CHAPTER 2

THEORITICAL FOUNDATION

Inventory management is among the most important operations management responsibilities because inventory requires a great deal of capital and affects the delivery of goods to customers. Inventory management has an impact on all business functions, particularly operations, marketing, accounting, and finance. Inventories also can be managed in a logical and consistent manner.

Inventory control is concerned with minimizing the total cost of inventory. In the U.K the term often used is stock control. The three main factors in inventory control decision making process are:

- The cost of holding the stock (e.g., based on interest rate)
- The cost of placing an order (e.g., for raw material stocks) or the set-up cost of production, and
- The cost of shortage, i.e., what ist lost if the stock is insufficient to meet all demand

The third factor is the most difficult to measure and is often handled by establishing a “service level” policy, e.g, certain percentage of demand will be met from stock without delay.

2.1 Inventory

As general, inventory was defined as raw material stock that has been used to produce or to gratify customer demand. “Inventory could be categorized such as : raw material, goods in course and finished goods. The definition related with process of operation transformation, so that can be explained by material stream process with inventory of material await to enter production process, inventory in course of representing middle phase in production system transformation” (Zulfikarijah, 2005, p.4)

The primary purpose of inventories is to uncouple the various phases of operations and supply chain. Raw materials inventory uncouples a manufacturer from its suppliers; work-in-process inventory uncouples the various stages of manufacturing from each other; and finished-goods inventory uncouples a manufacturer from its customers.

Within the overall uncoupling purpose, there are four reasons to carry inventory:

1. **To protect uncertainties**. In inventory systems, there are uncertainties in supply, demand, and lead time. Safety stock:Remaining inventory between the times that an order is placed and when new stock is received. If there are not enough inventories then a shortage may occur. Safety stock is a hedge against running out of inventory. It is an extra inventory to take care on unexpected events. It is often called buffer stock. The absence of inventory is called a shortage, however, buffer stock can often be reduced by better coordination of suppliers and customers in the supply chain
2. **To allow economic production and purchase.** Ideal condition of “one unit at a time at a place where user needs it, when he needs it”principle tends to incur lots of costs in term of logistic. So bulk buying, movement and storing brings in economic of scale, thus inventory
3. **To cover anticipated change in demand or supply.** There are several types of situations where changes in demand or supply may be anticipated: the price or availability of raw materials is expected to change, a planned market promotion, and smooth employment
4. **To provide for transit.** Transit inventories consist of materials that are on their way from one point to another in the supply chain. These inventories are affected by plant location decisions and by the choice of carrier. Sometime the inventory in transit is called pipeline inventory because it is in the “distribution pipeline”

Special terms used in dealing with inventory are described below:

- **Stock Keeping Unit (SKU)** is a unique combination of all the components that are assembled into the purchasable item. Therefore any change in the packagior product is a new SKU. This level of detailed specification assists in managing inventory.

- **Stockout** means running out of the inventory of an SKU.[1]
- **"New old stock"** (sometimes abbreviated NOS) is a term used in business to refer to merchandise being offered for sale which was manufactured long ago but that has never been used. Such merchandise may not be produced any more, and the new old stock may represent the only market source of a particular item at the present time.

If a firm adopts a 97% in-stock availability policy, does this mean all customers receive 97% service? Or it is more likely that 97% is an average, with some customers receiving above average service and other below average service? In reality, because different items stocked by the firm are ussually assigned different availability policies, the services received by an individual customer depends upon the mix of products bought by that customer.

2.2 Availability

When adopting an in-stock availability policy, firms typicallyassign higher availability to items with the highest level of either sales or profitability. Firms assign lowe availability to slow moving or less profitable items. Therefore, a customer may buy a mix of items that includes a higher proportion of lower availability items and thus receive less than 97% service. In contrast, another customer may buy relatively few of the low availability items and enjoy a higher than 97% level of service.

The availability level experienced by individual customers is not captured by current measures of inventory availability. Current measures are item or order oriented rather than focused on individual customers. Escalating pressures arising from a competitive business environment have forced firms to dedicate more resources to the needs of individual customers. Customer service, for instance, is one of the most visible topics in both the academic and the popular business press (Anderson and Narus 1995).

