 2008)

In order to establish productive relationships with suppliers, an understanding of the linkage between supplier and buyer is necessary. This is also necessary when it comes to the disclosure of consequences of the firm's performance and needed capabilities (Truman, 2000).

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## **Benefits of information sharing in buyer-supplier relationship**

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Gadde, et al. (2007) mention that the firm is enclosed by various types of boundaries. The boundaries of information and knowledge are of major importance to exchange with an appropriate business partner. Additionally, the consumer requirements can with more successfulness be achieved if appropriately information is being shared between the buyer and supplier. In these ways, products and services from competitors may be significantly improved. The firm may improve the accessibility to additional resources within the boundaries and in this matter the collaboration between suppliers with vital resources is a valuable resource by itself (Hunt, 2000). The buyers are normally interested in finding appropriate suppliers with vital resources to engage relationships with. In this sense, proper information and knowledge as well as risk can be exchanged. The outcome of a long term buyer-supplier relationship will be improved coordination of business process and enhanced flexibility of resource combining. In the coordination process both parts needs to share different kind of managerial information to be able to come up with common goals. That correct information is exchanged and utilized between the partners is important to make the relationship successful (Gadde, et al., 2007).

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## **Affections on buyer-supplier relationship**

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The advantages of a beneficial relationship are an enhanced ability to engage buyers, suppliers and other business partners to encourage valuable exchanges of information. Hunt (2000) Emphasize that relationships should be treated as resources and thus in this way be an important part of the firm's assets to maintain. From a market perspective, the asset of the firm is of major importance because it beneficially affects the profitability as well as the loyalty from the customers.

Firms that diligently work with valuable supplier relationships will approach a better respond to the changing market demands. This will result in a better customer service and an improved technical enlargement. In addition, a sufficient buyer-supplier relationship can also be a way to reduce the transaction uncertainties that may occur in the business exchange process. In this way, the supplier base can be gradually reduced and the production performance can be more comprised (Hsu, et al., 2008).

### **Case study: Cummins and Toshiba**

The case below will exhibit a US- Japanese case study, described from Gadde, et al. (2007). The study reveals the crucial role of buyer and supplier relationship with a sufficient level of information sharing between the Japanese producer of ceramic Toshiba, and Cummins the American producer of diesel engines.

**Case description**

In the eighties, Cummins's innovative idea was to develop a diesel engine with no need for a cooling system. Thus, the crucial issue for the project was to develop sustainable ceramic components. Cummins started its selection process of finding appropriate suppliers for developing the ceramic. A great deal of visits and communications with different suppliers were held. One of the companies that came to attention was the Japanese producer of ceramic Toshiba.

However, during the early phase of project the conditions for Cummins changed, due to research proved that redesign of the engine could be made in order to achieve energy efficiency. The ceramics could also be used to other functions due to its new discovered wear resistant. Cummins now initiated a R&D program for exhibiting a solution. The research showed that silicon nitride was the material that was needed to perform the operation. Cummins started a new evolution process of potential suppliers. At the end of this process Toshiba was the most suitable company because they had the same way of working and common objectives and attitudes.

After executive negotiations, both companies decided to consider a joint relationship. It was also agreed on a common working plan with the same time table etc. Toshiba and Cummins created a common project team consisting of people from each of the companies. Although, the intention was to jointly decide which components that were essentially to go further with for development. The wear resistance components were preceded and tested from both companies. After successful technical development and cost minimization of the components of the engine, Toshiba was appointed for the manufacturing part of the engine and Cummins for the design. At this time, there were great deals of technical uncertainties in regards to the result of the new engine.

In early 1987, the team had managed to achieve adequate performance data, but with no customers. At the same moment, Cummins had experienced some major engine components wear problems, which required redesign of the components. Cummins decided to consider a field test with about 60 engines, and by this in the end of 1989 they managed to get rid of the problem. They could now equip all the engines with correct ceramic components that were found during the field test. At this time the relationship and thereby the cooperation between Toshiba and Cummins was so successful that they formed a joint venture named "Engineering ceramic Technologies" (Enceratec) in the US.

Finally, there were two main reasons why "Enceratec" was founded. At first the both companies felt that they had developed a joint unique competence together. The second reason was that Toshiba had an unoccupied capacity in its production and thereby a need to cover the unoccupied capacity. From Cummins point of view, the interest of



reducing production cost of purchased components was one of the underlying backgrounds to the joint venture with Toshiba.

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## Reflection of the case

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The purpose of this section aims to expose important analytic reflections in regards to information sharing and the relationship between Cummins and Toshiba. Additionally, this part can be considered as an analytical part of the case, where the conceptual framework is being emphasized contra the case study.

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### The crucial role of information sharing

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The case of Cummins and Toshiba revealed the crucial role of information sharing when it comes to combining resources. Thus, recombining of the resource structure between internal and external resources will develop a sufficient level of cooperation and confrontation. The outcome of this will be enhanced information and knowledge accessibility for both companies. With evolved information sharing, more accurate cost estimation can be taken into consideration. For instance, in the development of the wear resistance ceramics, by considering efficient information sharing between the companies, information could jointly be exploited and thereby the cost of the developing process could be minimized, due to better opportunities for planning. In addition, with the sufficient relationship between Toshiba and Cummins, lifecycle-cost and the technical solution for the engine could jointly be improved. Thus, the diligent exchange of information was in this case conclusive for the successful outcome. Efficient sharing of information between Cummins and Toshiba enabled improved investments for production services of the both companies in the project.

In close examination of the case between Cummins and Toshiba, the both companies could take advantage of “purchasing information sharing”, thus Cummins openness in terms of the close relationship with Toshiba made it possible to jointly access strategic information such as required specifications for the ceramics. In this case, Cummins was very open to the supplier Toshiba with detail specification of the essential components for the engine. As a result from this, more accurate investments and possibility to lower the cost could be achieved.

Although, “supply chain information sharing” was also a fact in the case, a common working plan and time table made it possible to more accurately plan the quantity and the quality of the operations in the project. Furthermore, with the trust and cooperation which seems to occur between the two companies, additional resource combining in terms of shared employees could be taken into account. The activity structure of the two companies could even be combined by considering joint development of the engine components. Thus, the both companies divided responsibilities for different parts of the project, in this way they both could exploit their core competences. In the final stage of the engine project, there were a great deal of uncertainties, but with adequate level of information sharing and trust between the both companies. The uncertainties could in this way easier be managed.

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### The importance of the relationship between Cummins and Toshiba

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One of the underlain key success factors between Cummins and Toshiba were the well adapted relationship between the two companies. Without this extensive relationship, inadequate amount of information should be exchanged and the project had been significantly harder to execute. When Cummins evaluated Toshiba as a supplier, they discovered that a great deal of similarities between the companies. Thus, the activity structures in terms of working methods were similar. The activity coordination of the boundaries for the both companies was well coordinated due to their expertise of competence within their specific area of engine components. Furthermore, the exchange of internal activities for Cummins were coordinated with the undertaken activities by Toshiba. For instance, the common way to reveal the needed ceramic components, made an efficient activity co-ordination within the relationship.

When the both companies created a common project team to investigate the required components for the engine, they had through this founded a proficient resource element. A successful level of interaction in the working team resulted in a better resource utilization. This combination of resources between Cummins and Toshiba was also the way to innovatively design the new engine. In addition, Cummins was from the beginning clear to form objectives. Moreover, Cummins inspected the activity structure and resources ties of Toshiba, this was necessarily to avoid too much adaptively, which will result in that the resources may loses its value. Consequently, if the competence within the joint development team were too much adapted, the resources element would be considered as a single resource element. The consequences with too much adaptability and single resource element in the project team will be that the buying company Cummins will lose its ability and capacity to be innovative and lack of other developing capabilities.

When Cummins and Toshiba decided to jointly run a project, Cummins existing resources structure become questioned from various directions of Toshiba. These questions are of most importance in the development stage to achieve confrontation, which is of major importance for a well working resource element and relationship between the two parts. In addition, to acquire the efficient relationship, Cummins challenged Toshiba in early stage, by considering the technical demands of the ceramic components.

In this way, a strong coordination in the relationship between Toshiba and Cummins occurred. Although, when the cooperation between them begun, an enhanced interdependence and stronger integration was the result of the jointly performed project. The close relationship made also that knowledge sharing could be better utilized, due to the efficient exchange of the services through the supply chain.

Finally, the project of the ceramic diesel engine ended up in a joint Venture in the US between the both companies Cummins and Toshiba. Thus, this can be considered as a successful result of an evolving relationship between the partners. The strong bindings of information sharing between the activities and well adapted resource element resulted in an innovative solution of the ceramic diesel engine.

## Conclusion

Academic studies prove the beneficial aspects of exploiting information sharing between buyer and supplier. The reluctance of not considering adequate exchange of information will result in increased costs and enhanced level of uncertainty in business relationship. This chapter has emphasized the crucial aspects by considering a successful level of information sharing between a buyer and supplier situation.

In addition, there are numerous of conclusions that can be considered from the case study between Cummins and Toshiba. Although, the frequently exchange of information resulted in an efficient relationship between the both parts. Thus, the importance of information sharing when it comes to integrating of activities and utilize combining of resources within relationships may be considered as significant.

A well adapted relationship with an appropriate level of information sharing will be the backbone of innovativeness and reduced life cycle costs. Furthermore, minimized cost and enhanced technical performance are also aspects which will be significant improved with adequate level of information sharing. Finally, the information sharing in a buyer-supplier relationship will play a crucial role to improve the individual firm's overall performance.

# [16] Appendices

## Example of results from the model

	Performance assessment	Human resources	Quality system assessment	Manufacturing criteria	Business criteria	Information technology
Supplier 1	0,482	0,587	0,738	0,311	0,231	0,429
Supplier 2	0,279	0,285	0,179	0,507	0,411	0,429
Supplier 3	0,239	0,128	0,083	0,181	0,358	0,143

## Performance assessment

*A. Comparison of criteria with respect to performance assessment*

DMU	Shipment	Delivery	Cost	AHP
Shipment	1	5	6	0.723
Delivery	1/5	1	2	0.174
Cost	1/6	1/2	1	0.103
Consistency ratio = 0.0374				

*B. Comparison of suppliers with respect to shipment*

DMU	Supplier 1	Supplier 2	Supplier 3	AHP
Supplier 1	1	3	5	0.633
Supplier 2	1/3	1	3	0.260
Supplier 3	1/5	1/3	1	0.106
Consistency ratio = 0.0419				

*C. Comparison of suppliers with respect to delivery*

Supplier	Supplier 1	Supplier 2	Supplier 3	AHP
Supplier 1	1	1/5	1/6	0.082
Supplier 2	5	1	1/2	0.343
Supplier 3	6	2	1	0.575
Consistency ratio = 0.0299				

*D. Comparison of suppliers with respect to cost*

Supplier	Supplier 1	Supplier 2	Supplier 3	AHP
Supplier 1	1	1/3	1/6	0.100
Supplier 2	3	1	1/2	0.300
Supplier 3	6	2	1	0.600
Consistency ratio = 0.0000				

## Human resources

*A. Comparison of criteria with respect to human resources*

DMU	No. of employees	Organizational structure	Training	No. of technical staff	AHP
No. of employees	1	1/5	1/6	1/3	0.063
Organization structure	5	1	1/2	3	0.309
Training	6	2	1	4	0.492
Number of technical staff	3	1/3	1/4	1	0.136

Consistency ratio = 0.0367

DMU	Supplier 1	Supplier 2	Supplier 3	AHP
Supplier 1	1	1/3	1/5	0.110
Supplier 2	3	1	1/2	0.309
Supplier 3	5	2	1	0.581

Consistency ratio = 0.0037

*C. Comparison of suppliers with respect to organization structure*

Supplier 1	1	4	6	0.685
Supplier 2	1/4	1	3	0.221
Supplier 3	1/6	1/3	1	0.093

Consistency ratio = 0.0644

*D. Comparison of suppliers with respect to number of training*

Supplier 1	1	4	6	0.685
Supplier 2	1/4	1	3	0.221
Supplier 3	1/6	1/3	1	0.093

Consistency ratio = 0.0644

*E. Comparison of suppliers with respect to number of technical staff*

Supplier 1	1	1/3	2	0.230
Supplier 2	3	1	5	0.648
Supplier 3	1/2	1/5	1	0.122

Consistency ratio = 0.0041

## Quality system assessment

*A. Comparison of criteria with respect to quality system assessment*

DMU	Management commitment	Inspection and control	Quality planning	Quality assurance	AHP
Management commitment	1	1/4	1/4	1/6	0.062
Inspection and control	4	1	1/3	1/3	0.165
Quality planning	4	3	1	1/3	0.270
Quality assurance	6	3	3	1	0.503

Consistency ratio = 0.0944

DMU	Supplier 1	Supplier 2	Supplier 3	AHP
Supplier 1	1	4	5	0.665
Supplier 2	1/4	1	3	0.231
Supplier 3	1/5	1/3	1	0.104

Consistency ratio = 0.0996

*C. Comparison of suppliers with respect to inspection and control*

Supplier 1	1	5	7	0.724
Supplier 2	1/5	1	3	0.193
Supplier 3	1/7	1/3	1	0.083

Consistency ratio = 0.0844

*D. Comparison of suppliers with respect to quality planning*

Supplier 1	1	7	9	0.790
Supplier 2	1/7	1	2	0.133
Supplier 3	1/9	1/2	1	0.077

Consistency ratio = 0.0322

*E. Comparison of suppliers with respect to quality assurance*

Supplier 1	1	5	7	0.724
Supplier 2	1/5	1	3	0.193
Supplier 3	1/7	1/3	1	0.083

Consistency ratio = 0.0844

## Manufacturing criteria

<i>A. Comparison of criteria with respect to manufacturing criteria</i>							
DMU	Production capacity	Maintenance	Lead time	Up to date technology	Transportation-storage	NPD	AHP
Production capacity	1	2	3	1/2	4	1/3	0.151
Maintenance	1/2	1	1/2	1/4	2	1/7	0.062
Lead time	1/3	2	1	1/3	2	1/6	0.079
Up to date technology	2	4	3	1	6	1/2	0.241
Transportation-storage	1/4	1/2	1/2	1/6	1	1/9	0.039
NPD	3	7	6	2	9	1	0.428
Consistency ratio = 0.0183							
DMU	Supplier 1	Supplier 2	Supplier 3	AHP			
<i>B. Comparison of suppliers with respect to production capacity</i>							
Supplier 1	1	1/5	1/4	0.096			
Supplier 2	5	1	3	0.619			
Supplier 3	4	1/3	1	0.284			
Consistency ratio = 0.0923							
<i>C. Comparison of suppliers with respect to maintenance</i>							
Supplier 1	1	3	5	0.633			
Supplier 2	1/3	1	3	0.260			
Supplier 3	1/5	1/3	1	0.106			
Consistency ratio = 0.0419							
<i>D. Comparison of suppliers with respect to production planning</i>							
Supplier 1	1	2	1/4	0.201			
Supplier 2	1/2	1	1/5	0.118			
Supplier 3	4	5	1	0.681			
Consistency ratio = 0.0290							
<i>E. Comparison of suppliers with respect to up to date</i>							
Supplier 1	1	1	4	0.444			
Supplier 2	1	1	4	0.444			
Supplier 3	1/4	1/4	1	0.111			
Consistency ratio = 0.0000							
<i>F. Comparison of suppliers with respect to storage</i>							
Supplier 1	1	3	1/3	0.272			
Supplier 2	1/3	1	1/4	0.120			
Supplier 3	3	4	1	0.608			
Consistency ratio = 0.0767							
<i>G. Comparison of suppliers with respect to development</i>							
Supplier 1	1	1/3	6	0.290			
Supplier 2	3	1	8	0.646			
Supplier 3	1/6	1/8	1	0.064			
Consistency ratio = 0.0840							

## Business criteria

<i>A. Comparison of criteria with respect to business criteria</i>						
DMU	Reputation	Location	Price	Patent	Technical capability	AHP
Reputation	1	2	1/8	1/3	1/7	0.054
Location	1/2	1	1/9	1/5	1/8	0.036
Price	8	9	1	5	2	0.473
Patent	3	5	1/5	1	1/3	0.131
Technical capability	7	8	1/2	3	1	0.306
Consistency ratio = 0.0452						
DMU	Supplier 1	Supplier 2	Supplier 3	AHP		
<i>B. Comparison of suppliers with respect to reputation</i>						
Supplier 1	1	3	8	0.646		
Supplier 2	1/3	1	6	0.290		
Supplier 3	1/8	1/6	1	0.064		
Consistency ratio = 0.0840						
<i>C. Comparison of suppliers with respect to location</i>						
Supplier 1	1	4	5	0.665		
Supplier 2	1/4	1	3	0.231		
Supplier 3	1/5	1/3	1	0.104		
Consistency ratio = 0.0996						
<i>D. Comparison of suppliers with respect to price</i>						
Supplier 1	1	1/3	1/4	0.120		
Supplier 2	3	1	1/3	0.272		
Supplier 3	4	3	1	0.608		
Consistency ratio = 0.0767						
<i>E. Comparison of suppliers with respect to patent</i>						
Supplier 1	1	1	1	0.333		
Supplier 2	1	1	1	0.333		
Supplier 3	1	1	1	0.333		
Consistency ratio = 0.0000						
<i>F. Comparison of suppliers with respect to technical capability</i>						
Supplier 1	1	1/4	5	0.236		
Supplier 2	4	1	9	0.701		
Supplier 3	1/5	1/9	1	0.062		
Consistency ratio = 0.0893						

## Information Technology

### A. Comparison of criteria with respect to information technology

DMU	RFID	EDI	Internet	AHP
RFID	1	1/6	1/7	0.070
EDI	6	1	1/2	0.350
Internet	7	2	1	0.580

Consistency ratio = 0.0374

DMU	Supplier 1	Supplier 2	Supplier 3	AHP
Supplier 1	1	1	3	0.429
Supplier 2	1	1	3	0.429
Supplier 3	1/3	1/3	1	0.143

Consistency ratio = 0.0000

### C. Comparison of suppliers with respect to EDI

Supplier 1	1	1	3	0.429
Supplier 2	1	1	3	0.429
Supplier 3	1/3	1/3	1	0.143

Consistency ratio = 0.0000

### D. Comparison of suppliers with respect to internet

Supplier 1	1	1	3	0.429
Supplier 2	1	1	3	0.429
Supplier 3	1/3	1/3	1	0.143

Consistency ratio = 0.0000

(Sevкли, et al., 2008)

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# PURCHASING MANAGEMENT

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**CHALMERS**  
DEPARTMENT OF TECHNOLOGY MANAGEMENT AND ECONOMICS



## QUALITY MANAGEMENT IN PROCUREMENT AND MANAGEMENT OF MATERIAL RESOURCES

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### ABSTRACT

*Due to a dynamic and competitive environment, in which prices are subject to ever-increasing pressure, quality becomes a determining factor in the competitive struggle.*

*Among the key processes of the quality management system, the process of procurement and management of material resources directly affects the quality of the final products, and therefore the performance of the organization. An efficient process of procurement and management of material resources based on good relationships with the suppliers will help increase the effectiveness and efficiency of the organization and achieving lasting success by meeting the expectations of all stakeholders.*

**KEYWORDS:** Quality management, process of procurement and management of material resources, suppliers, reciprocal relationships

**JEL CLASSIFICATION:** M10

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### 1. INTRODUCTION

At a time when prices are subject to ever-increasing pressure, the competitive struggle moves from price competition towards quality, this becoming a competitive factor in the competitive struggle. To meet the increasing demands of the customers, the organizations focus their efforts and management strategies to meet these needs through continuous improvement of their products and processes. We are thus witnessing the enrichment of the quality concept, which acquires an integrative dimension throughout the entire organization.

