INDUSTRIAL COMPETITIVENESS: COST REDUCTION
Industrial Competitiveness
Cost Reduction

by

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The objectives of industrial management are:
- Implementation of the policy adopted by the owners or the board of directors
- Optimum return on investment
- Efficient utilization of Men, Machine and Money.
In other words, industry must make profit.

Manufacturing represents only one aspect of the activities of industrial management. Present-day manufacturing methodology does not consider making profit as their primary objective.

The manufacturing process requires the knowledge of many disciplines, such as design, process planning, costing, marketing, sales, customer relations, costing, purchasing, bookkeeping, inventory control, material handling, shipping, and so on.

Each discipline considers the problem at hand from a different angle. For example, in the case of the introduction of a new product:
- Marketing will evaluate its attractiveness to the customers
- The product designer will evaluate methods of achieving product functions
- The process planner will evaluate the required resources
- Finance will evaluate the required investment
- Manpower will consider the work force demands
- The manufacturing engineer will consider floor space and material handling
- Purchasing and shipping will consider how to store the product
Each discipline optimizes its task to the best of its ability. Each manufacturing discipline has its own objectives and criteria of optimization according to its function. For example: the designer main objective is meeting product specifications; the process planner’s main objective is that the items will meet drawing specifications; the production planner’s main objectives are meeting the due date, and minimizing work-in-process. The profit objective is not on top of the list of any manufacturing discipline. Even if each discipline functions optimally, this does not necessarily guarantee overall optimum success with respect to management’s prime objectives.

The traditional manufacturing cycle is a one-way chain of activities, where each link has a specific task to perform and the previous link is regarded as a constraint. Thus, for example, master production schedules accept the routing and bill of material as fixed (as well as quantities and delivery dates); it does not question these data and its planning must comply with them. Process planners accept the product design without question; in fact, they do not even consider the product as a whole, but rather, the processing of each item is regarded as a separate task. The capacity planner accepts the routing as given, and employs sophisticated algorithms to arrive at an optimum capacity plan.

Therefore, the chain of activities that comprises the manufacturing cycle is considered as a series of independent elements having individual probabilities of achieving a criterion. The probability of the success of any link is independent of every other link with which it is functionally associated. Thus the overall probability of the chain optimally achieving particular criteria is very low.

It is unanimously agreed that each discipline in the manufacturing process must consider the interest of other discipline interests. However, there is no practical and methodical way to accomplish this.

In this book an attempt to achieve a cooperation of all disciplines is made by organizing a meeting of all discipline managers to discuss and understand each other’s problems and difficulties. Each discipline presents its task and explains the difficulties and problems the he faces. Some of the problems are due to the rigidity of the system, i.e. constraint imposed by previous discipline. A group discussion follows to validate the necessity of such constraints, and to propose a method to eliminate or ease up the constraints. The standpoint of different disciplines is considered with a view to reach understanding and acceptance of operation methods.

The book is organized in two parts. The president of a company opens the symposium defining the need to increase company profit, and to reduce manufacturing cost.
Part one deals with how to reduce inventory cost by inventory management and control methods. Each session is devoted to a specific area, such as the objective and need of inventory; how to keep it to a minimum; how to verify the validity of inventory records; work-in-process reduction.

Part two deals with how to reduce cost of production management. Each session is devoted to a specific area such as: product specification; product design; process planning; production planning; shop floor control.

The role of management in cost reduction is the topic of a decision support session.

Two appendices are included to further explain cost reduction methods. Appendix 1 elaborates and explains SPC - statistical process control, 6σ method. Appendix 2 gives an example of the flexible production planning method.

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GLOSSARY

C         CONTROLLER
CC        COMPUTING CENTER
D         DESIGN MANAGER
H         HUMAN RESOURCE - PERSONNEL
F         FINANCE
FM        FOREMAN
I         INVENTORY MANAGER
M         MARKETING
P         THE PRESIDENT
PM        PRODUCTION MANAGER
PP        PROCESS PLANNING
PR        PURCHASING
PS        SCHEDULING
Q         QUALITY
S         SALES
Chapter 1

SHOP FLOOR COST REDUCTION

1. INTRODUCTION

The president of the automotive part manufacturer company was not at all certain how to react to the pressure from the traditional vehicle manufacturers, and therefore jobbers and distributors to decrease prices. This was on top of the cumulative average decrease in prices of 13.3% since 1998. All the while labor, energy and raw material costs have been rising in addition to an increase in competitors in emerging markets such as China or India.