(1.Financial dictionary, formerly http://www.specialinvestor.com/terms/1072.html, Special Investor)

Focus on individual customers is further evidenced by the emphasis on partnership, alliances, and other forms of close relationships between buyers and sellers in the supply chain (Lambert, Emmelhainz, and Gardner 1999)

To fill the gap between the increased need to measure service to individual customers and the measure of inventory availability in the current literature, single customer inventory availability measures are proposed in this research. The guiding principle is that firms must manage the frequency with which individual customers are faced with a stockout. This principle is particularly important to the management of relationships with key customers. A customer is considered “key” when, for any reason, it is targeted for special service.

The proposed set of single customer inventory availability measures is based on a common premise: What is the probability that an individual customer will be told that a product is unavailable for on-time delivery? In other words, what is the probability that a specific customer will face a stockout? Four measures are suggested. The first is the probability that an individual customer will be told that the next item ordered is avilable for on-time delivery. The second measures the probability that an individual customer will be told that the next order is available for on-time delivery. The third is the probability that an individual customer will not be told at least once in the next period (week,month, etc) that an item is not available for on-time delivery. The final measure is the expected number of times an individual customer will be told during the next period that an item is not available.

These measures use a customer’s purchase history to estimate shortages in future purchases. In other words, the measures are designed for suppliers with multiple customers of varying importance,with whom there is an available record of past purchases. It is assumed that customers have a consistent order profile; that is, they tend to purchase the same items in similar quantities and prices.Examples to which this assumption might apply include packaged goods manufacturers and industrial distributors. These measures were also designed to be easily implemented because they are based on a company’s existing records. Most firms have records of their customer's past purchases and have fileswith the inventory availability policies assigned to each item.

In addition to the measures above, we propose a managerial model designed to assist managers in the implementation of one of the measures, the item availability level promised to a specific customer.That measure is termed the single customer item availability (SCIA). The managerial model includes a mixed integer linear program (MILP) designed to identify the lowest cost combination of item availabilities that will guarantee the SCIA promised to a key customer. It is important to note that the goal of the MILP is to determine the item availability levels needed to support a pre-determined level of service to an individual customer, while minimizing the inventory required to do so. The managerial model also includes a procedure to quantify the level of safety stock needed to service different customers buying the same item but who are offered different levels of service. The procedure is based on setting "trigger" levels for individual customers.

The purpose of these "triggers" is to avoid keeping a separate safety stock for each key customer. Findings from the portfolio effect literature show that a separate safety stock for each customer is unreasonably expensive (Zinn, Levy and Bowersox 1989). Instead, firms keep a single safety stock, but use the proposed managerial model to determine the "trigger" for each item bought by each key customer. When that level of inventory is reached, firms may select one of several courses of action. They may stop selling the item to less important customers until the inventory is replenished, they may contact the key customer to obtain an update on their purchase intentions until a replenishment arrives or, finally, they may speed up replenishments.

(Customer-based measures of inventory availability, Journal of Business Logistic, 2002 by Zinn, Walter, John T, Croxton, Keely L)

2.3 Customer Service Level

The customer service level measures how often you have the items you've committed to stock when your customer want them. Keep in mind that if you don't have what your customer want, they must look for it elsewhere. Your competitors won't have to make sales calls, but your customers will seek them out. The customer service level is calculated with the following formula:

<u>Number of line items for stocked products shipped complete by the promise date</u>
Total number of line items for stocked products ordered

When calculating your customer service level, we only include sales of stocked items that are filled using warehouse inventory. We don't include sales of other kinds of products such as :

- **Special order items**----→ items that you don't keep on hand, but are specially ordered to fill a specific customer order
- **Direct or " drop " shipments------→** material sent directly from a vendor to your customer

Shipments of these types of items do not reflect how well you stock material to meet your customer 's immediate needs. Companies who include special order items and direct shipments when calculating a customer service level tend to overstate how well they are serving their customers fro warehouse inventory.