In this context, we believe that the process of procurement and management of material resources play a crucial role in ensuring quality, because the quality of the materials supplied determines the quality of final products. In accordance with ISO 9001: 2008, keeping under control the process of procurement the management of material resource is a mandatory requirement.

### 2. QUALITY MANAGEMENT IN PROCUREMENT AND IN THE MANAGEMENT OF MATERIAL RESOURCES

According to ISO 9000, and ISO 9000: 2005, ISO 9001: 2008, ISO 9004: 2009 standards, an organization can achieve sustainable success by implementing a quality management system designed to continuously improve performance, taking into account the most important

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expectations, those of the customers, shareholders, suppliers and those of the community. Part of the organization's management system, the quality management system aims at streamlining the organization's processes, adding value, lowering costs and increasing adaptability to the needs of the customer.

Lately there has been a growing concern for the quality of the processes. The set of ISO 9000 standards support the model of a quality management system based on processes and their management in a systemic vision to increase efficiency and effectiveness in achieving the objectives of the organization.

The project of the international standard ISO/CD 9001:2013 (the new edition of the ISO 9001 standard that will be published by the end of 2015) further strengthens the process-oriented approach, as the integrated management of processes is deemed the future in management.

Among the key processes of the quality management system, the process of procurement and management of material resources has a direct and decisive influence on product quality because the properties of the resources acquired are mostly traceable in the values of the main quality features of the final product. The control of the process of procurement and management of material resources is a mandatory requirement of ISO 9001: 2008 standard (according requirement 7.4.1).

In a quality management-oriented approach, we can define the **processes of procurement and management of material resources as a set of interdependent, logically linked and value-added sub-processes, which takes place within the organization in order to ensure and manage the elements necessary to conduct business in an efficient and effective manner.**

The following elements play an important role in the efficient execution of the process of procurement and management material resources: a clear definition of the purpose of the process, determining how to achieve each activity within each specific sub-process (issuing procedures) and identifying and assessing the benefit in the established activities.

From a systemic approach, the procurement process should ensure a balance between the needs and the material resources available so that the organization can operate effectively and efficiently (Deac, 2013). For this, the procurement and the management of material resources must satisfy the following conditions:

- ensure all material resources according to specified supply requirements
- purchase the material resources in the necessary quantities and at the right time
- purchasing costs to be at a minimum level.

Thus, we can say that to achieve a competitive advantage, the process of procurement and management of material resources must be carried out in accordance with the principles of the total quality concept: providing the products that are required, with the required quality, in the desired quantity, at the desired time, and at the lowest price possible.

In order to meet the total quality requirements, the procurement process must be strategically and proactively oriented and must effectively participate in developing the general strategies of the organization. Procurement strategies must be an integral part of the overall strategies of the organization and must harmonize with them.

In order to achieve the specific objectives, sub-processes are identified within the process of procurement and management of material resources and indicators and methods of performance control are established. Thus, the procurement process can integrate the following sub-processes:

1. defining the requirements related to the quality of material resources and issuing the technical specifications;
2. identifying, evaluating and selecting suppliers based on their capability to supply material resources in compliance with organizational requirements;
3. establishing, maintaining, managing and developing relationships with the suppliers;
4. monitoring, measuring and analysing the results in order to monitor the efficiency and efficacy of the process.

## 2.1. Defining requirements related to the quality of the material resources and issuing the technical specifications

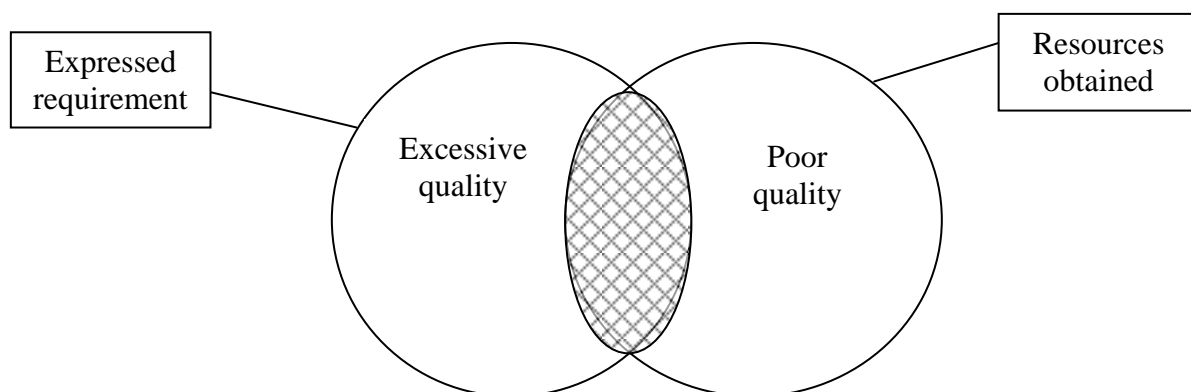
The role of the sub-process of issuing the technical specifications is to determine the level of quality required for the material resources to be supplied. The quality level can be defined by selection of brands or standards or by issuing the technical documentation, in the case of processes with particular characteristics or that have a large influence on the quality characteristics of the finished product - e.g. parts, parts for the automotive industry (Baily et al., 2004).

Requirements on the quality of material resources are defined by specifying the technical parameters, in two ways: by indicating performance parameters or compliance parameters.

Performance parameters involve describing the purpose, functions and performances expected by the client. In this case, the provider is encouraged to provide the product that best meets the specified parameters, being free to choose the detailed technical parameters of the product. The main advantage of this method of specifying the requirements is that the supplier may propose new or improved solutions to meet the needs of the buyer. The method is widely used especially for the acquisition of services, when it is not possible to specify some technical parameters of compliance.

Compliance parameters refer to the detailed definition of the technical parameters of the resources. An example of this is the acquisition of parts to be mounted within an assembly or raw materials whose chemical composition is very important for a process. Due to the complexity of defining the parameters of compliance, the procurement department should collaborate with other subsystems within the organization (common situation especially in manufacturing industries). In this case, the responsibility for drawing up the specialized technical specifications belongs with a specialized subsystem (design, technical). The procurement department holds only commercial duties (innovations on the suppliers' market, existence of alternative materials on the market, the possibility of obtaining resources in the amounts, the terms and at the prices you want).

In defining the technical parameters, it is very important to specify the accurate tolerance intervals and to eliminate any unnecessary requirements. It is a known fact that additional costs arise from both unnecessary requirements (excessive quality) and from missing requirements or elements (poor quality). In this case, an accurate analysis of the value will determine whether it is possible to use cheaper alternative resources, if the tolerances are too tight or if unnecessary requirements are added.



**Fig. 2. Relationship between the necessary requirements and the material resources obtained**

## **2.2. Identifying, evaluating and selecting suppliers based on their capability to supply material resources in compliance with organizational requirements**

This sub-process aims to monitor compliance of material supplies with the technical specifications and keeping their characteristics within the admitted tolerance.

Due to the competitive environment, higher quality decisions on the choice of supply sources will increase the effectiveness of the procurement process and will implicitly lead to quality assurance.

For best results in defining the supply sources, the research of the suppliers' market must be seen as a natural part of the procurement process. Research of the supply market will ensure identification of current or potential sources and their ability to meet the requirements of the organization, and the investigation of market trends and prospects for long-term supply.

The analysis efforts and the ways of action should be chosen according to the interests of the organization and the position of the supplier in relation to it. Thus, the provider must be categorized from several points of view before it can be appreciated as real. As a preliminary stage of the evaluation-selection efforts, both the suppliers' market and the organization's list of resources must be segmented. Through this segmentation, a gradation of effort, respectively maximum efficiency of the activity of identification, evaluation and selection of suppliers is achieved (Cârstea, 2000).

Identification of suppliers is followed by evaluation and selection. According to ISO 9001: 2008, organizations must find appropriate methods for the evaluation and selection of suppliers based on their ability to provide material resources according to organizational requirements, including the need to define the criteria for reassessment of suppliers.

In the case of existing sources, with whom the organization has ongoing contracts, evaluation will be based on past performance records related to: quality of materials provided, compliance with delivery deadlines, delivery of needed quantities, prices.

In the case of potential suppliers, the organization must assess their capability to meet the specified supply requirements. The type and extent of control depends on the impact of the supplied resources on the finished product. The classification system for evaluating the quality provided by vendors can have three levels.

A first level of investigation involves obtaining information from self-assessment questionnaires, recommendations, or by checking the provider's customer portfolio. The method is applicable when purchasing standardized material resources or products made based on the technical specifications of the beneficiary, but whose quality does not greatly influence the final product quality.

The second level of investigation involves visiting and assessing the provider (second party audit) in terms of its quality competences. Audit is required for parts and subassemblies obtained through complex processes (electronics, microelectronics) whose quality has a direct impact on the quality of final products, where the supplier is responsible both for the design and for the execution of the product. In this case, the following must be checked and assessed: the technical and technological capacity of the provider to achieve the required product, statistical methods used to maintain the quality level through a system of monitoring and adjusting the production process, methods for testing the measurement and monitoring equipment, sources of raw materials and their quality control, and staff qualifications by level of technicality required. At the same time, we can estimate the probability of establishing hassle-free and mutually beneficial relationships with the supplier.

At the last level, independent organizations, registries or certification bodies (third party audit) carry out the qualitative investigation. It is applicable for industries subject to special quality and safety regulations, such as the nuclear, aerospace, energy, automotive, pharmaceutical shipbuilding, and military industries, and for direct suppliers of these industries (e.g. automotive industry).

After the evaluation of potential sources, the organization carries out the selection of suppliers, that is chooses the most effective sources for the procurement process. Suppliers are selected based on their ability to meet the required selection criteria such as quality, delivery time, quantity, price, level of service, timely problem-solving abilities, etc.

Following the example of leading organizations, numerous large organizations have their own supplier accreditation programs, thus imposing a certain quality policy to their suppliers.

For example, in Renault, the selection of suppliers is carried out based on a reference document, like a checklist, adapted to the audited organization, which refers to:

- organization
- overall means of controlling quality throughout the several stages of a product's lifecycle
- logistic system the organization uses for its products: maintenance, packaging, storage, transport.

The Auditor's findings also include the recommendations for improvement (on all three areas of investigation), which are communicated to the supplier. The latter is obliged to submit a written and planned commitment to apply the improvements recommended within two months of receipt of the recommendations.

Based on the audit findings, the providers fall into one of the four compliance levels: A, B, C and D.

According to compliance level A, rated as "suitable", the supplier must meet all 140 of referential criteria in a proportion of 90-100%. This rating certifies the fact that the supplier has the capability to introduce new products into production and is able to implement the quality approach.

Compliance level B (the supplier meets 75-90% of the evaluation criteria) corresponds to the rating "low capacity, which should be improved" and achieving A level is possible within two years, through periodic reassessments. In this case, the supplier can develop new products within minimum one year and the implementation of the quality approach is only possible with support from the company.

If the supplier falls into compliance level C and receives the rating "unsuitable", it means that it cannot develop new products and the quality approach is impossible. Progressing to Level B is possible only based on a short-term improvement plan that must be verified through periodic reassessment every six months.

If the supplier receives compliance level D, it is declared unfit and it cannot be accepted.

Renault's major objective is to accept only those suppliers who have achieved A-level compliance. The rating is updated periodically at interval ranging from every six months to up to every three years, depending on: the level of compliance, the importance of different product categories (particularly those who have direct impact on company requirements), and function of significant changes that have occurred in the organizational structure of the providers.

For the vendor, the evaluation represents a diagnosis followed by recommendations that allow him to progress, and for the buyer it is an important criterion of choosing from a variety of offers (Oprean et al., 2012).

### **2.3. Establishing, maintaining, managing and developing relationships with the suppliers**

Although choosing one of the most efficient suppliers is a reliable source for securing sustainable success, the lack of a strategy in relations with suppliers can lead to a significant reduction of the results. This is the reason why lately the importance of supplier-customer relationship increased and a relationship of mutual satisfaction is obviously required.

Unfortunately, at often times, the organization's relations with its suppliers are characterized by limited trust in which the two partners are dealing from hostile positions and appear to have conflicting targets. Starting from the idea of a large number of suppliers that can be placed in competition, organizations believe that this is an appropriate way to acquire material resources at the lowest possible price. Currently, despite the trend towards strategic procurement and partnership



and cooperation of suppliers in multifunctional teams, many buyers continue to consume a lot of time bargaining with suppliers on price (Kotler, 2008).

While the classical transactional approach is not yet obsolete, organizations must move towards establishing mutually beneficial relationships. Current standards of quality management face a growing expansion of the client-provider relationship as the organization and its partners are interdependent and therefore a mutually beneficial relationship enhances their ability to create value (ISO 9004: 2009).

Through their quality policy, organizations need to establish the principles underlying their relationships with suppliers. They need to collaborate with suppliers to achieve a common goal and improve their products by understanding and assuming responsibility.

However, one single type of relationship does not apply to all providers. In the early 1990s, in the United States, automobile constructors opted for establishing classical relationships with their suppliers, while South Korean carmakers mainly developed partnerships with their suppliers (Calvi, et al., 2003, *apud* Le Moigne, 2013). The first to have established different relationships depending on the characteristics of automotive suppliers were the Japanese carmakers. Thus, the transactional approach can be considered relevant for current, routine supplies, while an orientation towards reciprocity will be advantageous for the procurement of critical products, with a strong impact on the quality of final products.

Large companies are moving towards sizing the relationships with their suppliers. In this sense, they are oriented in the following directions:

- cooperation in designing new products and technologies
- participation in joint research and development programs
- joint management of stocks
- supporting the suppliers' development programs
- information exchange related to processes, products and strategic issues
- sharing profits and risks.

The development of these relationships require changes in behavior and attitude of both partners. The prerequisite of the new relationship is for both partners to reach a common view on how they are going to collaborate.

#### **2.4. Monitoring, measuring and analysing the results in order to monitor the efficiency and efficacy of the process of procurement and management of material resources.**

At the organization level, the effectiveness of the quality management system is determined by the effectiveness of its processes.

Due to the strong impact of the process of procurement and management of material resources on compliance with the product requirements, controlling and establishing appropriate monitoring and measurement methods will have an important contribution to further improve the efficiency and effectiveness of the organization. The methods used to monitor, measure and analyze must demonstrate the ability to achieve the planned results and to comply with the organization's strategy. Performance is measured based on key performance indicators that must be established from the phase of designing the procurement process. If, for reasons of feasibility, certain indicators cannot be measured and monitored, criteria will be established (Popa, 2013).

Usually, performance indicators relate to operational activities. However, for the process to be effective, it is necessary that the performance indicators address tactical and strategic issues.

Monitoring, measuring and analyzing the performance of the process of procurement and management of material resources means to assess its efficiency and effectiveness.

**The analysis of efficiency** of the process of procurement and management of material resources aims to identify the deviations between what was planned and what was achieved, and runs on three directions: quality, costs and planning.

- **Maintaining quality control** takes into account the fact that quality deficiencies lead to additional costs. In this respect, the analysis will be achieved through a systematic evaluation of suppliers in terms of quality.
- **Cost control** takes into account the evolution of the total cost of supply. Monitoring the evolution of the total cost of supply allows to understand better the causes of variation and to perform corrective actions when necessary. The causes of variation are not limited to increasing the selling prices of the material resources but also to other elements in the supply chain such as storage costs, inspections, increased transportation costs, increased price for raw materials, etc.

Due to the significant share that the costs of supply hold in the turnover of an organization, any action to reduce them will have a huge impact on costs and therefore on profitability. In general, in developed economies, the process of procurement and management of material resources can reduce the cost with an estimated 5-10% (Cârstea, G., 2000).

- **Evaluation of meeting the deadlines** can consider, for example, purchase order processing time, the time required to adopt the corrective actions, suppliers' performance related to deliveries, number of stock-outs, etc.

**Efficiency analysis** of the process of procurement and management of material resources focuses on the main resources of the organization: management, employees, processes and information systems. Examples include annual number of training hours for procurement department employees, number of key suppliers connected to an electronic system of data exchange, etc.

The systematic evaluation of the performance of suppliers, as part of the performance evaluation of the procurement and management of material resources process, aims to continually improve supplier's capability and to ensure that the material resources provided meet the requirements of the organization.

Key performance indicators should be chosen to realistically reflect the contribution of suppliers to achieving the performances of the procurement process. These must be:

- relevant** for the activity requested by the suppliers and fully harmonized with the objectives of the organization
- regularly updated** and monitored to provide real-time information with a specific frequency thus allowing corrective measures
- reliable**, easily measurable, uninterpretable, to measure progress in real time, to provide an accurate evaluation, especially a qualitative evaluation
- objective** – a SMART objective must always be associated with an indicator (Canonne & Petit, 2013).

Evaluation of suppliers' performance can be achieved based both on quantitative and qualitative criteria, quantifiable indicators being the most frequently used. For example, Table 1 presents indicators that can be used to monitor supplier performance.