To cope with this dilemma he decided to organize a meeting with all department managers of the company to evaluate diverse proposals.

The Manager of Finance (Mr. F) raised his hand and asked to add some remarks and propose actions. He noted that in addition to the competition from the low cost countries, and the request by the customers for lower prices, there was another problem, which might turn into a bigger one. The stockholders of the company were dissatisfied with the return on their investment. In their last meeting a proposal was made to let the company operate for another six months and if the revenue had not increased to a satisfactory level, they would recommend closing the company.

To increase the stockholders revenue our profit must be increased.

$$
profit = selling\ price - actual\ cost
$$

To increase the profit there are several methods that I propose to consider, which are:
1. Increase sales prices
2. Increase sales volume
3. Decrease employee salary
4. Decrease cost of inventory
5. Decrease processing costs
6. Call for government assistance and tax reduction

The president asked the Manager of Finance (Mr. F) to elaborate on the government possible assistance (6\textsuperscript{th} method).

Mr. F explained: Companies can be competitive based on variables under their control; however, their competitiveness is directly affected by macroeconomic variables such as taxation rates and interest rates. The government should assist companies to compete better in the global industry by eliminating capital tax, lowering corporate income tax rates and lowering interest rates. Around 1,300 families’ livelihoods depend on our company. If our company were to be closed they would probably become unemployed and the government would have to support them. Therefore, it is in the government’s interest to assist us to survive. We can submit a request and ask for support.

The president thanked the Manager of Finance (Mr. F) for the clear definition of possible measures to take. He made the following remarks and notes for discussion.

The first option, i.e. to increase sales prices is out of the question in our present situation. We must lower sales prices while increasing profit.

I wish to remove the methods of increasing profit by decreasing labor cost. Our highly trained staff utilizes the full range of appropriate technology to ensure that each product shipped will be of the highest quality. Management policy is to keep our employees happy and be one of the higher paid companies in our field.

In principle I do not like to call on the government for assistance. We should work on our machines and not on the government.

The controller (Mr. C) noted that while considering the president’s notes, there are three available cost reduction methods: decrease cost of inventory; decrease processing cost, decrease management and overhead cost.
Shop floor cost reduction

The president agreed and proposed to start the discussion on how to reduce cost of inventory. He mentioned three modes of inventory: Raw Material, Work in Process (WIP) and Finished Products. I propose to discuss each one separately.

Let’s start with raw material cost reduction.
Chapter 2

INTRODUCTION TO INVENTORY

1. THE PURPOSE OF INVENTORY

The controller (Mr. C) pointed out that “inventory” is a broad term; it includes several types of inventory for a different purpose. To reduce the cost of inventory, each type should be treated differently.

The president asked the controller to elaborate on that statement.

Mr. C explained: The competitive factors in the market for a manufacturing company are prices, and qualitative aspects including services and delivery dates. It is normal that when a customer wants to purchase a certain product he will places his order with a company that meets his required delivery dates. Therefore, delivery dates are surely a very important factor for the company to be competitive.

To meet a customer’s demand, the company can take one of the following solutions:

A. Keep a very high stock of finished goods. Then, whatever demand comes there is no danger of losing the customer order, since the company can meet the demand immediately.

The drawbacks of this solution are as follows.

- Tied up capital in the finished stock can be dangerously high.
- Some of the finished stock may go to dead stock because the total demands are limited and the product life cycles are getting shorter and shorter.
- There is a need for large storage space.
• Retailers, wholesalers, and manufacturers in many cases have only limited space for keeping inventory, thus it is very difficult for them to keep all the stock.

Because of these reasons, this seems not to be the right solution.

B. Keep stock of raw material and have very short throughput times to replenish the stock of finished goods. One function of inventory is to act as a buffer between sales and production. In other words, it separates the sales function and the production function and enables each to function independently.

In its broadest perspective inventory can be defined as a matter of trying to keep the most economical amount of material in order to be able to increase the total value of profit. Inventory can also be considered in a negative sense as an asset not yet utilized: idle materials, idle machines, and idle manpower. In this sense the purpose of inventory management is to avoid having too much total idleness among an aggregate of all the assets owned.

From an investment standpoint, inventory is commercially wasteful. However, from an operating point it absorbs the difference between forecast and actual demand. Semi-finished components and subassemblies are maintained in order to:

• reduce the delivery time quoted for the end product;
• balance seasonal demand fluctuations;
• take advantage of volume discounts in purchasing and manufacturing.