("Achieving Effective Inventory Management", Jon Schreibfeder, 3rd Edition, 2005, p.34-35)

The following are five paremeter by which we can value customer service level :

1) Fill orders through inventory

If we have great customer service level, then we should easily be able to fill our customer orders. We should keep careful note of what our customer order and whether we have the item they are requesting at the time we receive the order. If we are almost always " out of stock", then we are failing to serve our customers the best way possible.

In a bussiness with diverse number of products, if we are able to fill the order for approximately 95% of the time then we are doing fine. If we are a business that offers only one product, 100% fulfillment of normal orders (barring abnormally large orders) should be our goals.

2) Just in time delivery order

The efficiency and the speed we are able to deliver the product or service which has been ordered is one of the important factor to value customer service level. If we are almost always missing our target delivery dates, then our customer service delivery chain needs major work.

We should compute the proportion of customer orders that have been delivered on time to the total number of customer orders. This calculation should be time-bounded, for instance, for a month's total number of orders, what percentage has been delivered on time? If we register that 95% of the time, our customer receive their order at the designated delivery date, then our bussiness is doing fine.

3) Resolve customer concerns

For great customer service, we need to respond to our customer's inquiries and resolve their concerns. A simple way of testing this would be to measure the proportion of the number of customer inquiries that have been effectively resolved to the total number of customer inquiries received.

4) Quick respond to customer's mails/emails and phone calls

How fast we respond to customer is another means of measuring our customer service level. If we are able to respond to our customers within 24 hours (less is even better) of receiving their call, correspondence or email, then we are doing great.

5) Pass according to customers

Finally, our customers themselves can tell us whether we pass or fail when it comes to fulfilling their needs. We can actually conduct a customer survey. The survey should focus on customer service issues so we can measure how well we are able to serve our customers from these customer's point of view.

(source:http://EzineArticles.com/?expert=mark_Gwilliam)

2.4 Safety Stock

Optimizing Safety Stock levels by calculating the magical balance of minimal inventory while meeting variable customer demand is sometimes described as the Holy Grail of inventory management. Many companies look at their own demand fluctuations and assume that there is not enough consistency to predict future variability. They then fall back on the trial and error *best guess weeks supply* method or the over simplified *½ lead time usage* method to manage their safety stock. Unfortunately, these methods prove to be less than effective in determining optimal inventory levels while maintaining or increasing service levels we will need to investigate more complex calculations.

One of the most widely accepted methods of calculating safety stock uses the statistical model of Standard Deviations of a Normal Distribution of numbers to determine probability. This statistical tool has proven to be very effective in determining optimal safety stock levels in a variety of environments. The basis for this calculation is standardized, however, its successful implementation generally requires customization of the formula and inputs to meet the specific characteristics of operation.

Understanding the statistical theory behind the formula is necessary in correctly adapting it to meet our needs. Error in implementation are ussually the result of not factoring in variables which are not part of original statistical model. The following is a list of the variables and the terminology used in this safety stock model:

- **Normal Distribution:** Term used in statistical analysis to describe a distribution of numbers in which the probability of an occurrence, if graphed, would follow the form of a bell shaped curve. This is the most popular distribution model for determining probability and has been found to work well in predicting demand variability based upon historical data

- **Standard Deviation:** Used to describe the spread of the distribution of numbers, standard deviation is calculated by the following steps :

  1.determine the mean (average) of a set of numbers

  2.determine the difference of each number and the mean

  3.square each difference

  4.calculate the average of the square

  5.calculate the square root of the average

In safety stock calculations, the forecast quantity is often used instead of the mean in determining standard deviation.