**Table 1.** Examples of indicators used to monitor suppliers' performance

Analysis directions	Indicators	
	Quantitative	Qualitative
1. Quality	<ul style="list-style-type: none"> <li>- non quality costs</li> <li>- rat of refuse</li> <li>- number of non-conforming products delivered</li> <li>- number of certified suppliers (ISO, specific certifications)</li> </ul>	<ul style="list-style-type: none"> <li>- satisfaction of internal customers</li> <li>- quality of services provided</li> </ul>

Analysis directions	Indicators	
	Quantitative	Qualitative
2. Cost	<ul style="list-style-type: none"> <li>- target prices</li> <li>- budget deviations</li> <li>- productivity</li> </ul>	<ul style="list-style-type: none"> <li>- price positioning relative to the market price</li> <li>- adequacy of the price / performance rapport</li> </ul>
3. Meeting deadlines/ service	<ul style="list-style-type: none"> <li>- rate of timely deliveries</li> <li>- rate of satisfying the demand</li> <li>- the time the supplier needs to develop a new product</li> <li>- level of services offered, rate of meeting the demand</li> </ul>	<ul style="list-style-type: none"> <li>- flexibility</li> <li>- adaptability</li> <li>- reactivity</li> </ul>
4. Innovation	<ul style="list-style-type: none"> <li>- research and development progress</li> <li>- recommendations for improvement</li> </ul>	<ul style="list-style-type: none"> <li>- creativity of recommendations and suggestions</li> </ul>
5. Management	<ul style="list-style-type: none"> <li>- adherence to the organization's procurement policy</li> <li>- OHSAS 18001:2007 certification</li> <li>- financial position</li> </ul>	<ul style="list-style-type: none"> <li>- climate and quality of the fostered relations</li> <li>- capability to understand and solve problems of the organization</li> </ul>

In addition to monitoring, measuring and analysing the performance of procurement and management of material resources process at an operational level, its strategic efficiency must also be assessed. In this case, the evaluation will focus on analysing the strategic contribution of the process of procurement and management of material resources and its degree of involvement in the foundation of the overall development strategy of the organization.

### 3. CONCLUSIONS

In an uncertain and highly dynamic environment, long-term survival of the organizations is possible by developing quality products at a competitive level. The best quality on the market can be achieved through continuous improvement of processes and by adding value to activities.

In this context, organizations can turn to the process of procurement and management of material resources as a source for quality improvement, given that it has a decisive role in quality assurance. Thus, management at the highest level of the organization must ensure the design and implementation of effective processes of procurement and management of material resources in order to ensure compliance of materials supplied with specified purchase requirements, to identify, evaluate and select sources supply, and to develop mutually beneficial relationships with suppliers and assess their capability to deliver products that comply with the requirements of the organization.

By means such as planning, controlling and determining appropriate methods for monitoring, measurement and analysis, the process of procurement and management of material resources will have an important contribution to improve further the efficiency and effectiveness of the organization.

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# Chapter 8

## STORES MANAGEMENT

- **Introduction :**

- Stores play a vital role in the operations of a hospital.
- It is in direct touch with the user departments in its day-to-day hospital activities.
- The most important purpose served by the stores is to provide uninterrupted service divisions.
- Further, stores is often equated directly with money, as money is locked up on the stores which includes different hospital stocks and equipment such as medicines, hospital linen, hospital stationary items, hospital equipment spares parts, new & un-used hospital items.

## The functions of stores can be classified as follows.:

1. To receive materials medicines, components, tools, equipment and other items and account for them.
2. To provide adequate and proper storage and preservation to the various items.
3. To meet the demands of the consuming departments by proper issues and account for the consumption.
4. To minimize obsolescence, surplus and scrap through proper codification, preservation and handling.



## Functions.....

5. To highlight stock accumulation, discrepancies and abnormal consumption and effect control measures.
6. To ensure good housekeeping so that material handling, material preservation, stocking, receipt and issue can be done adequately.
7. To assist in verification and provide supporting information for effective purchase action.

## LOCATION AND LAYOUT:

- The normal practice is to locate the stores near the consuming departments.
- In stores layout, the governing criteria are easy movement of materials, good housekeeping, and sufficient space for men and material handling equipment, optimum utilization of storage space, judicious use of storage equipment, such as shelves, racks, pallets and proper preservation from rain, light and other such elements.
- These problems are more important in the case of items that have a limited shelf life.
- Other important factors governing the location are
  - ❖ the number of end users and their location,
  - ❖ the volume and the variety of goods to be handled,
  - ❖ the location of the central receiving section and
  - ❖ accessibility of modes of transportation.



**The important factors in the design of stores building can be summarized as follows:**

**1. Lighting :**

- Clear and adequate lighting is a must for a proper work environment.
- Lighting effects can be accentuated through a judicious choice of colors for the walls..  
Recommended illuminations (the IES Code):
  - Casual reading ----- 100 lux
  - General office work ----- 400 lux
  - Fine assembly ----- 900 lux
  - Very severe task ----- 1300 to 2000 lux.
- The daylight factor of the building is determined by a modified photo-electric meter, known as day light meter.
- Artificial illumination is by filament lamps or fluorescent lamp. Fluorescent lamp is more economical, and light emitted by it is cool and efficient.

- **Safety :**

- This factor is perhaps the most important aspect. In stores a large volume of goods are handled every day.
- Accidents considerably reduce the moral and effectiveness of the system.
- It has been aptly said that “if accident is a disease, then safety education is its vaccine ”stores personnel's should be trained in giving first aids.

**The following measures are necessary if accidents are to be checked:**

- a. Safety consciousness should be instilled in the minds of stores personnel through training programmes, visual aids and literature.
- b. Safety appliances, such as goggles, hand gloves, full face integral helmets, use of leather clothing & boots etc., must be provided and their use must be encouraged.
- c. Good housekeeping is essential. Stocking must be in appropriate locations so that handling is minimum.

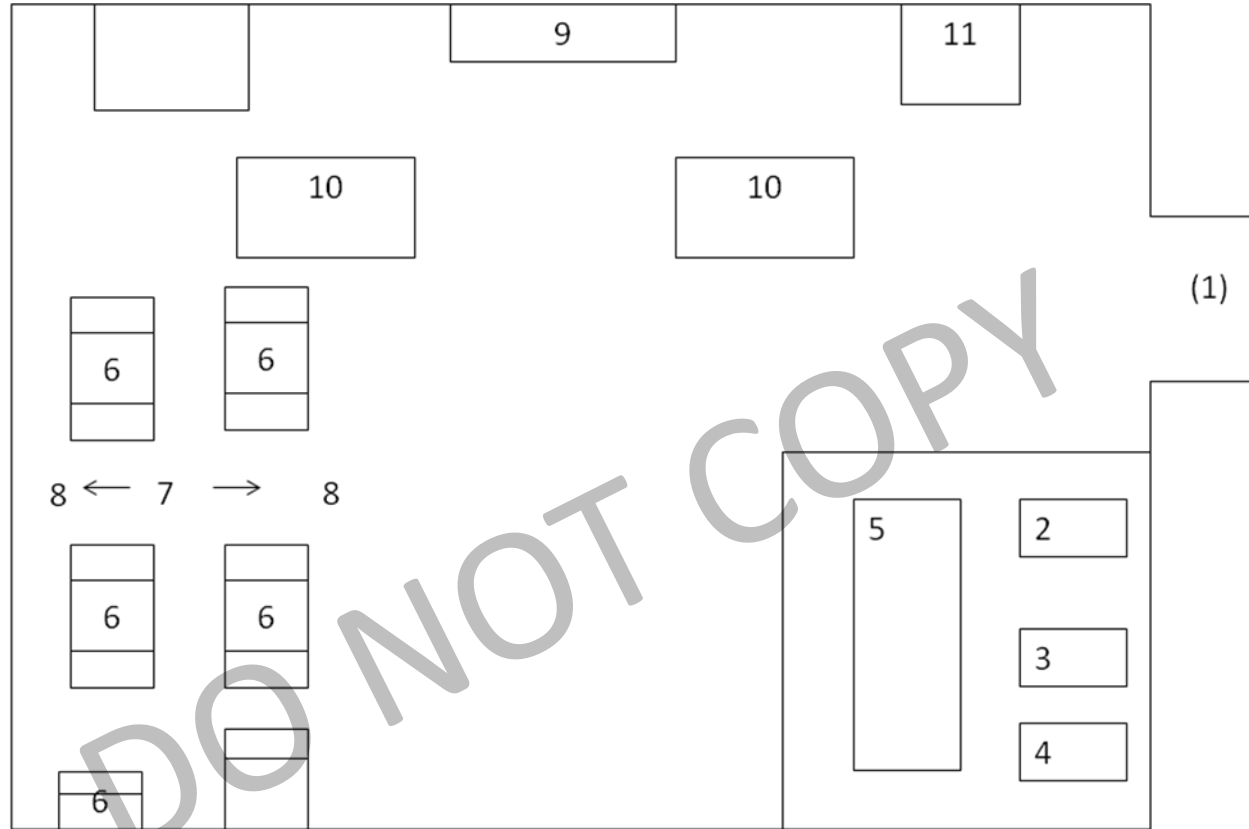
- d. All stores equipment must be kept in good order.
- e. Healthy competition can be stimulated by installing 'safety awards' and cash prizes. This also motivates others to practice safety.
- f. Provision of fire fighting facilities is necessary especially where inflammable materials are stored handled.
- g. Other factors which merit attention include provision of toilets, routine maintenance equipment, safe electrical wrings, etc.

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- **Factors to be Considered While Locating the Store – Room**

1. The location of stores should be carefully considered in terms of ensuring maximum efficiency.
2. The store-location should minimize the cost involved in carrying of inventories and other stores operation.
3. Stores location depends upon the nature and value of materials and frequency of consumption of material.
4. Stores should be easily accessible to all use departments and there by material handling should be reduced to minimum.
5. Medicines & materials inventories should be located near the main operation theater.
6. In big organizations having number of service units and each one is located far from the central office; decentralized storage system should be followed.

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(1)

- 1 - Incoming materials receiving gate.
- 2 - Place for dumping materials.
- 3 - Place for sorting and checking materials & medicines.
- 4 - Place for materials & medicines inspection.
- 5 - Place for temporary storing of materials before placing racks, bins, etc.
- 6 - Proper place for stringing each type of material.
- 7 - Main aisle
- 8 - Side aisle
- 9 - Service window
- 10 - Boxed containing material to be brought from container issues.
- 11 - Counters for keeping materials to be issued.

## The following are the factors to be considered while planning the layout of storage area:

1. A section adjacent to store-room should be kept reserved for the receipt of material and or their inspection before storage.
2. Stores layout should be planned, such that it provides easy receipt, storage and issue of material, preferably nearest to the point of use.
3. Store-room lay-out should minimize handling and transportation of materials.
4. An ideal store-room layout makes optimum utilization of the floor space and height.
5. The shelves, racks, bins etc, should be situated in clearly defined lanes, so that the items are quickly stored and located for physical counting or issuing.

5. The main lanes (or) aisles should usually be between 1.5 and 3 meters wide, depending upon the type of material and the amount of traffic involved.
6. Storage spaces should be clearly marked to ensure easy and quick identification.
7. Obstructions such as partitions, poles, staircases should be as far as possible eliminated or reduced.
8. The storage space must be adequately protected against waste, damage, deterioration and pilferage.
9. A place for storing the material should be decided depending on the material characteristics.
10. Store layout is such that for its efficient operations, it makes use of modern material handling equipment such as forklifts, trucks, conveyors etc.



10. Store lay out should be such that the store keeper is not compelled to put the newly arrived material on the top of the old. As a roll, all the old stock should be concerned first before using the new one.
11. Due space (20 to 25%) must be left in each section of store-room to allow for expansion.
12. The stores racking should not prevent the normal movement of air and temperature. The height of the rooms should be such as to give an air space of at least 500 c.ft per capita , preferably 1000 c.ft.
13. In vertical stacking (Loading one over other) the load should not touch the ceiling heights, otherwise it will prove hindrance in case of fire fighting.
14. Walls of the medical stores should be 9 -- inch bricks wall, with smooth plaster, should be white colored.
15. The height of the roof should not be less than 10 feet, in the absence of air conditioner for comfort.
16. Floor area should be at least 120 sq.ft for the occupancy by more than one person and 100 sq.ft for the occupancy by a single person.

- **Storage:**

Reduction in storage space and handling cost ensures maximum return on capital invested. The following points will come up for consideration:

1. **Where to store :**

The following factors govern the layout.

- a. **Similarly.** Items are stored by class, viz., Medicines, Capital Equipment and hardware s, etc.
- b. **Popularity.** Turnover should be considered. Fast moving items should be stored near points of issues.
- c. **Size.** Large items require to be stored near points of issues.
- d. **Capacity.** Location of doors and size, size of platforms and ramps, etc., should also be considered. Two way opening doors are preferred.
- e. **Characteristics.** Characteristics of Materials such as hazardous, sensitive, and perishable, require careful consideration.
- f. **Turn over.** First in first out, where by rotation of stock is ensured, so that the older stocks are consumed first and their stocks are depleted.

## 2. How to store :

Materials should be located by bin labels or sign boards giving descriptions and code numbers. The highest standards of cleanliness and orderliness should be aimed at. The following ways may be adopted.

- a. **Unit pilling.** Certain materials lend themselves easily adaptable to this system where each stack, tray, shelf contains a given number.
- b. **Slotted angle shelving.** This allows for a great deal of flexibility in storing.
- c. **Pallestisation.** This is of immense use when frequent handling of heavy materials is involved.
- d. **Aisles.** Aisles should be adequate for easy access, but not too wide to waste space.
- e. **Special Storing.** Certain materials like inflammable require special covers and due care, etc.

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- Machineries left idle and unattended deteriorate more quickly than it would, if fully and correctly used.
- Hospital Stores and stocks items may become spoiling through many different ways, among which are:
  - i. Dampness,
  - ii. Dryness,
  - iii. Coldness,
  - iv. Heat,
  - v. Dust and dirt, etc.
- The remedy in most cases must be obvious to the trained eye and mind. Windows should be placed at a height of not more than 3 feet above the ground. Windows area should be  $\frac{1}{5}$  th of the floor area. Doors and window combined should have  $\frac{2}{5}$  the floor area.
- There should be proper equipment for handling, preserving, inspecting and checking of all stores and stocks. And to affect this, adequate and efficient staff is as necessary as suitable shelves and containers.

- In planning the store-rooms(s) a little latitude for expansion should be introduced, but not too much, as during the period of non-requirement the surplus space runs away with money
- Situation of the stores is another important point.
- Proximity of the goods to the place where they are needed is the keynote to this point
- A saving in handling costs especially in heavy and bulky goods, and the time taken for transporting them from stores to the place of requirements are factors, which if not suitably organized, directly wastes money and indirectly means loss of business, especially very large hospital generators, heart-lung machines, hospital operation theater head lamps etc.

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- There appears to be no need here to refer to the types of construction.
- It is good rules, generally, to keep the articles of a like nature close to one another, or perhaps light articles together and heavy ones with others of similar character or “departmentally” or “sectionally” arranged spaces may be more appropriate places for their storage.
- A responsible head can, or ought to be readily able to determine this, if he will but devote some little time on the matter.
- It is however well worth its while. In fact, it is another illustration of sound investment showing excellent return.

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Some of the principle types of containers convenient for storage and inspection, with some of their appropriate uses are named below:

- Bags : Articles ready - made up in standard quantities, e.g., cement, barites, etc.
- Barrels : Liquids and solids etc., e.g., oils, fats.
- Baskets : Edibles sold by baskets, e.g., certain fruits, etc
- Bins : Small metal part, e.g., certain fruits, etc.
- Bottle : Liquids, chemicals in comparatively small quantities, e.g., spirits.
- Boxes : Hardware and miscellaneous goods.
- Carboys : Liquid chemicals and acids in large quantities.
- Cases : Hardware, etc.
- Casks : Hardware and miscellaneous goods.
- Cupboards : Small article, fittings, etc., requiring more protection than open shelves.
- Cylinders : Gases

- Drums : Paints, Spirits, oils and certain other liquids.
- Floors : Tubing's, Piping, sheet irons and other heavy metal fittings, manufactured goods and timbers, etc.
- Jars : Greases, etc.
- Kegs : Greases, paint, white lead etc.
- Racks : Tools, spares, parts, hardware, etc.
- Sacks : Dry goods ready-made upon standard weights in large and heavy quantities, e.g., cement, c3ertain types of chemicals.
- Tanks : Spirits, oils and other liquids.
- Tins : Certain materials requiring to be kept damp and air proof.
- Vats : Oils and greases.



- It is convenient and advantageous to have such containers as are readily adaptable to the practice of such form and size that they may be easily converted in to other sizes and used for other purposes. In this category come boxes, bins, cases, shelves, etc.

- **CODIFICATION:**

- Any organization stores a large number of items, often running in to lakhs. There should, therefore, be some means of identifying them.
- A common practice is to describe them by individual names. Since several departments use the same item, they call the same item by different names and store them in different places.

- **Process of Codification:**

- ❖ Codification is a process of representing each item stored in hospital medical store by a three digits number, each one of which indicate the group, the subgroup, the type and the dimension of the item.
- ❖ Many organizations in the public and private sectors, railways and DGS & D, have their own system of codification, varying from eight to thirteen digits.
- ❖ The first two digits normally represent the major groups, such as raw materials, spare parts, sub-contracted items, tools, oil, stationery, medicines etc. The next two digits indicate the sub-groups.
- ❖ Dimensional characteristics of length, width, head diameter usually constitute the further three digits and the last digit is reserved for minor variations.
- ❖ The codification could be thought of on the basis of source of purchasing where items obtained from one source of purchasing are grouped together and given codes. The codification could also be built on are grouped together and given codes.

- ❖ The codification of hospital items could also be built on the basis of alphabetical listing. It can also be done by numerical digits or by a basis of alphabetical listing. It can also be done by numerical digits or by a combination of English Letters and numerical.
- ❖ The universal decimal classification of codification which is used in libraries, introduces decimal for identifying items.
- Codification should be compact, concise, consistent and flexible enough to accommodate new items.
- As far as possible uniform dimensions, say the metric system should be adopted.
- It should be meaningful and oriented towards the needs of an individual organization. The groupings should be logical, holding similar parts near to one another.
- Each digit must be significant enough to represent some characteristics or aspect of the item. Two fundamental systems are described in detail in the following paragraphs.

- **KODAK SYSTEM :**

- The Kodak system of codification of hospital items has been developed by Eastman Kodak Company of New York which consists of 10 digits of numerical code.
- The logic of major grouping is based on sources of supply. All materials are divided into 100 basic classifications, contributed only by procurement considerations.

- **BRISCH SYSTEM :**

- The Brisch system of codification of hospital items named after a prominent consulting engineer in the UK consists of seven digits and is applied in three phases.
- The items are grouped into suitable preliminary categories, such as assemblies, components, off the shelf items.
- After these preliminary categories, items are grouped within the respective class in order to bring similar items together. The Brisch system, though it consists only of seven digits, is quite comprehensive as the basis is on logical major groupings.