Inventory control is divided into two main parts: inventory management and inventory accounting. The objective of inventory management is to keep capital investment in inventory to a minimum while maintaining a desirable service level; this is the planning and controlling aspect of inventory. The objectives of inventory accounting are to keep track of inventory transactions and to supply information required by other systems.

The use of computers in industry has made it possible to plan and control inventory as an integral part of the manufacturing system. The need for items and subassemblies is established to correspond with the exact date when assembly is scheduled to begin. These are dependent items - they depend on the master production schedule. The independent items are forecast and planned according to management policy in the master production schedule.

Conventional inventory management, with its theories of service level, economic order quantity, safety stock, and order point, was appropriate for manual systems; in spite of its unrealistic basic assumption of gradual
depletion (in manufacturing, depletion tends to occur in discreet lumps because of lot sizing at higher levels), there was nothing superior. However, in the era of the integrated manufacturing system conventional inventory management has become obsolete. Its objective of keeping capital investment in inventory to a minimum while maintaining the desired service level is met more satisfactorily by master production scheduling and requirement planning. In conventional inventory management, dead stock is defined as items in stock with no issue or movement for a predetermined period (e.g., two years). A slow moving item is defined as an item with issue movement of no more than, for example, 10% of the balance within a year. Whereas these terms were suitable for the conventional system, with the computerized integrated manufacturing system the definitions should be changed. As we plan future activities we do not count on historical data; thus, for example, a better definition of dead stock would be: stock that we don’t plan to use for a predetermined period in the future, where requirement planning furnishes this information. In an extreme case, if an order was cancelled dead stock might consist of items just arrived or that has not yet been received in inventory.

1.1 Inventory objective

Inventory control is central to the various manufacturing activities; in most industries the activities start and end in inventory. The received raw material is first entered into the storeroom, and then issued to the manufacturing shops, and the finished items are entered into the stockroom; items are issued for assembly, and subassemblies and finished products are entered into the storeroom; purchased components are entered into the storeroom when received; finally, shipping to customers is carried out from inventory. This procedure places inventory at the junction point of all activities, thereby making it a good source of information concerning the progress of manufacturing.

The objective of the inventory system is to supply information required by other systems; thus the inventory system is a dependent system it depends on the applications desired and on the information required by the integrated system. The inventory system should be designed according to these specifications.

The following are examples of the above-mentioned applications and retrievable information that serve as the objectives of the inventory system:

- Control over plant properties.
- Supply data about on-hand stock to the requirement planning system.
- Supply data to expediters on the availability of items required for assembly.
Chapter 2

- Supply data for alternative materials.
- Approval of suppliers’ bills.
- Supply data on the value of stock to the balance sheet.
- Supply data on material cost to the costing system.
- Control over indirect material usage.
- Supply data to estimate cost of products.
- Supply data on order delivery dates.
- Control over raw materials supplied to subcontractors (when the customer supplies the material).
- Control over quality control of suppliers.
- Supply data to suppliers’ rating system.
- Supply data for calculating shop hourly rates.
- Supply data for budget preparation.
- Supply data for forecasting future sales.
- Supply data for tax considerations.
- Supply data for evaluation of different price systems in inventory.
- Supply data needed for decisions on buying or expansion of plants producing required material.
- Control over dead stock and slow-moving items.
- Control over physical count of stock.

Each of the specified objectives should be analyzed vis-à-vis the required data and the way that they will be handled. In addition, the reliability and data processing technique requirements should also be considered. The inventory system is constructed with these objectives in mind.

In conclusion to the elaborate inventory theory we can define three types of inventory, which are:
- Raw material (Depended Items and Independent Items)
- Work In Process (WIP)
- Finished goods

The president thanked Mr. C and he suggested that we start our discussion by considering only the reduction of the raw material inventory.
Chapter 3

RAW MATERIAL REDUCTION SESSION

1. WHY RAW MATERIAL

The Inventory Manager (Mr. I) pointed out the raw material costs about 35% of product cost. At an interest rate of about 4% that means that if we completely eliminate the raw material inventory we might save only 35% x 4% which is about 0.014 or 1.4%. This will not meet the requirement of over 3% cost reduction.

The president noted that the inventory reduction, as high as it will be, will not solve the problem of the required reduction.