- **Lead Time:** Highly accurate lead times are essential in the safety stock/reorder point calculation. Lead time is the amount of time from the point at which we determine the need to order to the point at which the inventory is on hand and available for use. It should include supplier or manufacturing lead time, time to initiate the purechase order or work order including approval steps, time to notify the supplier, and the time to process through receiving and any inspections.
- **Lead-time demand:** Forecast demand during the lead-time period. For example, if our forecasted demand is 3 units per day and our lead time is 12 days, then our lead time demand would be 36 units
- **Forecast:** Consistent forecasts are also an essential part of the safety stock calculation. If we don't use a formal forecast, we can use average demand instead
- **Forecast period:** The period of time over which a forecast is based. The forecast period used in the safety stock calculation may differ from our formal forecast periods. For example, we may have a formal forecast period of four weeks while the forecast period we use for the safety stock calculation may be one week

- **Demand history:** A history of demand broken down into forecast periods. The amount of history needed depends on the nature of our business. Business with a lot of slower moving items will need to use more demand history to get an accurate model of the demand. Generally, the more history the better, as long as sales pattern remains the same
- **Order cycle:** Also called replenishment cycle, order cycle refers to the time between orders of a specific item. Most easily calculated by dividing the order quantity by the annual demand and multiplying by the number of days in the year
- **Reorder point:** Inventory level which iniatiates an order. Reorder Point = Lead Time Demand + Safety Stock
- **Service level:** Desired service level expressed as a percentage
- **Service factor:** Factor used as a multiplier with the Standard Deviation to calculate a specific quantity to meet the specified service level.

Service Level	Service Factor	Service Level	Service Factor
50.00%	-	90.00%	1.28
55.00%	0.13	91.00%	1.34
60.00%	0.25	92.00%	1.41
65.00%	0.39	93.00%	1.48
70.00%	0.52	94.00%	1.55
75.00%	0.67	95.00%	1.64
80.00%	0.84	96.00%	1.75
81.00%	0.88	97.00%	1.88
82.00%	0.92	98.00%	2.05
83.00%	0.95	99.00%	2.33
84.00%	0.99	99.50%	2.58
85.00%	1.04	99.60%	2.65
86.00%	1.08	99.70%	2.75
87.00%	1.13	99.80%	2.88
88.00%	1.17	99.90%	3.09
89.00%	1.23	99.99%	3.72

In the safety stock calculation we will refer to the multiplier as the service factor and use the demand history to calculate standard deviation. In its simplest form this year would yield a safety stock calculation of : safety stock = (standard deviation) * (service factor). If our lead time , order cycle time, and forecast period were all the same and if our forecast was the same for each period and equaled the mean of the actual demand for those periods, this simple formula would work great. Since this situation is highly unlikely to occur we must add factors to the formula to compensate for these variations.

This is where the trouble lies. We must add factors to adapt this theory to work with our inventory, however, each factor we add comprimises the integrity of the original theory. This isn't quite as bad as it sounds. While the factoring can get complicated we can keep tweaking it until we find an effective solution. Our final formula will look like : safety stock= (standard deviation) * (service factor) * (lead-time factor) * (order cycle factor) * (forecast-to-mean-demand factor)

There is not a general consensus on the formulas for these factors; in fact, many calculations don't even acknowledge the need for them

- **Lead-time factor:** this is necessary to compensate for the differences between lead time and forecast period. The standard deviation was based on the forecast period, a factor is necessary to increase or decrease the safety stock to allow for this variance. A formula is lead time factor = square root (lead time/forecast period)
- **Order cycle factor:** Since longer order cycles result in an inherent higher service level we will need to use a factor to compensate for this. A formula is order cycle factor = square root (forecast period/order cycle)
- **Forecast-to-mean-demand factor:**Remember that the original statistical model was based upon the mean of the distribution. Substituting a forecast for the mean in the calculation of standard deviation creates a problem if the forecast mean and the actual are not close and also if the forecast varies between forecast periods (seasonality, sales of growth)
- **Minimum reorder point:** For slow moving products and especially if the lead time is short, there's should be programmed in a minimum reorder point which is the equivalent of one average sale
- **Lead-time variances:** Supply problems tends to be related more to a vendor than an item and the severity of the variations do not fall into the pattern of a normal distribution. The safety stock calculated for demand variation will also cover for some supply variations, however, the best way to deal with variable supply is to have a high level of communication with the vendor and not to count on safety stock. We may find that certain items which are critical to our operation

may require a safety stock calculation based on upon the nature of the supply chain of the specific item

(“Inventory Accuracy”, Piasecki, 2003)