- **System Approach: A Practical Method :**

- There are different systems of codification for rationalized storekeeping. But the best is that which gives, along with standard form, also the history and sizes of materials.
- Codification should also avoid calling the article by its function or its used name.
- It should give an objective name which should be versatile in nature. It should give an objective name which should be versatile in nature.
- The system is more commendable for adoption where large number of items having large variety is piled up in stores some are as follows.
  1. Arbitrary system
  2. Pneumonic system
  3. Decimal system

## 1. Arbitrary system :

- Arbitrary system as the word 'arbitrary' denotes, is based on the serial number under which a material is received, and the same is allotted a code number.
- This arbitrary number is quoted for all transactions in the Stores Department and that remains the code number of a particular item.
- In this system either one has to follow the arbitrary number allotted to an article upon its receipt or the standardization Department gives the arbitrary number.
- To quote an example, if Standardization Department has so far standardized 9000 items, and if now it wants to standardize any other item, then that particular item may be codified as 9001.

- This system has some advantages of its own as well as some disadvantages inherent in it. The primary advantage is that there is no fixed limit for codifying any number of items.
- This means, for every item it requires to refer to the key, which is cumbersome and that is the reason why this system is not popular.

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## 2. Pneumonic system :

- The other system of codification is Pneumonic under this system the material is codified by giving figures and letters as codes. It may be decimal or arbitrary.
- The difference lies in suffixing or prefixing alphabets according to requirements. This sort of system is quite prevalent where English System of accounting is in vogue.
- Besides giving a code, it can give a hint about the material or the item, as in this system the first letter carries the first alphabet of the name.
- This system is most common in numbering the vehicles, e.g., WBL-7352. Here, W. B. stands for west Bengal, L for Lorry and 7352 is the arbitrary registration number. In a similar fashion, for store items alphabets can be fixed or prefixed.



- This system too has advantages and disadvantages both. Primarily, without referring to the key, only seeing the coded alphabet one can find out the item and later on, by referring to the key the history of the item can be found out.
- This system is quite popular where non-metric system of material accounting is in vogue. i.e., English system.
- The main disadvantage is that this system is not very much flexible, and it has its limits, and further, it may also become very confusing at times.

### **3. Decimal system :**

- To some extent decimal system may be said to be universal in its working. It is simple and easy to codify stores under this system.
- Stores, holding up to 250, 00 items can easily adopt this method without any complication. To follow this system one has to categorize stores in classes, groups, sub-groups, types and last three digits can be left for sizes or sub-types.

- **STORES RECORDS :**

The store-keeper has to maintain two stores records namely Bin card & stores ledger.

### Bin card

No. _____				Max. Qty _____					
Name of article _____				Min. Qty _____					
Symbol _____				Previous Year _____					
Unit _____				Consumption _____					
Bin No. _____									
Stores Ledger folio _____									
ORDERED				Date	Ref	Received	Issued	Balance	Remarks
No.	Date	Qty	Date Received						
RESERVED									
Job No.	Qty	Date issued							

- Bin card is a stores record in which the items received and issued are clearly specified by the store-keeper.
- Whenever the materials are received, the store-keeper has to prepare a stores received note indicating the type of materials and quantity and based on that he has to fill-up the receives column in the bin card after placing the materials in their respective Bins.
- When any issue of materials is made he has to check for the authorization of the requisition before issuing the materials.
- On making the issues he has to enter into the issues column that quantity of materials issued.
- The column reserved indicates the number of items and their type kept as reserve for important jobs.

- **Store Ledger:**

- It is same as Bin card, the difference is only with regard to the addition of amount column in this stores ledger used in day to day management of hospital stores.
- Whenever the materials are received from the supplier, after checking the consignment, the number of items received must be shown in the received column, under quantity.
- After the invoice sent by the supplier is verified, the rate and amount column are also filled-up.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Bank Balance		\$4,567.00	Cash Balance			\$1,234.56	Total Inventory		\$9,000	Fill the white cells only !!				
2	DAILY SALES			Monday			Oct 3		OVERHEAD (including taxes)			Cumulative		Estimated	
3	Sales	GST, tax2	PST, tax1	Cash	Checks	Charged	Received on Account		Comment	CASH	CHECK	Totals	Markup		
4	no GPST	Collected	Collected	Received	Received	to Acct.	Cash	Check	Rent:				17%		
5	PAID OUT to suppliers									Store Insurance			Estimated		
6	Name of Supplier	TOTAL no tax	TOTAL + tax	CASH	CHECK	GST	PST		Phone + Electricity				change in		
7									Equipment				Inventory		
8									Bank Charges				Total		
9									Store Maintenance				Total		
10									Van:	Insurance			Total		
11									gas				Total		
12									maintenance				Total		
13									Bank Charges				Total		
14									Total GST				Total Inventory		
15									WAGES				\$9,000		
16													Total		
17													Total		
18													Total		
19	Totals =														
20	BANKING			Actual Balance =			\$4,567								
21	Comments		Cash Deposit	Check Deposit	Cash OUT										
22	Comments		Est. Balance	Cash											
23			\$4,567.00	Balance											
24															

# Stores ledger

Name of material _____				Minimum Quantity _____					
Symbol _____ Unit _____				Maximum Quantity _____					
Bin No. _____				Previous yr. Consumption _____					
Bin card No. _____				Period of delivery _____					
Ordered	Date	Quantity			Amount			Rate	Remarks
		Received	Issued	Balance	Received	Issued	Balance		

- When any issue is made, the store-keeper on checking the authorization of materials requisition has to make entries in the Bin card and stores ledger.
- The main advantage of stores ledger is that it adds as a counter-check for the entries shown in the Bin Card.
- Both Bin card and stores ledger must be properly up-dated in order to facilitate the physical checking of inventories.
- All discrepancies found out have to be corrected then and there, and there by the stores records are helpful for perpetual inventory control.

- **Materials Issue Procedure: (to be followed in the hospital stores) :**

A standard procedure of material issue from hospital stores should be developed keeping in view of the following points.

- 1) Materials should be issued only against proper authorization (e.g., Materials Requisition).
- 2) Issuing of material should take the least possible time so that there should not be inconvenience or interruption in service process.
- 3) Materials should be kept at accessible and definite place to enable quick issue.
- 4) Proper system of classification of materials should be adopted for avoiding the issue of wrong materials.
- 5) Persons who come to take materials should be adopted for avoiding the issue of wrong materials.
- 6) Every issue should be recorded immediately in proper records like Bin cards, stock register.
- 7) Material issued should be priced and entered into the stores Ledger by costing department, (finance department) and not by stores-personnel.
- 8) Unauthorized persons should not be allowed to meddle with the stocks.

- **Material Requisition:**

- Whenever materials are needed for use, the departmental head should initiate a “Material Requisition Note”.
- This formal request to issue the materials stating their description quantity for particular work order. The M. R. Note should be signed by the requisitioned and authorized by a higher authority.
- Material Requisition is prepared in triplicate, one for departmental reference and other two for hospital stores.
- After issuing the material the store-keeper will retain one and send the other copy of material requisition to costing department for material pricing and passing entries.
- A bill of Material (i.e. specification of Materials) may also sometimes be used as a document to demand materials from stores.

## MATERIAL REQUISITION

### ABC HOSPITAL LTD, MATERIAL OR STORES REQUISITION

Department \_\_\_\_\_ Material Requisition No. \_\_\_\_\_

Department No. \_\_\_\_\_ Date \_\_\_\_\_

To

The Store Keeper

Please Issue the following materials

Description	Code No.	Qty	For cost office		Bin Card No.	Stores Ledger Folio	Remarks
			Rate	Amt			

Requisitioned By \_\_\_\_\_ Issued by \_\_\_\_\_

Authorized BY \_\_\_\_\_ Received by \_\_\_\_\_





- **Bill of Materials:**

- A bill of materials gives a complete list of all materials required with quantities for a particular hospital ward or departmental process.
- This bill of materials serves the purpose of materials requisition and all materials listed on the bill are sent to the purchase department.
- A bill of materials should be prepared if the job is of non-standardized nature so that reasonable estimate of all materials required may be made by the service department before the job is started.

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ABC Hospital LTD.

Bill of Materials

Job No. \_\_\_\_\_

Department Authorized \_\_\_\_\_

Serial No.	Description of Materials	Stores Code No.	Quantity Required	For Cost Office		Remarks
				Rate	Amount	

Drawing officer \_\_\_\_\_

Priced by \_\_\_\_\_

Received by \_\_\_\_\_

Store Keeper \_\_\_\_\_

Stores Ledger folios \_\_\_\_\_

## • **Transfer of Surplus Materials :**

- Transfer of excess materials or medicines from one department in a hospital to another or from one job to another should be discouraged because it may create complication in ascertaining proper materials cost of job.
- In such cases for proper accounting the “Material Transfer Note” is to be prepared by transferring department
- The copies of Material transfer note are routed to
  - (1) receiving department
  - (2) Stores department
  - (3) Costing office and one copy is retained by transferring department for its reference.

It should be signed by the heads of both the departments affecting the transfer.

ABC HOSPITAL LTD.  
MATERIAL TRANSFER NOTE

From

Job No. \_\_\_\_\_

No. \_\_\_\_\_

Department \_\_\_\_\_

Date \_\_\_\_\_

To

Job No. \_\_\_\_\_

Department \_\_\_\_\_

Description	Code No.	Quantity	For Cost Office		Remarks
			Rate	Amount	

Approved by \_\_\_\_\_ Received by \_\_\_\_\_ Priced by \_\_\_\_\_

Debited \_\_\_\_\_

Credited \_\_\_\_\_



- **STORES ACCOUNTING: (related to hospital store)**

- In relation to the estimation of the cost of the service for pricing decisions, stores accounting assumes a key role.
- Material costing is very important in terms of the valuation of the cost of materials consumed by the various service department in a hospital set up.
- We will discuss the materials costing under classifications of the receipt of materials, issue of materials, and of the stocks held at the end of the accounting period.

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- **COSTING OF THE RECEIPT OF MATERIALS:**

- ❑ The factors that are to be included in the building up of the cost of the medical and health care materials received are material price, freight charge, insurance and taxes. Price usually refers to the price quoted and accepted in the purchase orders.
- ❑ Prices may often be stated in various ways, such as net prices, prices with discount terms, free on board, cost insurance and freight, etc.
- ❑ The freight costs incurred in transporting the goods are usually collated under a separate head. Sometimes prices may include this element. Hence care should be taken to ensure that there is no double counting.

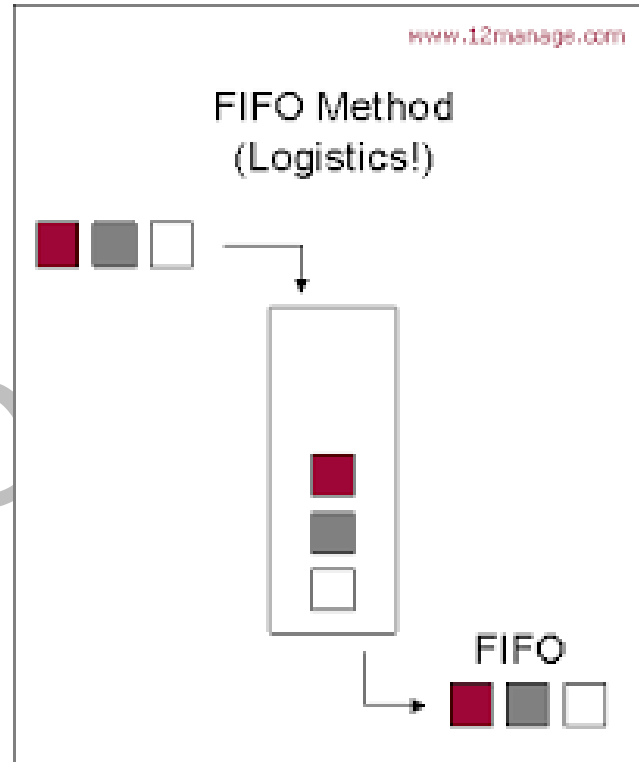
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- ❑ Goods in transit are mostly covered by insurance. All such insurance expenses must be calculated and added to the base cost and transportation cost.
- ❑ Under the miscellaneous head, we need to classify costs incurred by way of customs duties, taxes, and packages, cost of handling. Such separate classifications give a better framework for cost control.
- ❑ In sum, we can say that cost of the materials received is equal to the price quoted less discounts, plus freight, insurance duties, taxes and package charges. Very often such detailed classification helps in quicker analysis and effective control.

- **COSTING OF THE ISSUES TO PRODUCTION:**

- First in first out (FIFO), average cost, standard cost, base stock method, market price at the time of issue, latest purchase price, replacement or current cost are some of the methods used in costing the issues to services provided by health care & hospital organization .



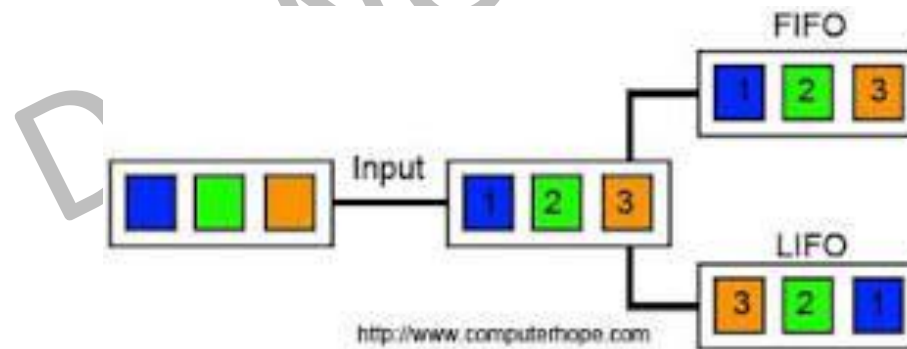
- **FIFO:**

- The assumption made here is that the oldest hospital stock is depleted first. This is logical in the case of items which deteriorate with time.
- In FIFO process, the value of the stocks held on hand is the money that has been paid for that amount, of stock at latest price levels and hence can straightaway be used in balance sheet, truly reflecting the value.
- The limitations of FIFO process are that the process becomes unwieldy when too many changes in price levels are encountered.

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- **LIFO:**

- The basic assumption here is that the most recent receipts are issued first. In a period of rising prices, latest prices are charged to the issues, thereby leading to lower reported profits and hence savings in taxes.
- When there are wide fluctuations in price levels, LIFO tends to minimize unrealized gains or losses in inventory of hospital items. However, LIFO systems have the same disadvantages as that of FIFO systems.



- **Average cost:**

- In this method, the issues to the medical service department are split into equal batches from each shipment at stock.
- It is a realistic method reflecting the price levels and establishing the cost figures.
- The rate is arrived at by dividing the total cost by the number of items.
- Then, this rate is applied to the issues to service.
- As more purchases are made, a new average is computed and this average is applied to the subsequent list issues.

- **Costing the closing Stock:**

- Generally the guideline used here is that either the market price or stock at cost is to be used, whichever is less.
- The main factors which determine the cost of closing stock of various hospital items stored in hospital stores are price levels, obsolescence and deterioration.
- When the prices fluctuate, the kind of system used for evaluating the cost of issues to service affects the costing of closing stock.
- As we saw earlier, each system of costing tends to undervalue the stocks during periods of decreasing price levels.
- So, a provision has to be made to account for such variations from the actual value of the stocks.

## ● **STOCK VERIFICATION:**

- It is the process of physically counting, measuring or weighting the entire range of items in the stores and recording the results in a systematic manner.
- The purpose served by stock verification of the various stored items stored in the hospital is as follows.
  1. To reconcile the stock records and documents for their accuracy and usefulness.
  2. To identify areas which require more disciplined document control
  3. To backup the balance sheet stock figures; and to minimize pilferage and fraudulent practices.
- Stock verification of stored hospital items is usually varied out by the materials audit department, reporting to either the materials manager or the internal audit.
- One person is reporting to either the materials manager or the internal audit.
- One person is usually given the exclusive responsibility with adequate facilities and authority.
- Physical verification can be carried out periodically or a continuous basis.

- **Periodic verification :**

- Under this system, the entire cross-section of the hospital stocks is verified at the end of one period, which is usually the accounting period.
- In big organizations this is not achieved in a day and usually several days are taken to complete this task.
- As no transactions can take place during the verification. This could pose some problems. Physical verification requires careful planning and execution.

- **CONTINUOUS VERIFICATION :**

- Under continuous verification system, verification is done throughout the year as per a pre-determined plan of action.
- A - Items may be verified thrice a year, B-items twice a year and C-items once a year. As no transactions can take place during the verification.
- It, therefore presupposes that a perpetual inventory record for each item is maintained showing all transactions so that reconciliation can be done.



- **PROCESS OF VERIFICATIONS :**

- Items are verified
- ✓ By counting in the case of bearings,
- ✓ By weight in the case of sheets,
- ✓ By measuring in the case of lubricants and so on.
- ✓ However, when large stocks of items such as sand, scrap and ore fuel need to be verified, it is based only on estimates as the question of exact measurement is ruled out.
- In the actual process of stock verification, the stores personnel should be quicker identification of items.
- For instance, some items may be located in many places. By virtue of their experience, only stores personnel will be able to locate them. So the material audit people will have to work in close coordination with them.
- Discrepancies must be discussed with Stores so that any omissions may be rectified and then only should they be reported to top management.

- Major discrepancies may require a re-verification.
- Such discrepancies may be due to pilferage on a large scale, wrong posting of records and loose documents control. They require careful analysis and immediate corrective measures.
- After discrepancies have been noted, stock adjustments must be made using standard stock adjustment documents duly signed by the appropriate authority.
- A typical stock adjustment form is shown below:

Date of verification : Part number : Part description : Location code : Quantity as per record : Quantity on verification : Discrepancy : Amount : Value Prepared by                      S/d Approved by                      S/d	Serial number ..... Serial No. ref. no. .... Stock verification sheet ..... Surplus Deficient
--	--

- After the approval, the stock records can be corrected.
- Surprise checks and verifications are made by materials audit department to detect any fraudulent acts.
- Material audit plays the role of a watchdog of stores, pointing out weak areas and remedying them.
- It assists in accurate records – keeping and smoothes finalization of annual accounts.

- **VALUE ANALYSIS:**

- Value analysis developed in U.S.A. in 1947. Lorry D. Miles who as working at G. E. found this value analysis as a cost reduction technique.
- Value analysis was introduced because of the inherent desire in the man to make cheaper and to sell cheaper; without any change in the utility of the products.

**Value:**

$$\text{Value} = \frac{\text{Function (or) utility}}{\text{Cost}}$$

- Value is the cost proportionate to the function.
- To increase the value of a product, the utility of product should be increased otherwise the cost should be decreased.
- Value can be divided into the following classifications.

## Use Or Functional Value :

1. The properties and qualities which accomplish a use, work or service.
2. **Esteem value :**
3. The properties, features or attractiveness which causes us to want to own it.
4. **Cost value :**
5. The sum of labour, material and various other costs required to produce it.
6. **Exchange value :**
7. Its properties or qualities which enable us to exchange it for something else we want.

