



Chapter 2

Literature Review

This chapter studies and explores various textbooks and publications related to the subjects of our interest: incoming inspection and supplier evaluation.

2.1 Role of Suppliers and Raw Materials in Today's Business

Suppliers are providers of goods or services necessary for operation of the buying company. These materials are used as an important input into the buying organizations' manufacturing process. In this regard, raw materials and suppliers are obviously one factor that is not only important, but also essential to running of an organization in manufacturing business.

In term of money, raw materials usually represent a large proportion of total manufacturing cost of most commodity products. For many organization the purchases of materials from suppliers and subcontractors accounts for at least half of the total manufacturing cost, and in many cases this value can exceed 70 percent [Barrie, 1994] Dennis (1996) also made a similar estimation that over 50% of the manufacturing costs are due to raw materials and bought-in items.

Apart from the importance considered in term of purchased value, raw materials purchased from suppliers do have profound effects on the quality of finished products. While the process and people factors can be monitored, and in many cases, controlled to be under specific conditions determined by the producing company, quality of raw materials is beyond its direct control and depends mostly on the suppliers. These purchased materials, in many cases, are the largest source of variability added to the production process and is found to be the culprit of numerous quality problems. Under real manufacturing conditions, it is often difficult to determine the exact amount of defects that have been caused by raw materials because there are several factors involved in the formation of defects. Nonetheless, many authors have tried to estimate the effect of raw materials on finished products' quality problems.

- Crosby estimates that 50 percent of a company's quality problems are caused by defective purchased materials. [Smock, 1982]

- Burt (1982) and Dennis (1996) among many other authors, made the same estimation that about half of quality problems in finished products could be caused by raw materials.

From the above statements, it is clear that quality of raw materials is vital to quality and profitability of the buying organization. With more emphasis on JIT (Just-in-Time) concept in which materials are ordered in the quantity and delivered only when they are needed for production. Any problem in raw materials received thus means disruption of the buying company's production because there is no backup inventory. It is clear that companies adopting this JIT concept are becoming more dependent on supplier's performance and product quality.

There is a trend for many companies towards greater dependence on suppliers. This is the result of the modern management philosophy that encourages firms to focus on their core competencies and thus become more specialized. Adoption of these concepts means that a greater number of parts/ services are to be outsourced to external suppliers/ subcontractors. [Barrie, 1993]

2.2 Incoming Inspection

Incoming inspection is carried out to verify the acceptability and condition of bought-out materials and equipment. It is one method of assessing a supplier's capability [Lionel, 1993]. The main objective of carrying out incoming inspection is basically to detect defective materials upon receipt in order to stop these defective items from entering the production process.

According to Juan (1983) product acceptance involves the disposition of product based on its quality. This disposition involves several important decisions:

1. Conformance: Judging whether the product conforms to specification
2. Fitness for use: Deciding whether nonconforming product is fit for use
3. Communication: Deciding what to communicate to insiders and outsiders.

The first step in planning for inspection is to choose the quality characteristics to be checked from product specifications. It should be noted that product specifications are prepared by comparatively a few people who are well aware of fitness for use, but are normally used by many inspectors and operators, most of whom lack this awareness. Therefore some supplementary information beyond

product specifications must also be provided to help inspectors/ operators understand the specifications and quality characteristics to test.

In his book “Quality Planning and Analysis”, Juran (1993) summarized methods that can be used to evaluate supplier product as follows

Method	Approach	Application
100 percent inspection	Every item in a lot is evaluated for all or some of the characteristics in the specification	Critical items where the cost of using defective materials justifies the cost of inspection
Sampling Inspection	A sample of each lot is evaluated by a predefined sampling plan and a decision is made to accept or reject lot	Important items where the suppliers have adequate quality history with the company
No Inspection	The lot is sent directly to a storeroom or processing department	For standard materials or goods that are not used in production, e.g., office supplies
Use of Supplier Data	Use the inspection data from suppliers instead of incoming inspection	Items from suppliers having strong quality record

The basic principle used in determine the amount of incoming inspection (100 percent inspection, sampling, or no inspection) needed for a product is to weigh the cost of inspection against cost of using that defective product in production, taking into account also the following factors:

- Previous quality history on the product item and the supplier
- Criticality of the item under consideration
- Criticality on later manufacturing or service operations.
- Process capability information
- Availability of necessary instruments for testing
- Product homogeneity

After the quality characteristics to be tested have been specified, for each of these characteristics the detailed inspection plan can be prepared. These detailed inspection plan generally includes such matters as [Juran, 1993]

- Type of test to be done
- The number of units to be tested (sample size)
- The method of selecting the samples to be tested
- The type of measurement to be made
- Conformance criteria for the units, usually the specified product tolerance limits.