2.5 Inventory Controlling System

In the field of this role system operation is required, where this system is used to write down transaction and to monitor inventory management performance. Computer ,manual, combination or both can use this system. In this time many computerized system, except inventory, which has a few amount and its cost-effective price because the expense of computer system are higher than manual

Good inventory control system both using manual and also computer have the following function : (Zulfikarijah, 2005,p.21-22)

1. Counting/Calculating transaction

Every inventory system requires record-keeping method, which must support requirement of organizational accountancy and inventory management function. Sometime this method require note to write down every acceptance and payment, however usage of correct method every quality controlling system required appropiate transaction subsistem. Note inventory accuracy really have to be majored, some system do not responding righteously because note that exist in company or inaccurate inventory order.

2. Arranging inventory decision

Inventory system unites decision order to determine when and how many oredering. If it’s implementation in some system, computer also earns automatically buy order pursuant to used regulation.

3. Reporting on exception

At order decision of automatic inventory stay in system, hence exception will be reported to management. This exception cover inaccurate forecast, too big order purchasing which have been yielded, running out of tired inventory which could reach level that have been determined.

4. Forecasting

Decision of inventory casn be relied on forecasting request. There are some forecast techniques can be used as quantitative and also qualitatives. Decision of inventory does not only rely on inventory manager or marketing purely, quantitative technique can be packed into the system. Adjusment play role in forecasting of which can used to modify quantitative forecasting in the situation, which do not as usual.

5. Top management report

Quality controlling system can yield result for management culminates as does for the manager of inventory. The report will measure entire/all inventory performance and the report can assist in making of policy of broader inventory. This report cover: given service story; inventory operating expenses and compared to investment story; other period level. Many confidences placing ratio as performance size measure, its result insufficient information for the making of inventory policy. In practice more system gives very information less for the management of top.

2.5.1 Poor Inventory Control (Schreibfeder, 1997)

Inventory is not just a materials management or warehouse department issue. The purchasing, receiving, engineering, manufacturing, and accounting departments all contribute to the accuracy of the inventory methods and records. Inaccurate inventory data will contribute to shipments delays, production stoppages, purchasing of the wrong parts, and stocking too much inventory.

Regardless of the type of manufacturer (discrete, process, engineer to order, etc), deficient areas all seem to remain the same . Here the checklist to consider the depth of company's inventory control:

a) Area 1 - Bill of material (BOM)

The accuracy of your BOM is an important factor to consider when analyzing your inventory level, with following question, such as :

- How often your BOM's reviewed and updated?
- Are your BOM's accurate? Do they contain an engineer's concept of the product from several years ago, or do they reflect the actual parts and subassemblies that are used on the shoop floor?
- Do your BOM's reflect the actual manufacture flow? Do the engineers think the product uses one set of routings while the shop floor produces the product in a completely different manner?
- Is scrap or shrinkage factored into the yields? Bills created using 100 percent yields are almost always incorrect

Result: Inventory shortage due to inaccurate usage of parts

b) Area 2 - Receiving Policies

The receiving policy must be documented and actively managed to ensure receiving is timely and discrepancies (short shipments, over shipments, reject,etc) are consistently processed

c) Area 3 - Do you know each part's ATP (Available to promise)?

ATP is the amount of inventory not already committed to a customer order or to be used as subassembly in another unit,. When ATP is not known , many manufacturers either bulk up inventory to a level that assures them they can't possibly run out or they run very light inventory levels. Both side are bad. Inventory that doesn't turn adequately waste company assets and dangerously low levels increase the risk of stock outs that may halt production. The best way to check the use and accuray of ATP is to watch order entry personnel. If they put customer on hold, run to the warehouse, and physically check stock status, then you've got the problem.

d) Area 4 – Engineering Changes

Are changes in finished good components reviewed and effectivity dates communicated to all departments in a timely manner? Some question should be considered such as :

- Does your company use engineering change committee to analyze the criticality of proposed changes? Don't allow one engineer to make a part obsolete without a balanced look at what the change might do to other areas of your bussiness (e.g..creating obsolute inventory)
- Do your engineer change notice includes include effectivity dates that are actively managed? If not, buyers may continue to orders part based on their historical records and previous drawings.