- **Definition of value:**

Value can be defined as, “the minimum money has to be expended in purchasing or manufacturing as product to create the appropriate use or esteem factors”.

- **Definition of value analysis:**

- Value analysis of the hospital stocks can be defined as “an organized creative approach which has as its objective-the achievement of the value of the product”.
- Value analysis aims at reducing the cost value to the value of the product.
- Based on these classifications, value is defined as “the minimum money which has to be expended in purchasing or manufacturing a product to create the appropriate use or esteem factors”.
- We could now define value analysis as “an organized creative approach which has as its objective – the achievement of the value of the product”. Value analysis aims at reducing the cost value to the value of the product.

- It should be borne in mind that:
- Value is not inherent in a product, it is relative term, and value can change with time and place.
- It can be measured only by comparison with other products which perform the same function.
- Value is the relationship between what someone wants and what he is willing to pay for it.
- In fact, the heart of value analysis technique is the functional approach. It relates to cost of function whereas others relate cost to product.
- Value =  $\frac{\text{Function}}{\text{Cost}}$

## ● **SELECTION OF PRODUCTS FOR VALUE ANALYSIS:**

- The first step for the implementation of a value analysis programme is the selection of products to be analyzed.
- As mentioned earlier, value analysis makes its mark during the maturity stage of the product.
- This means that one has to start thinking along these lines during the later part of the growth stage what is important here is the switch from performance-oriented thinking to value-oriented thinking.
- The two approaches for the choice of products for value analysis are through ABC analysis and Contribution analysis.
- In the ABC analysis, the products are classified according to their consumption value and ranked in descending order.
- The products which offer the minimum sales or consumption value are selected. These would offer the best results in terms of returns when analyzed.
- Critical and service holding items are to be subjected to value analysis in order to examine the rigidity of the specification.



- **Stage in Value Analysis:**

The value engineering exercise proceeds systematically through following six stages. These are:

1. Organization
2. Evaluation
3. Speculation
4. Investigation
5. Recommendation
6. Implementation

### **1. The organization Stage :**

It is composed of product selection and its analysis.

## 2. Evaluation Stage :

- This is also called information stage. It is desirable to design an evaluation sheet on which to record all the collected information. The information that is to be reordered on the evaluation sheets includes.
  - Design
  - Purchasing
  - Derived information
  - Service
  - Costing

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### 3. Speculation Stage :

Speculation stage can be regarded as the heart of the matter. The essential technique of this is functional approach. This has the following steps.

- i. The functional approach to cost reduction.
- ii. Assessing the value of a function.
- iii. Alternative actions following functional assessment.
- iv. Further studies during the speculation stage.
  - i. What are the functions, whether essential or can be eliminated?
  - ii. What material is used or proposed or can another material be used?
  - iii. What factors control the amount of material used?
  - iv. How much of the basic material is wasted during service?
  - v. What labour operations are involved?
  - vi. What tolerance have been specified and if so, why?
  - vii. What surface finish is required to meet the function?
  - viii. What is the “brought out” content of the cost? This division is based on make or buy.

Thus the crux of speculation stage is only creative thinking.

#### 4. Investigation :

- i. Design Contribution.** This includes change in design, the material used, the dimension and limits etc.
- ii. Service Contribution.** Covers process of service use of standard components, reduction of labour costs etc.
- iii. Purchase contribution.** To reduce the cost of material and parts which is supplied?
- iv. Applying the ABC of value Engineering.** There are 10 points suggested by Miles as long ago as 1947. These heads are :
  - A = Actual necessity or otherwise has 4 points
  - B = Best way or not has 3 points
  - C = Competitive cost of not has 3 points
- v. The Recommendation.** The proposed alteration and comparison of costs before and after all to be submitted for final recommendation by management.
- vi. Implementation.** This is the stage at which management revives and decides upon the value engineering suggestions submitted.

- **Benefits of Value Engineering:**

Results are derived on two factors

- Benefits to the company
- Benefits to the customer

**a. Benefits to the company :**

It is again divided as tangible and intangible results.

- **Tangible Results:**

- The results of value engineering will be of two sorts tangible and intangible.
- The tangible results are the actual savings in day to day hospital practices which can be expressed in monetary terms.
- The saving is usually much more than this.

- **Intangible Results:**

These are:

- i. Increased Cooperation
- ii. Enhanced states of the purchasing function
- iii. Simulation of creative thought
- iv. Increased cost-consciousness
- v. Mutual understanding
- vi. Development of latent ability

- **Benefits to the customer :**

To live and to prosper, industry must provide the customer with what he wants, when he wants it, and at price he is willing to pay. Value technique must, therefore consider the customer and his requirements.

- **IMPLEMENTATION AND METHODOLOGY:**

1. Identifying the function – any useful product has some primary function which must be identified, a bulb to give light, a refrigerator to preserve food, etc. In addition it may have secondary functions such as withstanding shock, etc. These two must be identified.
2. Evaluation of the function by comparison – value being a relative term, the comparison approach must be used to evaluate functions. The basic question is, “Does the function accomplish reliability at the best cost” and can be answered only by comparison.

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3. Develop alternatives – realistic situations must be faced, objections overcome and effective engineering manufacturing and other alternatives developed. In order to develop effective alternatives and identify unnecessary cost the following thirteen value analysis principles must be used :

1. Avoid generalities.
2. Get all available costs.
3. Use information only from the best source
4. Brainstorming sessions.
5. Blast, create and refine.
6. Identify and overcome roadblocks.
7. Use industry specialists to extend specialized knowledge.
8. Key tolerances not to be too light.
9. Utilize and pay for vendor's skills and techniques.
10. Utilize vendor's available functional products.
11. Utilize specialty processes.
12. Utilize applicable standards.
13. Use the criterion "would I spend my money this way"?



- The above 13 principles are all self-explanatory except for the fifth-blast, create, and refine which is explained below:
- In the blast stage, alternative products, materials, processes or ideas are generated. The ideas would qualify for at least satisfying the accomplishment of the blast stage arte used to generate alternatives which accomplish the function almost totally. In the refining stage the alternatives generated are sifter and refined so as to arrive at the final alternative to be implemented.

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- **WASTE MANAGEMENT:**

Wastage is formed after completion of a process or during the process or sometime it takes place at storeroom, with in the hospital premises. Some kinds of wastages are listed below.

1. Waste of water (eg. Excessive rain water)
2. Waste of electricity (eg. Using electrical equipment unnecessarily)
3. Waste of land (due to poor and inadequate irrigation system lack of pollution control procedures)
4. Waste of time (particularly in production plant as machine and labour idle time)
5. Under-utilization of productive resources.

- From the above definitions we can list the reasons for the generation and accumulation of obsolete, surplus and scrap items:

- 1. Changes in service design :**

This way leads to some items getting invalid so far as the final product is concerned. Hence, the entire stock of such items becomes obsolete.

- 2. Rationalization :**

Sometimes materials are rationalized so as to minimize variety and simplify procurement. The rationalization process renders some items as surplus or obsolete.

- 3. Cannibalization :**

When a machine breakdown occurs, sometimes it is rectified using parts of an identical machine, which is not functioning due to various reasons. When continued unchecked, this results in obsolete and scrap items.

#### **4. Faulty planning and forecasting :**

- The marketing department may have projected a service forecast which might be on the higher side.
- Any materials planning have to be based on sales forecasts and this could result in surplus items.
- Wrong indenting by the user departments also leads to accumulation.

#### **5. Faculty purchase practices :**

- Sub-optimizing decisions like buying in bulk to take care of discounts and transportation economy without taking into account factors such as shelf life, storage space requirements and technological changes once again lead to the accumulation of surplus and obsolete stocks.

#### **6. Other causes :**

- Many items are held as insurable spares for many years without any consumption. Faulty store-keeping methods, without adequate preservation, lead to spoilage. Inferior materials handling, improper codification and poor manufacturing methods also result in obsolete, surplus and scrap items.

## • **Factors Involved In Waste Formation:**

### **1. Faulty Transportation methods :**

- Improper transportation leads to waste formation.
- When materials are transported in bulk, wastage occurs by spillage materials.
- In some volatile elements, wastage is in the form of evaporation losses (e.g. Petrol). During loading and unloading materials are damaged due to careless handling.

### **2. Improper Storage :**

- Improper storage facilities lead to waste formation.
- During storage, wastages and deterioration in quality occur, due to corrosion, improper use of preservatives, humidity, dust, excessive heat, cold, rain and other environmental factors.
- So the application of scientific warehousing methods reduces the wastages.

### **3. Lack of Control Procedure :**

- This factor also contributes in formation of wastages. When the production planning is made, materials purchase and utilization should be planned carefully.

- **Methods of Waste Control:**

The following two methods are used separately or jointly to control the wastes.

1. Technical Research
2. Managerial Research

### **1. Technical Research :**

- Through technical research waste can be converted to a profit-making stable product.
- At that time, the gain is double, since the expense relating to waste disposal is eliminated.
- Frequently, through research a waste is turned into a by-product that becomes a profitable co-product of the operation.

### **2. Managerial Research :**

Managerial Research concentrates in the proper analysis of requirement, innovative organization, better control of consumption and a well-designed information system with inbuilt checks on the bottlenecks.

- **IDENTIFICATION AND CONTROL:**

- The combing process of combining the stock records and movement's analysis has been found very effective in locating such stocks in the total inventory.
- A list of such items and their value in terms of money and time must be made.
- Similarly, such lists must be prepared for items which have not moved for 2 years, 3 years, and 5 years and above.
- Such lists can then be put up to top management for disposal action.
- Care must be taken to prepare a separate list of imported spares and insurance items. Such combing and movement analysis must be done on a continuous basis.

Sl. No.	Part number description	ABC	Last date of issue	Stock on hand in number of days consumption	Value of orders on hand

- Whenever changes in service programme, design and service lines are contemplated, a senior executive from materials management must definitely be kept in the picture.
- This helps in several ways.
- He is in a position to inform top management of the amount of stock of materials on hand that are likely to be rendered obsolete if and when the changes are introduced.
- This could even guide the management as to when the changes are introduced.



- The materials manager in turn can freeze further orders for such materials and try to negotiate with the suppliers to take back the stock.
- For some items he can introduce the buy-back clause where in the supplier takes back items not consumed within a specific period.
- For new item, which may be required, he can try to develop sources and place orders so that changes can be expeditiously introduced.
- All this highlights that a close coordination is required in order to avoid stocking obsolete and surplus items.
- Selective control based on ABC analysis, accurate forecasting techniques and proper preservation minimizes such accumulation.

- Many organizations have introduced formal documentation in introducing changes in design or service.
- It is called the “Effective Point advice”. This is popularly known as EPA.
- Here, the proposed changes, details of new materials and products required, details of materials and products which will be invalid / obsolete when the change occurs and the approximate date when the change departments.
- EPA thereby helps in tapering off the stocks of “invalid” items, cancellation of orders for such items, placing orders for buying and / or manufacturing new items and related activities.
- The reclamation of scarp has not attracted the attention of the top management in Indian industry.
- Big organizations have a full-fledged scrap salvaging departments. These departments segregate the scarp into categories. Colour coding the scarp is also done to avoid the mixing of different categories of scarp.



**END OF CHAPTER 8**

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## **CHAPTER 14**

# **Materials: Inventory Control**

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### **Store and Storekeeping**

Stores play a vital role in the operation of a company. Generally unworked material is stored and the place where it is stored is called Store Room. It is in direct touch with the user departments in its day-to-day activities. The chief aim of the stores is to ensure the smooth flow of production without any interruption. Stores generally include raw materials, work in progress and finished goods.

Effective storekeeping and inventory control are indispensable to the control of material cost. Further, stores often equated directly with money, as capital is blocked in inventories.

### **Purpose of Storekeeping**

- (1) Storekeeping helps to examine carefully all goods and materials on receipts.
- (2) It is essential to arrange for a systematic and efficient storing of materials.
- (3) Storekeeping ensure accurate and prompt distribution of materials to user departments as per issue requisition note.
- (4) It is essential because stores often equated directly with money, as capital is blocked in inventories.

### **Functions of the Storekeeper**

The store is a service department headed by the storekeeper who holds the responsible position in the organisation of the stores department. He is as much responsible for the articles incharge as a cashier for the cash. Important functions of the storekeeper are given below:

- (1) He must receive raw materials, components, tools, equipment and other items and account for them properly.
- (2) He must provide adequate and proper storage and preservation to the various items.
- (3) He must check, and provide proper classification and codification of materials.

- (4) Issue the materials as per material issue requisition duly signed by an authorized person.
- (5) He has to take steps to prevent leakage, theft, wastage and deterioration.
- (6) He must ensure good storekeeping.
- (7) He should not permit any person without authorization.
- (8) He should maintain proper records in order to know desired quantities available.
- (9) He must provide adequate informations to the top executives for verifications and effective decision making.

### **Stores Layout**

In order to achieve the objectives of effective inventory control, well planned layout of stores should be required. A planned stores layout will facilitate easy movement of materials, good housekeeping, sufficient space for materials handling. It ensures effective utilization of storage space and judicious use of storage equipments. The stores department should be equipped with shelves, racks, pallets and proper preservation from rain, light and other such elements. An ideal location of stores should facilitate the volume and variety of goods to be handled. In order to bring down the transport cost it should be close to roads or railway stations. And also as far as possible, a the stores department should be near to the receiving department. In the case of large organizations usually stores attached to each consuming department, whereas receiving is done centrally.

### **Types of Stores**

The types of stores depend on the size, types and policy of the organization. Organization of stores varies from concern to concern. As per the requirement of the firm the stores organization may be classified into :

- (a) Centralized Stores.
- (b) Decentralized Stores.
- (c) Combination of both, i.e., Centralized Stores with Sub Stores.

**(a) Centralized Stores:** This system is suitable to small-scale industries where it is desirable to centralize the materials in one department. Under this system, the store room will be most conveniently situated where it is near to all the departments.

### ***Advantages of Centralized Stores***

- (1) Well planned layout of stores.
- (2) Effective utilization of floor space.
- (3) Better supervision of stores is possible.
- (4) Effective material handling is possible.
- (5) Lot of manual work may be eliminated.
- (6) Better control is possible.
- (7) Less investment is required.
- (8) Ensures minimum wastages.
- (9) Facilitates prompt flow of materials.
- (10) Better forecasting is possible.

**Disadvantages**

- (1) Increases transportation costs.
- (2) Delay and inconvenience because of over-crowding of materials.
- (3) Greater risk of loss in case of fire.
- (4) Break down in transport will affect continuous flow of production.
- (5) Increases cost of materials handling.

**(b) Decentralized Stores:** Under this system each department has its own stores. It is suitable to large concern where there are several departments each using a different type of material from its own stores. In this system all the disadvantages of centralized stores can be eliminated.

**(c) Combination of Both :** This system is also termed as Imprest System or stores control. Centralized Stores with Sub Stores is usually adopted in large factories where departments are situated at a distance from the central stores. In order to minimize the cost of transportation and materials handling, this type of organization would be located nearer to the receiving department. Under this system material receipts are stored in the central stores and issues are made to the sub-stores. Under imprest system of stores control sub stores which are located nearer to the central stores for the purpose of draw supplies from central stores and issue the required quantity to production. To maintain the stocks at the predetermined level, the sub-stores make requisition from the central stores.

**Fixation of Stock Level**

Material control involves physical control of materials, preservation of stores, minimization of obsolescence and damages through timely disposal and efficient handling. Effective stock control system should ensure the minimization of inventory carrying cost and materials holding cost. Level of stock is the important aspect of inventory control. Stock level may be overstocking or understocking. Overstocking requires large capital with high cost of holding. In the case of understocking, production and overall performance of the concern as a whole will affect. Thus, fixation of stock level is essential to maintain sufficient stock for the smooth flow of production and sales. The following are the important techniques usually adopted in different industries :

- (a) Maximum Stock Level.
- (b) Minimum Stock Level.
- (c) Danger Level.
- (d) Re-Order Level.
- (e) Economic Ordering Quantity (EOQ).
- (f) Average of Stock Level.

**(a) Maximum Stock Level:** The maximum stock level indicates the maximum quantity of an item should not be allowed to increase. The maximum quantity of an item can be held in stock at any time. The following factors can be considered while fixing the maximum stock levels :

- (1) Availability of capital.
- (2) Availability of floor space.
- (3) Cost of storage.
- (4) Possibility of fluctuation of prices in raw materials.
- (5) Cost of insurance.
- (6) Economic order of quantity.

- (7) Average rate of consumption.
- (8) Re-order level and lead time.
- (9) Seasonal nature of supply.
- (10) Risk of obsolescence, depletion, evaporation etc.

The maximum stock level can be calculated by the following formula :

$$\text{Maximum Stock Level} = \text{Re-Order Level} + \text{Re-Ordering Quantity} \\ (\text{Minimum Consumption} \times \text{Minimum Re-Ordering Period})$$

**(b) Minimum Stock Level:** Minimum stock level indicates the minimum quantity of material to be maintained in stock. Accordingly, the minimum quantity of an item should not be allowed to fall. The minimum stock is also known as Safety Stock or Buffer Stock. The following formula is adopted for calculation of minimum stock level :

$$\text{Minimum Stock Level} = \text{Re-Order Level} - (\text{Normal Consumption} \times \text{Normal Re-Order Period})$$

**(c) Danger Level:** It is the stock level below the Minimum Level. This level indicates the danger point to affect the normal production. When materials reach danger level, necessary steps should be taken to restock the materials. If there is any emergency, special arrangements should be made for fresh issue. Generally this level is fixed above the minimum level but below the re-ordering level. The formula for determination of danger level is :

$$\text{Danger Level} = \text{Average Rate of Consumption} \times \text{Emergency Supply Time}$$

**(d) Re-order Level:** Re-order level is also termed as Ordering Level. It indicates when to order, i.e., orders for its fresh supplies. This is the stock level between maximum and the minimum stock levels. The re-order stock level is fixed on the basis of economic order quantity, lead time and average rate of consumption. Calculation of re-order level is adopted by the following formula :

$$\text{Re-order Level} = \text{Minimum Level} + \text{Consumption during the time to get fresh delivery}$$

(or)

$$\text{Re-order Level} = \text{Maximum Consumption} \times \text{Maximum Re-ordering Period}$$

**(e) Economic Order Quantity (EOQ):** Economic Order Quantity is one of the important techniques used to determine the optimum quantity or number of orders to be placed from the suppliers. The main objectives of economic order quantity is to minimize the cost of ordering, cost of carrying materials and total cost of production. Ordering costs include cost of stationery, salaries of those engaged in receiving and inspecting, general office and administrative expenses of purchase departments. Carrying costs are incurred on stationery, salaries, rent, materials handling cost, interest on capital, insurance cost, risk of obsolescence, deterioration and wastage of materials and evaporation. Economic Order Quantity can be calculated by the following formula :

$$E O Q = \sqrt{\frac{2 A B}{C S}}$$

**Where :**

- E O Q = Economic Ordering Quantity
- A = Annual Consumption
- B = Buying Cost per Order
- C = Cost Per Unit
- S = Storage and Carrying Cost per Annum

**(f) Average Stock Level:** Average stock level is determined on the basis of minimum stock level and re-order quantity. This is calculated with the help of the following formula :

**Average Stock Level**

$$= \text{Minimum Stock Level} + \frac{1}{2} \text{ of Re-order Quantity}$$

(or)

$$= \frac{\text{Minimum Level} + \text{Maximum Level}}{2}$$

**Illustration: 1**

From the following particulars calculate the

- (a) Maximum Stock Level.
  - (b) Minimum Stock Level.
  - (c) Re-ordering Level.
  - (d) Average Stock Level.
- (1) Normal consumption = 600 units per week.
  - (2) Maximum consumption = 840 units per week.
  - (3) Minimum consumption = 480 unit per week.
  - (4) Re-order quantity = 7200 units.
  - (5) Re-order period = 10 to 15 weeks.
  - (6) Normal reorder period = 12 weeks.