2.3 Supplier Evaluation

Supplier evaluation is carried out to summarize the performance of a supplier using a set of selected criteria over a period of time. Supplier evaluation is generally understood as a systematic process of monitoring and assessing the past performance of suppliers. This is true but not all about supplier evaluation. Supplier evaluation can also take place with potential suppliers that the company has never traded with before. In any case, the evaluation of suppliers is continuing purchasing task. Current suppliers have to be monitored to see if expected performance materializes. New sources need to be screened to see if their potential warrants serious future consideration [Juran, 1993]

Under the total quality management, supplier development is an essential part that needs to be developed in order to achieve total quality [Dennis, 1996]. This supplier development area comprises of three distinct but related activities: supplier assessment, supplier improvement, and supplier partnership. The role of supplier evaluation is to provide the information with respect to areas that the supplier is performing well and those that are unsatisfactory. This information can be used to aid in supplier improvement and serve as the basis of the buying organization in selecting suppliers to form long-term partnership.

The buying organization establishes a set of criteria it wants to focus on the supplier assessment. Typical criteria of assessment include product acceptance, delivery, price and service [Dennis 1996]. A general practice in supplier rating is to determine appropriate weights for the assessed areas, depending on their relative importance and the buying organization's emphasis. Supplier are then assessed and

given marks in each area. The final score provides a numerical representation of the suppliers' performance over the period of assessment.

In addition to quality in term of product acceptance, price, delivery and service, sometimes it is very important that the supplier's capability be assessed, particularly for critical, or high-cost items. The objective of supplier's capability assessment is to verify whether the supplier's has the capability to meet the buying organization's requirements and manufacture products to specifications.

According to Lionel (1993), as assessment of a supplier should include four distinct part which are:

Engineering – supplier's manufacturing facilities should be evaluated to verify whether he has the capability to manufacture of supply materials/ product to the specification.

Quality - The supplier's quality system should also be evaluated. The evaluation would verify whether the supplier's quality system is being effectively implemented and fully supported by senior management.

Economics/ Schedule – An evaluation should be made of the supplier's price and delivery records. The points are to see if the company's pricing is competitive and whether there is a proven ability to deliver on-time.

Financial Stability – An evaluation on supplier's financial stability should also be made, especially for critical, high-cost materials or when long-contracts are concerned.

A supplier audit, which is an on-site assessment of suppliers, could also be done as part of supplier evaluation. The audit verifies the supplier's capability, quality system management and support from management to achieve quality, etc. Juran (1993) suggested a list of potential areas of concentration for supplier audit team as shown in the following page.

Category	Areas to consider
Management	Philosophy, quality policies, organization structure, commitment to quality, etc.
Design Process	Organization, systems in use, caliber of specifications, orientation to modern techniques, attention to reliability, engineering change control
Manufacture	Physical facilities, maintenance, special processes, process capability, production capacity, caliber of planning, lot identification and traceability
Quality	Organization structure, availability of quality control and reliability engineers, quality planning (materials, in-process, finished goods, packing, storage, shipping, usage, field service), audit of adherence to plan
Inspection and test	Laboratories, special tests, instruments, measurement control
Purchasing	Specifications, supplier relations, procedures
Quality coordination	Organization for coordination, order analysis, control over subcontractors, quality cost analysis, corrective action loop, disposition of nonconforming product
Data systems	Facilities, procedures, effective use reports
Personnel	Indoctrination, training, motivation
Quality results	Performance attained, self-use of product, prestigious customers, prestigious subcontractors.