2. ELIMINATE RAW MATERIAL INVENTORY ALTOGETHER

Mr. F was the first to respond and noted that he agrees with the proposal to reduce or eliminate inventory altogether. He pointed out that from an investment standpoint, inventory is commercially wasteful. Furthermore it created additional investments in order to store and manage the inventory. Warehouses must be built, workers hired to carry the goods to these warehouses, and probably a carrying cart needs to be bought for each worker.

In the warehouse people would be needed for inventory management and rust prevention. Even then, some stored goods still rust and suffer damage. Additional workers will be needed to repair the goods before removal from
the warehouse for use. Once stored in the warehouse, the goods must be inventoried regularly. This requires additional workers, and probably buying computers, hardware and software, for inventory control.

All this will contribute to cost increases.

3. **ELIMINATE INVENTORY ERRORS**

This remark provoked the Production Management Director (PM): he rose angrily and said that from a manufacturing point of view, inventory is a must and it is not a waste. Even with the present inventory size there are problems that cause waste. If inventory quantities are not completely controlled, (which usually they are not) shortages and dead stock can arise. A single mistake in inventory management that creates a shortage of an item needed may cause the assembly line to stop, or workers being idle while waiting for the material. The waste caused by even one such mistake will eat up the profit, (saved by not keeping stock) that ordinarily amounts to only a few percent of sales and thereby endanger the business itself.

The Company Controller (Mr. C) raised his hand and asked to add some remarks and propose actions. May I draw your attention to the fact that over 3% of inventory cost might be just a figure caused by inventory system faulty data (errors). If we increase the reliability of our inventory data we might decrease cost by the required amount.

Let me explain what I mean.

Inventory accounting control (not inventory management) handles a huge amount of transactions. A moderate size company processes about 500,000 transactions every month. With such an amount of transactions, data errors are inevitable. An error rate of as low as 1% will result in 5,000 faulty data items; these errors will be compounded to an extent that depends on the number of times these faulty data items are used (some input data items might be used as often as 30 times in different applications and reports). Consequently, an input data error rate of 1% might result in an average total of 50,000 errors in data processing files and reports.

Errors can cause considerable damage, for example, possible results could include the purchase of material already in stock or failure to buy or produce an item required for assembly. Some errors produce less serious results, such as paying a debt to the wrong vendor, while others may be simply unpleasant and add to the large stock of jokes told about the stupidity of computers.

Special care is usually taken to reduce the number of errors that originate at the input end of data processing. However, the measures employed are often not sufficient, since even an error rate of 0.1% – about the lowest limit that can be expected-is intolerable. People make mistakes and there is nothing that can be done about it.
What I suggest is to examine our records and to devise a system that will reduce the number of errors and thereby reduce inventory cost.

The president and the participants were amazed by the proposal and they indicated that it was hard to believe that there could be so many errors in the inventory records, and asked what might be done to prevent them.

The Production Management Director (Mr. PM) and the Finance Manager (Mr. F) indicated that they were aware of errors in the inventory system. In many cases the records indicate that there are sufficient items for assembly or processing, but when they request an issue, the response is that the item in question is not available.

The Controller (Mr. C) indicated that there are cases where the book value of the inventory is very high. When investigating such cases it appears that the unit price is wrong. It turned out to be a unit cost where the price was for a box of 100 units. There were several cases of confusions and errors in the unit of measure and some of errors in specifying the code number of an item and the catalog books.

3.1 How to eliminate the inventory errors

The President asked Mr. C to elaborate on his proposal for eliminating inventory errors.

Mr. C explained: Inventory is a passive stage in the manufacturing cycle; it does not plan or initiate any activity, but merely serves the active stages. This fact can be used to increase the reliability beyond the general reliability measures. Moreover, it may serve as a production information and control system for companies that do not wish to control manufacturing at the operation level and are satisfied with controlling it at the part level.

Inventory transactions are not initiated by the storekeeper, but rather by one of the active stages of the manufacturing cycle. Therefore, each inventory transaction can be validated by comparing it to the planned activities. Fig. 3-1 shows the inventory file as a nucleus with many reference files as satellites. These reference files contain all planned inventory activities. Each transaction is marked by a transaction code that indicates in which reference file the initiation of this transaction is recorded. Before updating the inventory file, a validation check will be made against the appropriate file. If the transaction is found to be valid, updating will take place; if not, the transaction will be marked as an error.

The numbers on the connecting lines in Fig. 3-1 indicate the transaction codes. For example, an inventory transaction with code 01 results from a purchasing order. The transaction indicates the item code number, the