**Solution:**

**Re-order Level**

$$= \text{Maximum Consumption} \times \text{Maximum Re-order Period}$$

$$= 840 \times 15 = 12600 \text{ units}$$

**Minimum Stock Level**

$$= \text{Re-order Level} - (\text{Normal Consumption} \times \text{Normal Re-order Period})$$

$$= 12600 - (600 \times 12)$$

$$= 12600 - 7200 = 5400 \text{ units}$$

**Maximum Stock Level**

$$= \text{Re-order Level} + \text{Re-order Quantity} - (\text{Minimum Consumption} \times \text{Minimum Re-order Period})$$

$$= 12600 + 7200 - (480 \times 10)$$

$$= 19800 - 4800 = 15000 \text{ units.}$$

**Average Stock Level**

$$= \frac{\text{Minimum Stock Level} + \text{Maximum Stock Level}}{2}$$

$$= \frac{5400 + 15000}{2}$$

$$= \frac{20400}{2}$$

$$= 10200 \text{ units}$$



**Illustration: 2**

The following information available in respect of a material X :

Re-order Quantity	=	1800 units
Maximum Consumption	=	450 units per week
Minimum Consumption	=	150 units per week
Normal Consumption	=	300 units per week
Re-order Period	=	3 to 5 weeks

Calculate the following :

- (a) Re-order Level
- (b) Minimum Stock Level
- (c) Maximum Stock Level

**Solution:**

**(a) Re-order Level :**

$$= \text{Maximum Consumption} \times \text{Maximum Re-order Period}$$

$$= 450 \times 5 = 2250 \text{ units}$$

**(b) Minimum Stock Level :**

$$= \text{Re-order Level} - (\text{Normal Consumption} \times \text{Normal Re-order Period})$$

$$= 2250 - (300 \times 4)$$

$$= 2250 - 1200 = 1050 \text{ units.}$$

**(c) Maximum Stock Level :**

$$= \text{Re-order Level} + \text{Re-order Quantity} - (\text{Minimum Consumption} \times \text{Minimum Re-order Period})$$

$$= 2250 + 1800 - (150 \times 3)$$

$$= 4050 - 450 = 3600 \text{ units.}$$

**(d) Normal Re-order Period:**

$$= \frac{\text{Minimum Re-order period} + \text{Maximum Re-order Period}}{2}$$

$$= \frac{3 \text{ weeks} + 5 \text{ weeks}}{2}$$

$$= \frac{8}{2} = 4 \text{ weeks}$$

**Illustration: 3**

Two components P, Q are used as follows. Normal usage 1000 units per week each. Re-ordering quantity P – 20,000; Q 8,000. Re-ordering period P – 4 to 6; weeks; Q 2 to 4; minimum usage 2000 units per week; each maximum usage 3000 units per week each.

You are required to calculate the following each of the components :

- (1) Minimum Stock Level
- (2) Maximum Stock Level
- (3) Average Stock Level
- (4) Re-ordering Level

**Solution:**

(1) <i>Re-ordering Level</i>	=	Maximum Consumption x Maximum Re-Order Period
Product P	=	3000 x 6 = 18,000 units
Product Q	=	3000 x 4 = 12,000 units
(2) <i>Minimum Level</i>	=	Re-order Level – (Normal Consumption x Normal Re-order Period)
Product P	=	18,000 – (1,000 x 5)
	=	18,000 – 5,000 = 13,000 units
Product Q	=	12,000 – (1,000 x 3)
	=	12,000 – 3,000 = 9,000 units
(3) <i>Maximum Level</i>	=	Re-order Level + Re-order Quantity – (Minimum Consumption x Minimum Re-order Period)
Product P	=	18,000 + 20,000 – (2,000 x 4)
	=	38,000 – 8,000 = 30,000 units
Product Q	=	12,000 + 8,000 – (2,000 x 2)
	=	20,000 – 4,000 = 16,000 units
(4) <i>Average Stock Level</i>	=	Minimum Level + ½ of Re-order Quantity
Product P	=	13,000 + ½ (20,000)
	=	13,000 + 10,000 = 23,000 units
Product Q	=	9,000 + ½ (8,000)
	=	9,000 + 4,000 = 13,000 units

**Illustration: 4**

From the following information for last twelve months, compute the

- (1) Re-order Level
- (2) Minimum Level
- (3) Maximum Level
- (4) Average Stock Level for the components of X and Y

	<i>Components</i>	
	X	Y
Maximum Consumption in a month	3,000	3,000
Minimum Consumption in a month	2,000	2,000
Average Consumption in a month	1,000	1,000
Re-order period in a month	8 to 12	4 to 8
Re-order quantity in units	8,000	12,000

**Solution:**

$$\begin{aligned}
 (1) \quad \text{Re-order level} &= \text{Maximum Consumption} \times \text{Maximum Re-order period} \\
 \text{Product X} &= 3,000 \times 12 = 36,000 \text{ units} \\
 \text{Product Y} &= 3,000 \times 8 = 24,000 \text{ units} \\
 (2) \quad \text{Minimum Level} &= \text{Re-order Level} - (\text{Normal Consumption} \times \text{Normal Re-order Period}) \\
 \text{Product X} &= 36,000 - (1,000 \times 10) \\
 &= 36,000 - 10,000 = 26,000 \text{ units} \\
 \text{Product Y} &= 24,000 - (1,000 \times 6) \\
 &= 24,000 - 6,000 = 18,000 \text{ units} \\
 (3) \quad \text{Maximum Level} &= \text{Re-order Level} + \text{Re-order quantity} - \\
 &\quad (\text{Minimum Consumption} \times \text{Minimum Re-order Period}) \\
 \text{Product X} &= 36,000 + 8,000 - (2,000 \times 8) \\
 &= 44,000 - 16,000 = 28,000 \text{ units} \\
 \text{Product Y} &= 24,000 + 12,000 - (2,000 \times 4) \\
 &= 36,000 - 8,000 = 28,000 \text{ units} \\
 (4) \quad \text{Average Stock Level} &= \text{Minimum Level} + \frac{1}{2} \text{ of Re-order Quantity} \\
 \text{Product X} &= 28,000 + \frac{1}{2} (8,000) \\
 &= 28,000 + 4,000 = 32,000 \text{ units} \\
 \text{Product Y} &= 28,000 + \frac{1}{2} (12,000) \\
 &= 28,000 + 6,000 = 34,000 \text{ units}
 \end{aligned}$$

Normal Re-order Period :

$$\begin{aligned}
 \text{Product X} &= \frac{8 \text{ Months} + 12 \text{ Months}}{2} \\
 &= \frac{20}{2} = 10 \text{ months} \\
 \text{Product Y} &= \frac{4 \text{ Months} + 8 \text{ Months}}{2} \\
 &= \frac{12}{2} = 6 \text{ months}
 \end{aligned}$$

**Illustration: 5**

From the following particulars calculate Economic Order Quantity :

Annual Consumption = 16,000 Units

Buying Cost per order = Rs. 18

Cost per unit of material = Re. 1

Storage and Carrying cost = 20% of average inventory

**Solution:**

Calculation of Economic Order Quantity:

$$\text{Economic Order Quantity} = \sqrt{\frac{2 A B}{C S}}$$

Where :

A = Annual Consumption

B = Buying Cost per order

C = Cost per unit of material

S = Storage and Carrying cost

$$\begin{aligned} \text{E O Q} &= \sqrt{\frac{2 A B}{C S}} \\ &= \sqrt{\frac{2 \times 16000 \times 18}{1 \times 20 \%}} = \sqrt{\frac{2 \times 16000 \times 18}{1 \times \frac{20}{100}}} \\ &= 1700 \text{ units} \end{aligned}$$

**Illustration: 6**

A company uses a particular material in a factory which is 20000 units per year. The cost per unit of material is Rs. 10. The cost of placing one order is Rs. 100 and the inventory carrying cost 20% on average inventory. From the above information calculate Economic Order Quantity.

**Solution:**

Calculation of Economic Order Quantity :

$$\text{E O Q} = \sqrt{\frac{2 A B}{C S}}$$

A – Annual Consumption = 20000 units

B – Buying Cost per order = Rs. 100

C – Cost per unit = Rs. 10

S – Storage and Carrying cost = 20% on average inventory

$$\begin{aligned} \text{E O Q} &= \sqrt{\frac{2 A B}{C S}} \\ &= \sqrt{\frac{2 \times 20000 \times 100}{10 \times 20 \%}} = \sqrt{\frac{2 \times 20000 \times 100}{10 \times \frac{20}{100}}} \\ &= 1414 \text{ units} \end{aligned}$$

**Illustration: 7**

Find out the Economic Order Quantity and order schedule of raw materials and packing materials with the following data given to you :

(1) *Cost of ordering :*

Raw materials = Rs. 1000 per order

Packing materials = Rs. 5000 per order

(2) *Cost of holding Inventory :*

Raw materials = 1 Paise per unit per month

Packing materials = 5 Paise per unit per month

(3) *Production rate :*

2,00,000 Units per month

**Solution:**

Calculation of Economic Order Quantity :

$$E O Q = \sqrt{\frac{2 A B}{C S}}$$

Where :

E O Q = Economic Order Quantity

A = Units Consumed in a month

B = Buying Cost per order

C = Cost per unit

S = Inventory Carrying Cost per month

(a) **Raw materials :**

$$\begin{aligned} E O Q &= \sqrt{\frac{2 \times 2,00,000 \times 1000}{0.01}} \\ &= \sqrt{40,00,00,00,000} \\ &= 2,00,000 \text{ units} \end{aligned}$$

Thus one order for 2,00,000 units each month

(b) **Packaging Materials**

$$\begin{aligned} E O Q &= \sqrt{\frac{2 \times 2,00,000 \times 5000}{0.05}} \\ &= \sqrt{40,00,00,00,000} \\ &= 2,00,000 \text{ units} \end{aligned}$$

Thus one order for 2,00,000 units per month

**Illustration: 8 \***

A Ltd. Co. is committed to supply 24000 bearings per annum to B Ltd. on a steady basis. It is estimated that it costs 10 paise as inventory holding cost per bearing per month and that the set up cost per run of bearing manufacture is Rs. 324.

- (1) What should be the optimum run size for bearing manufacture?
- (2) What would be the interval between two consecutive optimum runs?
- (3) Find out the minimum inventory cost per annum.

**Solution:****(1) Economic batch or run size**

$$E O Q = \sqrt{\frac{2 A B}{C S}}$$

Where :

- A = Annual Consumptions  
 B = Buying Cost or set up cost  
 C = Cost per unit  
 S = Carrying Cost or Holding Cost per unit

$$= \sqrt{\frac{2 \times 324 \times 24000}{10}} = 3600 \text{ units}$$

**Alternative Solution**

The economic batch size figure can also be obtained by taking monthly figure as follows :

$$= \sqrt{\frac{2 \times 2000 \text{ units} \times \text{Rs. } 324}{0.10}}$$

$$= 3600 \text{ units}$$

**(2) Number of Set Up per Annum**

$$\begin{aligned} \text{Number of set up per annum} &= \frac{\text{Annual Production}}{\text{Economic run size}} \\ &= \frac{24,000}{3,600} \\ &= 6 \frac{2}{3} \text{ times} \end{aligned}$$

$$\text{Interval between two consecutive optimum runs} = \frac{12}{20} = \frac{12 \times 3}{20} = \frac{36}{20} = 1.8 \text{ months}$$

**(3) Minimum Inventory Cost per Year**

$$\begin{aligned} &= \frac{24,000}{3,600} \times 324 + \frac{3,600}{2} \times 1.2 \\ &= \text{Rs. } 2,160 + \text{Rs. } 2,160 = \text{Rs. } 4320 \end{aligned}$$

**Illustration: 9**

A company manufactures a product from a raw material which is purchased at Rs. 60 per kg. The company incurs a handling cost of Rs. 360 plus freight of Rs.390 per order. The incremental carrying cost of inventory of raw material is Re. 0.50 per kg. per month. In addition, the cost of working capital finance on the investment in inventory of raw material is Rs. 9 per kg. per annum. The annual production of the product is 1,00,000 units and 2.5 units are obtained from one kg. of raw material.

**Required :**

- (1) Calculate the Economic Order Quantity of raw materials.
- (2) Advise, how frequently should order for procurement be placed.
- (3) If the company proposes to rationalize placement of orders on quarterly basis, what percentage of discount in the prices of raw material should be negotiated?

[ CA Inter, Nov. 2001 ]

**Solution:**

$$(1) \text{ Economic Order Quantity} = \sqrt{\frac{2 A B}{S}}$$

- A = Annual Consumption  
 B = Buying Cost per order  
 S = Storage and Carrying cost

$$\begin{aligned} A \text{ (Annual requirement of Raw materials in kgs)} &= \frac{1 \text{ kg} \times 1,00,000 \text{ units}}{2.5 \text{ units}} \\ &= 40000 \text{ kg.} \\ S \text{ Carrying Cost and Storage Expenses} &= (0.5 \times 12) + \text{Rs.}9 \\ &= \text{Rs.} 15 \text{ per unit} \\ B \text{ Buying Cost per order} &= \text{Rs.} 360 = \text{Rs.} 390 = \text{Rs.} 750 \end{aligned}$$

$$\begin{aligned} \text{E O Q} &= \sqrt{\frac{2 \times 40000 \times 750}{15}} \\ &= 2000 \text{ kgs} \\ (2) \text{ Annual Consumption} &= 40000 \text{ kgs} \\ \text{Quantity per order} &= 2000 \text{ kgs} \\ \text{No. of orders} &= \frac{40,000}{2,000} = 20 \text{ orders in 12 months} \\ \text{Frequency} &= \frac{12 \text{ months}}{20 \text{ orders}} = 0.6 \text{ months} \\ (\text{or}) &= \frac{365 \text{ months}}{20 \text{ orders}} = 18 \text{ days (approx.)} \\ (3) \text{ Quarterly Orders} &= \frac{40,000 \text{ kgs}}{4 \text{ orders}} = 10000 \text{ kgs per order} \\ \text{No. of orders} &= \frac{40,000}{10,000} = 4 \text{ orders} \\ \text{Total Cost :} & \text{Rs.} \\ \text{Order Placing Cost (4 x 750)} &= 3,000 \\ \text{Carrying Cost} = \frac{10,000}{0.5 \times 4} \times 15 &= \frac{75,000}{78,000} \end{aligned}$$

Total Cost of EOQ :			
No. of Orders	=	20	Rs.
Order Placing Cost (20 x 750)	=	15,000	
Carrying Cost = $\frac{2,000}{0.5 \times 4} \times 15$	=	15,000	
		30,000	
Increase in cost to be compensated by discount :			
Total Cost	=	Rs. 78,000	
Total Cost E O Q	=	Rs. 30,000	
Increase in Cost		48,000	
Price of discount per unit	=	48,000	= Rs. 1.20 per unit
		40,000 kg	
Percentage of discount in the prices of raw materials	=	$\frac{\text{Rs. 1.20}}{60} \times 100$	
		= 2% discount	

### The ABC Analysis

A B C Analysis is one of the important techniques which is based on grading the items according to the importance of materials. This method is popularly known as Always Better Control. This is also termed as Proportional Value Analysis – In inventory control, this technique helps to analyze the distribution of any characteristic by money value of importance in order to determine its importance. Accordingly, materials are grouped into three categories on the basis of the money value of importance of materials.

- (1) High Value Materials – A
- (2) Medium Value Materials – B
- (3) Low Value Materials – C

The items, which are of high value and less than 10 per cent of the total consumption or inventory can be called as 'A' grouped materials. It is required to exercise selective control and focus more attention because of high value items. Similarly, 70 per cent of materials in total consumption or inventory which lies 10 per cent of the inventory value can be grouped under 'C' categories. The materials which have moderate value that lies between the high value materials and low value materials are grouped under 'B' category. The following table shows more explanation about A B C Analysis :

Category	Percentage to total inventory	Percentage to total inventory cost
A	Less than 10	70 to 80
B	10 to 20	15 to 25
C	70 to 80	Less than 10

### Advantages of A B C Analysis

- (1) Exercise selective control is possible.
- (2) Focus high attention on high value items is possible.
- (3) It helps to reduce the clerical efforts and costs.
- (4) It facilitates better planning and improved inventory turnover.
- (5) It facilitates goods storekeeping and effective materials handling.



## Classification and Codification

In order to ensure the effective inventory control, it should be carried out with the classification and codification of materials. Codification is the process of representing each item by a number, the digits of which indicate the group, the sub group, the type and the size and shape of the items. The codification process could be obtained by the nature of materials in grouping all items of the same metal content say ferrous and non-ferrous etc. The system of codification could be built by the end use of items, that is, items grouped according to maintenance, spinning, weaving, packing, foundry, machine shop etc.

### Advantages of Codification

- (1) Codes ensure the secrecy of materials.
- (2) It is essential for mechanical accounting.
- (3) Easy identification of material is possible.
- (4) It ensures effective material control.
- (5) It minimizes length in description of materials.
- (6) Effective materials handling is possible.
- (7) It helps in avoiding duplication of materials.
- (8) Codification facilitates less clerical work.
- (9) Cost reduction is possible.

### Methods of Coding

The following are the three important Methods of Codification :

- (1) Numerical Method.
- (2) Alphabetical Method.
- (3) Numerical Cum Alphabetical Method.

**(1) Numerical Method:** Under this method, each number or numerical digit is allotted to each item or material. Accordingly, each code should uniquely indicate one item. For example, in printing press following codes may be assigned :

Paper	145
Ink	155
Gum	165

There are various universal decimal classification of codification used in libraries may be indicated for identification of items.

**(2) Alphabetical Method:** In this method alphabets or letters are used for codification of each category of materials. Accordingly each letter or alphabet is allotted for each item or material. For example, 'C' for copper, 'S' for steel and so on.

**(3) Numerical Cum Alphabetical Method:** This method is done by a combination of numerical and alphabetical method. Under this method both numerical along with alphabet is allotted for each item. For example, IR 5 may indicate Ink Red of Grade 5, Steel wire 6 may be denoted by SW 6 etc.

## Inventory System

The chief aims of inventory control is as follows :

- (1) To maintain a balanced inventory.
- (2) To ensure the smooth flow of production.
- (3) To keep the investment in inventory as low as possible.

Accordingly stock verification is an important aspect to ensure and maintain a balanced inventory. The following are the two systems of stock verification adopted in different industries :

- (1) Periodic Inventory System.
- (2) Perpetual Inventory System.
- (3) Continuous Stock Verification.

**(1) Periodic Inventory System:** Under this system, quantity and value of materials are checked and verified at the end of the accounting period after having a physical verification of the units in hand.

**(2) Perpetual Inventory System:** The Perpetual Inventory System is also known as Automatic Inventory System. This is one of the important methods adopted for verification inventories to know the physical balances. According to I C M A London defines Perpetual Inventory System as a method of recording stores balances after every receipt and issue to facilitate regular checking and to obviate closing down for stock taking.

### *Advantages of Perpetual Inventory System*

- (1) It facilitates rigid control over stock of materials.
- (2) It gives upto date details about materials in stock.
- (3) Not necessary to stop production for stock taking.
- (4) It assists to minimize pilferage and fraudulent practices.
- (5) It enables to reconcile the stock records and document for accuracy.
- (6) It helps to take the important decisions for corrective actions.

### **Perpetual Inventory Records**

Perpetual Inventory represents a system of records maintained by the organization. The records are of two types, viz. :

- (a) Bin Cards
- (b) Stores Ledger

A constant comparison of the quantity balances of these two set of records is made and the balances are reconciled.

**(a) Bin Cards:** Bin Card is only quantitative record of stores receipt, issue and balance and is kept by the Storekeeper for each item of stores.

**(b) Stores Ledger:** Stores ledger is both quantitative and monetary value record of stores receipt, issue and balance and is prepared by the Cost Accounting Department.

## Bin Card Vs Stores Ledger

The Difference between Bin Card and the Stores Ledger can be summarized as follows :

<i>Bin Card</i>	<i>Stores Ledger</i>
(1) Bin Cards are maintained at the stores	(1) Stores Ledger is maintained in the Accounts Department.
(2) It is posted by Issue Clerk	(2) It is posted by Ledger Clerk.
(3) Bin Cards meant for recording record of quantity only	(3) It is as a record of quantity and value.
(4) Transactions posted individually	(4) Transactions can be posted periodically.
(5) Posting can be made at the time of issue.	(5) In stores ledger posting can be made after issue.

**(3) Continuous Stock Verification :** Since Verification of physical inventory is an essential feature of a sound system of material control, a system of continuous stock taking is introduced. Continuous stock taking ensures that the balances of all items of stocks are checked at least three to four times in a year by physical verification. It avoids long and costly procedure of closing down the stores for stock taking on periodical basis. Stock discrepancies are detected on timely basis and preventive measures can be taken. The correctness of the physical stocks as reflected in the books is ensured and thus the monthly accounts represent a true and fair view of the business. Continuous Stock Verification not only serves as an essential tool of material control but also will help in proper presentation of accounting information to the management.

## Continuous Stock Taking Vs Periodic Stock Taking

The differences between Continuous Stock Taking and Periodic Stock Taking can be summarized as follows :

<i>Continuous Stock Taking</i>	<i>Periodic Stock Taking</i>
(1) Continuous stock taking is held throughout the year.	(1) It is held once in a year.
(2) Stock discrepancies are detected and prevented without delay.	(2) Under this system preventive measures is the delay process.
(3) Under this system normal work will not be disrupted.	(3) Under this system there is closing down the stores for stock taking.
(4) Permanent personnels are required.	(4) Temporary personnel are required.
(5) Long and costly procedure on continuous stock verification.	(5) It is cheaper and shorter period is required.
(6) Physical verification of materials are on random basis.	(6) All materials are thoroughly checked.

## Material Storage Losses

The investment in materials constitute a major portion of current assets, so it is essential to exercise effective stores control. Stores control helps to avoid losses from misappropriation, damage, deterioration etc. Generally material storage losses arising during storage may be classified as :

- (1) Normal Loss
- (2) Abnormal Loss

**(1) Normal Loss:** Normal Losses arise during the storage of materials due to the avoidable reasons of pilferage, theft, careless of materials handling, clerical errors, improper storage, wrong entries etc.

**(2) Abnormal Loss:** Abnormal Losses arise during the storage of materials due to unavoidable causes of evaporation, shrinkage, bulk losses due to accident, fire, etc.

**Accounting Treatment of Normal Loss and Abnormal Loss**

The following are the accounting treatment of normal and abnormal loss of materials arising during storage :

- (1) **Normal Loss** : (a) Inflate the issue price. (b) Charge to stores overheads. (c) Treat it as a separate item of overheads to be recovered as a percentage of materials consumed.
- (2) **Abnormal Loss** : Abnormal losses are directly charged to Costing Profit and Loss Account.
- (3) If the loss is due to error in documentation it should be corrected through adjustment entries.

**Inventory Turnover Ratio**

Inventory Turnover Ratio may be defined as “a ratio which measures the number of times a firm’s average inventory is sold during a year.” It is a ratio which is useful to measure the firm’s inventory performance. High rate of inventory turnover ratio denotes that materials are fast moving stock. A low turnover rate indicates the locking up of working capital in undesirable items. The Inventory turnover ratio is calculated by the following formula :

$$\text{Material Turnover Ratio} = \frac{\text{Cost of Material Used}}{\text{Average Value of Material in Stock}}$$

$$\text{Material Turnover in days} = \frac{\text{Days during the period}}{\text{Inventory Turnover Ratio}}$$

**Illustration: 10**

Calculate the Inventory Turnover Ratio for the year 2003 from the following details :

	<i>Material X</i> Rs.	<i>Material Y</i> Rs.
Opening Stock	50,000	1,75,000
Closing Stock	30,000	1,25,000
Purchases	3,80,000	2,50,000

Determine fast moving materials

**Solution:**

	X Rs.	Y Rs.
Opening Stock	50,000	1,75,000
Add : Purchases	3,80,000	2,50,000
	4,30,000	4,25,000
Less : Closing Stock	30,000	1,25,000
Materials Consumed	4,00,000	3,00,000

$$\begin{aligned} \text{Average Inventory} &= \frac{\text{Opening Stock} + \text{Closing Stock}}{2} \\ &= \frac{50,000 + 30,000}{2} \quad \frac{1,75,000 + 1,25,000}{2} \\ &= \frac{80,000}{2} ; \quad \frac{3,00,000}{2} \\ &= \text{Rs. } 40,000; \text{ Rs. } 1,50,000 \end{aligned}$$

$$\text{Material Turnover Ratio} = \frac{\text{Materials Consumed}}{\text{Average Inventory}}$$

$$\text{Material X} = \frac{4,00,000}{40,000} = 10 \text{ times}$$

$$\text{Material X} = \frac{3,00,000}{1,50,000} = 2 \text{ times}$$

The turnover ratio of Material X being higher than that of Material Y, the former is a fast moving material.

### QUESTIONS

1. What do you mean by store and storekeeping?
2. Explain the purpose of storekeeping.
3. What are the important functions of storekeeper?
4. What do you mean by stores layout?
5. Explain briefly the different types of stores.
6. What do you understand by Maximum Stock, Minimum Stock and Re-order Level?
7. What is Economic Order Quantity? Explain its significance.
8. Explain the concept of A B C Analysis.
9. Explain briefly the Classification and Codification of materials.
10. What are the advantages of Codification?
11. Explain briefly the Methods of Coding.
12. What is Perpetual Inventory System? Explain its advantages.
13. What do you understand by Bin Card and Stores Ledger?
14. What are the differences between Bin Card and Stores Ledger?
15. What is Continuous Stock Verification? What are the differences between Continuous Stock Taking and Periodic Stock Taking?
16. Explain briefly the material storage losses.
17. What is Inventory Turnover Ratio? Explain its importance.
18. From the following particulars calculate :  
(a) Re-order Level. (b) Minimum Level. (c) Maximum Level. (d) Average Level.  
Normal usage 100 units per day  
Maximum usage 130 units per day  
Minimum usage 60 units per day  
Economic Order Quantity 5000 units  
Re-order Period 25 to 30 days.  
[Ans : (a) Re-order Level = 3900 units. (b) Minimum Level = 1150 units. (c) Maximum Level = 7400 units. (d) Average Level = 4275 units]
19. Calculate E O Q from the following:  
Annual Consumption = 600 units.  
Ordering Cost Rs. 12 per order.  
Carrying Cost 20% Price per unit Rs. 20.  
[Ans : E O Q = 60 units].
20. Calculate (a) Maximum Level, (b) Minimum Level, and (c) Re-order Level.  
Re-order Quantity = 1500 units.  
Re-order Period = 4 to 6 weeks.  
Maximum Consumption = 400 units per week.  
Normal Consumption = 300 units per week.  
Maximum consumption = 250 units per week.  
[Ans : Re order Level = 2400 units.  
Maximum Level = 2900 units.  
Minimum Level = 900 units.  
Normal Re order Period = 5 weeks].

21. A manufacturing company purchases 2000 units of a particular material per year at a unit cost of Rs.20, the ordering cost per order is Rs.50 and the inventory carrying cost is 25%. Find out the Economic Order Quantity and number of orders to be placed in a year.  
[Ans : E O Q 200 units each in 10 orders].
22. Calculate Economic Order Quantity from the following particulars :  
Annual Consumption = 20000 units.  
Buying Cost per order Rs. 10.  
Cost per unit Rs. 100.  
Inventory Carrying Cost 10% of cost.  
[Ans : E O Q = 200 units].
23. The following information is available in respect of Material X  
Re-order Quantity = 3000 units  
Re-order Period = 4 to 6 weeks  
Maximum Consumption = 800 units per week  
Normal Consumption = 600 units per week  
Minimum Consumption = 500 units per week  
Calculate : (a) Re-order Level, (b) Minimum Level,  
(c) Maximum Level, (d) Average Stock Level.  
[Ans : (a) Re-order Level = 4800 units ; Minimum Level = 1800 units;  
Maximum Level 5800 units ; Average Stock Level : 3800].
24. The following information is available in respect of Component Y :  
Maximum Stock Level 8,400 units  
Maximum Consumption 1,500 units per month  
Minimum Consumption 800 units per month  
Re-order period 2 to 4 months  
You are required to calculate :  
(1) Re-order Level  
(2) Re-order quantity  
[Ans : 6,000 units; 4,000 units]
25. Two Components of X and Y are used as follows :  
Normal usage 50 units per week each  
Minimum usage 25 units per week each  
Maximum usage 75 units per week each  
Re-order quantity X : 400 units, Y : 600 units  
Re-order period X : 4 weeks , Y : 2 to 4 weeks  
Calculate for each components :  
(a) Re-order Level  
(b) Minimum Level  
(c) Maximum Level  
(d) Average Stock Level  
[Ans : (a) 300 units (b) 150 units (c) 850 units (d) 500 units].
26. Calculate the economic order quantity from the following particulars :  
Annual requirement 1,600 units  
Cost of materials per units Rs.40  
Cost of placing and receiving one order Rs.50  
Annual carrying cost of inventory 10% of inventory value
27. Calculate Economic Order Quantity from the following :  
Annual consumption 600 units  
Ordering cost Rs.12 per unit  
Carrying cost 20%  
Price per unit Rs.20  
[Ans : 60 units]
28. Find out the Economic Order Quantity and the number of orders per year from the following information :  
Annual consumption 36,000 units  
Cost per unit Rs. 54  
Ordering cost Rs. 150 per order

Inventory carrying cost 20% of the average inventory

[Ans : EOQ – 1000 units ; No. of orders 36]

29. The following information relating material Q.75 is available :

Annual consumption 2,400 units

Cost per unit Rs. 2.40

Ordering cost per order Rs. 4

Storage cost 2% per annum

Interest rate 10% per annum

Calculate EOQ and No. of orders to be placed in a year.

[Ans : EOQ – 258 units ; No. of orders 10]



# WAREHOUSING MANAGEMENT

Gaurav Narkhede | Josue Servais | Mike Macos | Prasenjit Bada

## TYPE OF WAREHOUSING

- Public Warehousing
- Private Warehousing
- Contract Warehousing
- Multi-client Warehousing

- Part of firms logistics system that stores products at and between point of origin and point of consumption.
- Term "Warehousing" is referred as transportation at zero miles per hour
- Warehousing provides time and place utility for raw materials, industrial goods, and finished products, allowing firms to use customer service as a dynamic value-adding competitive tool.

## DESIGN CONSIDERATION

Ideal Facility for Pure Supplier Consolidation (Full Pallet Movement)

Warehouse Space Requirements

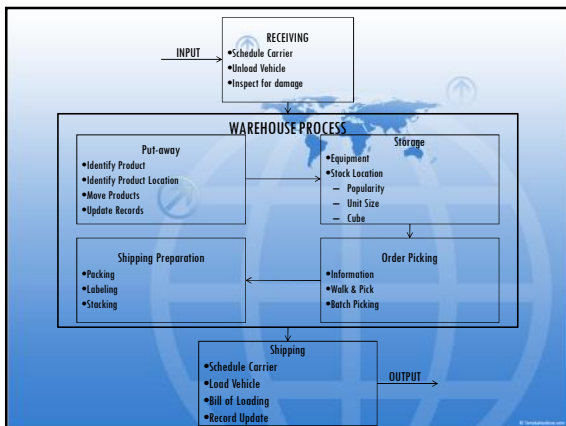
## THE ROLE OF THE WAREHOUSE IN THE LOGISTICS SYSTEM

- The warehouse is where the supply chain holds or stores goods.
- Functions of warehousing include
  - Transportation consolidation
  - Product mixing
  - Docking
  - Service
  - Protection against contingencies

## PRINCIPLES OF WAREHOUSE LAYOUT DESIGN

- Use one-story facilities
- Move goods in a straight line
- Use efficient materials-handling equipment
- Use an effective storage plan
- Minimize aisle space
- Use maximum height of the building





### COSTS OF OPERATING A WAREHOUSE

- Capital costs
  - Costs of space & materials handling equipment
- Operating costs
  - Cost of labor
  - Measure of labor productivity is the number of units that an operator can move in a day

### OBJECTIVES OF EFFICIENT WAREHOUSE OPERATIONS

- Provide timely customer service.
- Keep track of items so they can be found readily & correctly.
- Minimize the total physical effort & thus the cost of moving goods into & out of storage.
- Provide communication links with customers

### WAREHOUSE ACTIVITIES

- Receive goods
- Identify the goods
- Dispatch goods to storage
- Hold goods
- Pick goods
- Marshal shipment
- Dispatch shipment
- Operate an information system



### Benefits of Warehouse Management

- Benefits of Warehouse Management
  - Provide a place to store & protect inventory
  - Reduce transportation costs
  - Improve customer service levels
- Complexity of warehouse operation depends on the number of SKUs handled & the number of orders received & filled.
- Most activity in a warehouse is material handling.

### Receive goods

- Accepts goods from
  - Outside transportation or attached factory & accepts responsibility
- Check the goods against an order & the bill of lading
- Check the quantities
- Check for damage & fill out damage reports if necessary
- Inspect goods if required

**Identify the goods** 

items are identified with the appropriate stock-keeping unit (SKU) number (part number) & the quantity received recorded

**Dispatch goods to storage**

goods are sorted & put away

**Hold goods**

goods are kept in storage & under proper protection until needed

**Maximize productivity & minimize cost, warehouse management must work with the following** 

- Maximize use of space
  - space is the largest capital cost
- Effective use of labor & equipment
  - labor is the largest operating cost
  - material handling equipment is the second largest capital cost

**Pick goods** 

items required from stock must be selected from storage & brought to a marshalling area

**Marshal the shipment**

goods making up a single order are brought together & checked for omissions or errors; order records are updated

**FACTORS INFLUENCING EFFECTIVE USE OF WAREHOUSES** 

- Cube utilization and accessibility
- Stock location
- Order picking and assembly
- Physical Control & Security - Elements

**Dispatch the shipment** 

orders are packaged, shipping documents are prepared, & goods loaded on the vehicle

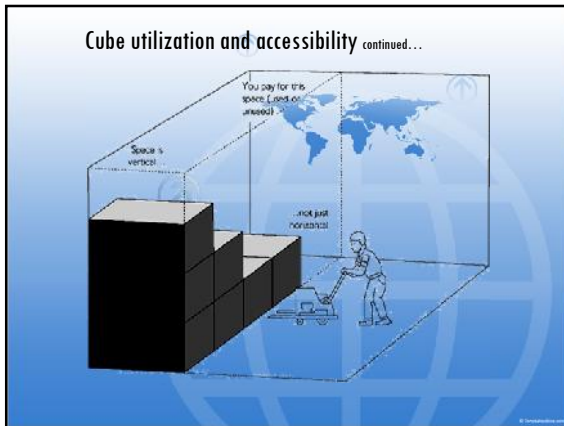
**Operate an information system**

a record must be maintained for each item in stock showing the quantity on hand, quantity received, quantity issued, & location in the warehouse

**Cube utilization and accessibility**

Goods stored not just on the floor, but in the cubic space of the warehouse; warehouse capacity depends on how high goods can be stored

Accessibility means being able to get at the goods wanted with a minimum amount of work



**Stock Location** continued...

- Two other systems sometimes used are
  - Point-of-use storage
    - Inventory stored close to where it will be needed
    - Used in repetitive manufacturing & JIT systems
  - Central storage
- Contains all inventory in one central location

**Stock Location**

- Objectives
  - To provide the required customer service
  - To keep track of where items are stored
  - To minimize effort to receive, put away, and retrieve items
- Basic Stock Locating Systems
  - Group functionally related items together
  - Group fast-moving items together
  - Group physically similar items together
  - Locate working stock and reserve stock separately

**Stock Location** continued...

- Advantages of Point-of-use Storage
  - Materials are readily accessible to users
  - Material handling is reduced or eliminated
  - Central storage costs are reduced
  - Material is accessible all the time

**Stock Location** continued...

- Fixed Location
  - SKU assigned a permanent location, & no other items are stored there
  - Fixed-location systems usually have poor cube utilization
  - Usually used in small warehouses; throughput is small, & there are few SKUs
- Floating (Random) Location
  - Goods stored wherever there is appropriate space
  - Advantage is improved cube utilization
  - It requires accurate and up-to-date information
  - Warehouses using floating-location systems are usually computer-based

**Stock Location** continued...

- Advantages of Central Storage
  - Ease of control
  - Inventory record accuracy is easier to maintain
  - Specialized storage can be used
  - Reduced safety stock, since users do not need to carry their own safety stock

### Order Picking and Assembly

- When an order is received, items must be obtained from the warehouse, grouped, & prepared for shipment, systems used
  - Area system
  - Zone system
  - Multi-order system

### PHYSICAL CONTROL & SECURITY - ELEMENTS

- Good part numbering system
- Simple, well-documented transaction system
  - Identify the item
  - Verify the quantity
  - Record the transaction
  - Physically execute the transaction
- Limited access
  - Inventory must be kept in a safe, secure (locked) place with limited general access
- Well-trained workforce

### Order Picking and Assembly continued...

- Area system
  - Order picker circulates throughout warehouse selecting items on an order -- order is ready to ship when order picker is finished
- Zone system
  - Warehouse is divided into zones, & each picker works only in an assigned zone -- order is divided by zone, & the items from each zone are sent to the marshaling area

### VIDEO

[http://www.youtube.com/watch?v=C6J2d\\_0w24E](http://www.youtube.com/watch?v=C6J2d_0w24E)

### Order Picking and Assembly continued...

- Multi-order system
  - Same as the zone system, except that each picker collects items for a number of orders at the same time

### Questions ?



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## INVENTORY CONTROL

### Why Inventory Control?

Control of inventory, which typically represents 45% to 90% of all expenses for business, is needed to ensure that the business has the right goods on hand to avoid stock-outs, to prevent shrinkage (spoilage/theft), and to provide proper accounting. Many businesses have too much of their limited resource, *capital*, tied up in their major asset, *inventory*. Worse, they may have their capital tied up in the wrong kind of inventory. Inventory may be old, worn out, shopworn, obsolete, or the wrong sizes or colors, or there may be an imbalance among different product lines that reduces the customer appeal of the total operation.

Inventory control systems range from eyeball systems to reserve stock systems to perpetual computer-run systems. Valuation of inventory is normally stated at original cost, market value, or current replacement costs, whichever is lowest. This practice is used because it minimizes the possibility of overstating assets. Inventory valuation and appropriate accounting practices are worth a book alone and so are not dealt with here in depth.

The ideal inventory and proper merchandise turnover will vary from one market to another. Average industry figures serve as a guide for comparison. Too large an inventory may not be justified because the turnover does not warrant investment. On the other hand, because products are not available to meet demand, too small an inventory may minimize sales and profits as customers go somewhere else to buy what they want where it is immediately available. Minimum inventories based on reordering time need to become important aspects of buying activity. Carrying costs, material purchases, and storage costs are all expensive. However, stock-outs are expensive also. All of those costs can be minimized by efficient inventory policies.

### Inventory Control

Inventory control involves the procurement, care and disposition of materials. There are three kinds of inventory that are of concern to managers:

- *Raw materials,*
- *In-process or semi-finished goods,*
- *Finished goods.*

If a manager effectively controls these three types of inventory, capital can be released that may be tied up in unnecessary inventory, production control can be improved and can protect against obsolescence, deterioration and/or theft,

The reasons for inventory control are:

- Helps balance the stock as to value, size, color, style, and price line in proportion to demand or sales trends.
- Help plan the winners as well as move slow sellers
- Helps secure the best rate of stock turnover for each item.
- Helps reduce expenses and markdowns.
- Helps maintain a business reputation for always having new, fresh merchandise in wanted sizes and colors.

Three major approaches can be used for inventory control in any type and size of operation. The actual system selected will depend upon the type of operation, the amount of goods.

### **The Eyeball System**

This is the standard inventory control system for the vast majority of small retail and many small manufacturing operations and is very simple in application. The key manager stands in the middle of the store or manufacturing area and looks around. If he or she happens to notice that some items are out of stock, they are reordered. In retailing, the difficulty with the eyeball system is that a particularly good item may be out of stock for sometime before anyone notices. Throughout the time it is out of stock, sales are being lost on it. Similarly, in a small manufacturing operation, low stocks of some particularly critical item may not be noticed until there are none left. Then production suffers until the supply of that part can be replenished. Such unsystematic but simple retailers and manufacturers to their inherent disadvantage.

### **Reserve Stock (or Brown Bag) System**

This approach is much more systematic than the *eyeball* system. It involves keeping a reserve stock of items aside, often literally in a brown bag placed at the rear of the stock bin or storage area. When the last unit of open inventory is used, the brown bag of reserve stock is opened and the new supplies it contains are placed in the bin as open stock. At this time, a reorder is immediately placed. If the reserve stock quantity has been calculated properly, the new shipment should arrive just as the last of the reserve stock is being used.

In order to calculate the proper reserve stock quantity, it is necessary to know the rate of product usage and the order cycle delivery time. Thus, if the rate of product units sold is 100 units per week and the order cycle delivery time is two weeks, the appropriate reserve stock would consist of 200 units ( $100u \times 2w$ ). This is fine as long as the two-week cycle holds. If the order cycle is extended, the reserve stock quantities must be increased. When the new order arrives, the reserve stock amount is packaged again and placed at the rear of the storage area.

This is a very simple system to operate and one that is highly effective for virtually any type of organization. The variations on the reserve stock system merely involve the management of the reserve stock itself. Larger items may remain in inventory but be cordoned off in some way to indicate that it is the reserve stock and should trigger a reorder.

## Perpetual Inventory Systems

Various types of perpetual inventory systems include manual, card-oriented, and computer-operated systems. In computer-operated systems, a programmed instruction referred to commonly as a trigger, automatically transmits an order to the appropriate vendor once supplies fall below a prescribed level. The purpose of each of the three types of perpetual inventory approaches is to tally either the unit use or the dollar use (or both) of different items and product lines. This information will serve to help avoid stock-outs and to maintain a constant evaluation of the sales of different product lines to see where the emphasis should be placed for both selling and buying.

## Stock Control

A stock control system should keep you aware of the quantity of each kind of merchandise on hand. An effective system will provide you with a guide for what, when, and how much to buy of each style, color, size, price and brand. It will reduce the number of lost sales resulting from being out of stock of merchandise in popular demand. The system will also locate slow selling articles and help indicate changes in customer preferences. The size of your establishment and the number of people employed are determining factors in devising an effective stock control plan. Can you keep control by observation? Should you use on-hand/on-order/sold records? Detachable ticket stubs? Checklists? And/or physical inventory? If so, how often?

With the observation method (the *eyeball* system), unless the people using it have an unusually sharp sense of quantity and sales patterns, it is difficult to keep a satisfactory check on merchandise depletion. It means that you record shortages of goods or reorders as the need for them occurs to you. Without a better checking system, orders may only be placed at the time of the salesman's regular visit, regardless of when they are actually needed. Although it may be the simplest system, it also can often result in lost sales or production delays. Detachable stubs or tickets placed on merchandise provide a good means of control. The stubs, containing information identifying the articles, are removed at the time the items are sold. The accumulated stubs are then posted regularly to the perpetual inventory system by hand or through the use of an optical scanner.

A checklist, often provided by wholesalers, is another counting tool. The checklist provides space to record the items carried, the selling price, cost price, and minimum quantities to be ordered of each. It also contains a column in which to note whether the stock on hand is sufficient and when to reorder. This is another very simple device that provides the level of information required to make knowledgeable decisions about effective inventory management.

Most smaller operations today, except for the very smallest, are using some form of a perpetual online system to record the movement of inventories into and out of their facilities. In a retail operation, the clerk at the register merely scans the ticket with a reader, and the system shows the current price and removes the item from the inventory control system. A similar process occurs in a manufacturing operation, except that the "sale" is actually a transfer of the inventory from control to production. This is a particularly critical system in a large operation such as a grocery store where they regularly maintain 12,000 plus items. Often a vendor will provide on-site or computerized assistance needed to help their smaller customers maintain a good understanding of their own inventory levels and so keep them in balance



## Inventory Control Records

Inventory control records are essential to making buy-and-sell decisions. Some companies control their stock by taking physical inventories at regular intervals, monthly or quarterly. Others use a dollar inventory record that gives a rough idea of what the inventory may be from day to day in terms of dollars. If your stock is made up of thousands of items, as it is for a convenience type store, dollar control may be more practical than physical control. However, even with this method, an inventory count must be taken periodically to verify the levels of inventory by item.

**Perpetual inventory control records** are most practical for big-ticket items. With such items it is quite suitable to hand count the starting inventory, maintain a card for each item or group of items, and reduce the item count each time a unit is sold or transferred out of inventory. Periodic physical counts are taken to verify the accuracy of the inventory card.

**Out-of-stock sheets**, sometimes called want sheets, notify the buyer that it is time to reorder an item. Experience with the rate of turnover of an item will help indicate the level of inventory at which the unit should be reordered to make sure that the new merchandise arrives before the stock is totally exhausted.

**Open-to-buy records** help to prevent ordering more than is needed to meet demand or to stay within a budget. These records adjust your order rate to the sales rate. They provide a running account of the dollar amount that may be bought without departing significantly from the pre-established inventory levels. An open-to-buy record is related to the inventory budget. It is the difference between what has been budgeted and what has been spent. Each time a sale is made, *open-to-buy* is increased (inventory is reduced). Each time merchandise is purchased; *open-to-buy* is reduced (inventory is increased). The net effect is to help maintain a balance among product lines within the business, and to keep the business from getting overloaded in one particular area.

**Purchase order files** keep track of what has been ordered and the status or expected receipt date of materials. It is convenient to maintain these files by using a copy of each purchase order that is written. Notations can be added or merchandise needs updated directly on the copy of the purchase order with respect to changes in price or delivery dates.

**Supplier files** are valuable references on suppliers and can be very helpful in negotiating price, delivery and terms. Extra copies of purchase orders can be used to create these files, organized alphabetically by supplier, and can provide a fast way to determine how much business is done with each vendor. Purchase order copies also serve to document ordering habits and procedures and so may be used to help reveal and/or resolve future potential problems.

**Returned goods files** provide a continuous record of merchandise that has been returned to suppliers. They should indicate amounts, dates and reasons for the returns. This information is useful in controlling debits, credits and quality issues.

**Price books**, maintained in alphabetical order according to supplier, provide a record of purchase prices, selling prices, markdowns, and markups. It is important to keep this record completely up to date in order to be able to access the latest price and profit information on materials purchased for resale.

## **Controlling Inventory**

Controlling inventory does not have to be an onerous or complex proposition. It is a process and thoughtful inventory management. There are no hard and fast rules to abide by, but some extremely useful guidelines to help your thinking about the subject. A five step process has been designed that will help any business bring this potential problem under control to think systematically thorough the process and allow the business to make the most efficient use possible of the resources represented. The final decisions, of course, must be the result of good judgment, and not the product of a mechanical set of formulas.

### **STEP 1: Inventory Planning**

Inventory control requires inventory planning. Inventory refers to more than the goods on hand in the retail operation, service business, or manufacturing facility. It also represents goods that must be in transit for arrival after the goods in the store or plant are sold or used. An ideal inventory control system would arrange for the arrival of new goods at the same moment the last item has been sold or used. The economic order quantity, or base orders, depends upon the amount of cash (or credit) available to invest in inventories, the number of units that qualify for a quantity discount from the manufacturer, and the amount of time goods spend in shipment.

### **STEP 2: Establish order cycles**

If demand can be predicted for the product or if demand can be measured on a regular basis, regular ordering quantities can be setup that take into consideration the most economic relationships among the costs of preparing an order, the aggregate shipping costs, and the economic order cost. When demand is regular, it is possible to program regular ordering levels so that stock-outs will be avoided and costs will be minimized. If it is known that every so many weeks or months a certain quantity of goods will be sold at a steady pace, then replacements should be scheduled to arrive with equal regularity. Time should be spent developing a system tailored to the needs of each business. It is useful to focus on items whose costs justify such control, recognizing that in some cases control efforts may cost more the items worth. At the same time, it is also necessary to include low return items that are critical to the overall sales effort.

If the business experiences seasonal cycles, it is important to recognize the demands that will be placed on suppliers as well as other sellers.

A given firm must recognize that if it begins to run out of product in the middle of a busy season, other sellers are also beginning to run out and are looking for more goods. The problem is compounded in that the producer may have already switched over to next season's production and so is not interested in (or probably even capable of) filling any further orders for the current selling season. Production resources are likely to already be allocated to filling orders for the next selling season. Changes in this momentum would be extremely costly for both the supplier and the customer.

On the other hand, because suppliers have problems with inventory control, just as sellers do, they may be interested in making deals to induce customers to purchase inventories off-season, usually at substantial savings. They want to shift the carrying costs of purchase and storage from the seller to the buyer. Thus, there are seasonal implications to inventory control as

well, both positive and negative. The point is that these seasonable implications must be built into the planning process in order to support an effective inventory management system.

### **STEP 3: Balance Inventory Levels**

Efficient or inefficient management of merchandise inventory by a firm is a major factor between healthy profits and operating at a loss. There are both market-related and budget-related issues that must be dealt with in terms of coming up with an ideal inventory balance:

- Is the inventory correct for the market being served?
- Does the inventory have the proper turnover?
- What is the ideal inventory for a typical retailer or wholesaler in this business?

To answer the last question first, the ideal inventory is the inventory that does not lose profitable sales and can still justify the investment in each part of its whole.

An inventory that is not compatible with the firm's market will lose profitable sales. Customers who cannot find the items they desire in one store or from one supplier are forced to go to a competitor. Customer will be especially irritated if the item out of stock is one they would normally expect to find from such a supplier. Repeated experiences of this type will motivate customers to become regular customers of competitors.

### **STEP 4: Review Stocks**

Items sitting on the shelf as obsolete inventory are simply dead capital. Keeping inventory up to date and devoid of obsolete merchandise is another critical aspect of good inventory control. This is particularly important with style merchandise, but it is important with any merchandise that is turning at a lower rate than the average stock turns for that particular business. One of the important principles newer sellers frequently find difficult is the need to mark down merchandise that is not moving well.

Markups are usually highest when a new style first comes out. As the style fades, efficient sellers gradually begin to mark it down to avoid being stuck with large inventories, thus keeping inventory capital working. They will begin to mark down their inventory, take less gross margin, and return the funds to working capital rather than have their investment stand on the shelves as obsolete merchandise. Markdowns are an important part of the working capital cycle. Even though the margins on markdown sales are lower, turning these items into cash allows you to purchase other, more current goods, where you can make the margin you desire.

Keeping an inventory fresh and up to date requires constant attention by any organization, large or small. Style merchandise should be disposed of before the style fades. Fad merchandise must have its inventory levels kept in line with the passing fancy. Obsolete merchandise usually must be sold at less than normal markup or even as *loss leaders* where it is priced more competitively. Loss leader pricing strategies can also serve to attract more' consumer traffic for the business thus creating opportunities to sell other merchandise as well as well as the obsolete items. Technologically obsolete merchandise should normally be removed from inventory at any cost.

Stock turnover is really the way businesses make money. It is not so much the profit per unit of sale that makes money for the business, but sales on a regular basis over time that eventually results in profitability. The stock turnover rate is the rate at which the average inventory is replaced or turned over, throughout a pre-defined standard operating period, typically one year. It is generally seen as the multiple that sales represent of the average inventory for a given period of time.

Turnover averages are available for virtually any industry or business maintaining inventories and having sales. These figures act as an efficient and effective benchmark with which to compare the business in question, in order to determine its effectiveness relative to its capital investment. Too frequent inventory turns can be as great a potential problem as too few. Too frequent inventory turns may indicate the business is trying to overwork a limited capital base, and may carry with it the attendant costs of stock-outs and unhappy and lost customers.

Stock turns or turnover, is the number of times the "average" inventory of a given product is sold annually. It is an important concept because it helps to determine what the inventory level should be to achieve or support the sales levels predicted or desired. Inventory turnover is computed by dividing the volume of goods sold by the average inventory. Stock turns or inventory turnover can be calculated by the following equations:

$$\text{Stock Turn} = \frac{\text{Cost of Goods Sold}}{\text{Average Inventory at Cost}}$$

$$\text{Stock Turn} = \frac{\text{Sales}}{\text{Average Inventory at Sales Value}}$$

If the inventory is recorded at cost, stock turn equals cost of goods sold divided by the average inventory. If the inventory is recorded at sales value, stock turn is equal to sales divided by average inventory. Stock turns four times a year on the average for many businesses. Jewelry stores are slow, with two turns a year, and grocery stores may go up to 45 turns a year.

If the dollar value of a particular inventory compares favorably with the industry average, but the turnover of the inventory is less than the industry average, a further analysis of that inventory is needed. Is it too heavy in some areas? Are there reasons that suggest more inventories are needed in certain categories? Are there conditions peculiar to that particular firm? The point is that all markets are not uniform and circumstances may be found that will justify a variation from average figures.

In the accumulation of comparative data for any particular type of firm, a wide variation will be found for most significant statistical comparisons. Averages are just that, and often most firms in the group are somewhat different from that result. Nevertheless, they serve as very useful guides for the adequacy of industry turnover, and for other ratios as well. The important thing for each firm is to know how the firm compares with the averages and to determine whether deviations from the averages are to its benefit or disadvantage.

## **STEP 5: Follow-up and Control**

Periodic reviews of the inventory to detect slow-moving or obsolete stock and to identify fast sellers are essential for proper inventory management. Taking regular and periodic inventories must be more than just totaling the costs. Any clerk can do the work of recording an inventory. However, it is the responsibility of key management to study the figures and review the items themselves in order to make correct decisions about the disposal, replacement, or discontinuance of different segments of the inventory base.

Just as an airline cannot make money with its airplanes on the ground, a firm cannot earn a profit in the absence of sales of goods. Keeping the inventory attractive to customers is a prime prerequisite for healthy sales. Again, the seller's inventory is usually his largest investment. It will earn profits in direct proportion to the effort and skill applied in its management.

Inventory quantities must be organized and measured carefully. Minimum stocks must be assured to prevent stock-outs or the lack of product. At the same time, they must be balanced against excessive inventory because of carrying costs. In larger retail organizations and in many manufacturing operations, purchasing has evolved as a distinct new and separate phase of management to achieve the dual objective of higher turnover and lower investment. If this type of strategy is to be utilized, however, extremely careful attention and constant review must be built into the management system in order to avoid getting caught short by unexpected changes in the larger business environment.

Caution and periodic review of reorder points and quantities are a must. Individual market size of some products can change suddenly and corrections should be made.

*Source: U.S. Small Business Administration*

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