Results: The wrong parts are ordered, automatically creating obsolute inventory, and the new parts are missing, thereby creating shortage.

e) Area 5 – Scrap Reporting

If a parts are damaged during the assembly process, company need to review how replacement parts are issued. Many companies allow production personnel open acces to inventory and don't require any recording of theadditional parts used for a particular run or job.

There are several reason why all parts used in the production process should be charged against the particular work order, they are :

- Usage of additional parts will affect the profitability of each job, so tracking the parts actually used is critical
- Recording actual usage of parts will enable you to decrement the replacement parts from inventory , thereby reflecting more accurate on-hand balances

f) Area 6 – Lead Times

Review and update the accuracy of vendor lead times. Buyers are in the best position to establish product lead times for each vendor, and they ussually complete them when the MRP system is implemented. Generally, lead times continue to decrease across most industries. If company vendor's lead time was 30 day's a view years ago, chances are the lead-time is much less today.. If company need US$ 100,00 of inventory for a particular work order , and company lead times are actually 15 days instead of the old 30 days, company has reduced its profitability by about US$ 350 (assuming an 8% carrying cost).

Lead time should be re-evaluated periodically and changed to reflect the vendor’s actual performance. The flip side of inaccurate lead times will create missed shipments due to stockouts and shortages.

g) Area 7 – Reorders Trigger

Reorder points and minimum stocking levels are established to alert buyers when it is time to order. How do you evaluate individuals within your purchasing function ? If their annual performance evaluation is based only on the avoidance of shortages , chances are your inventory turns are lower than normal. Make them responsible for a minimum level of turns as well .

h) Area 8 – Warehouse Locator System

Maintaining accurate inventory data and well-run physicall warehouse is critical for a manufacturing company’s success. Policies and procedures should be developed, implemented, and maintained after physical aspects are under control. These policies are best supported with a fully integrated computer system provide immediate access to all inventory transactions as they occur.

With management’s commitment to maintaining accurate inventory levels, and new policies and procedures being supported with fully integrated computer systems, it becomes much easier to know when enough is enough

2.6 Forecasting method

Forecasting is the art and science of predicting future events. A forecast is ussually classified is ussually classified by the future time horizon, which fall into three categories : (Heizer &Reinder, 2001, p.78)

1. Short range forecast-----→ This forecast has a time span of up to one year but is generally less than three month. It is used for planning purchasing, job scheduling, workforce level, job assignment, and production level.

2. Medium range forecast---→ This forecast generally span from three month to three years. It is useful in sales planning, production planning and budgeting, cash budgeting, and analyzing various operating plans.
3. Long range forecast--------→ Generally three years or more in time span. Long range forecast are used in planning for new products, capital expenditures, facility location or expansion, and research & development

2.6.1 Types of Forecasts

Organizations use three major types of forecast in planning future operations : (Heizer &Reinder, 2001, p.79)

1. Economic forecast address the business cycle by predicting inflation rates, money supplies, housing starts, and other planning indicators.
2. Technological forecast are concerned with rates of technological progress, which can result in the birth of exciting new products, requiring new plants and equipment.
3. Demand forecast are projection of demand for a company's products or services. These forecast, also called sales forecasts, drive a company's production, capacity, and scheduling system and serve as inputs to financial, marketing, and personnel planning.

2.6.2 Seven steps in Forecasting System

There are seven step in forecasting system should be followed : **(Heizer &Reinder, 2001, p.80)**

1. Determine the use of forecast
2. Select the item should be forecasted
3. Determine the time horizon of the forecast
4. Select the forecasting model
5. Gather the data needed to make the forecast
6. Makes the forecast

7. Validate and implement the result

2.6.3 Forecasting Methods

There are two general methods to forecaste, qualitative and quantitative methods (Roger G.Schroeder, 2007, p.217)

Qualitative forecasting method utilizes managerial judgement, experience, relevant data, and an implicit mathematical model. Qualitative is used when past data are not reliable indicators of future conditions. It is also used for new-product introductions, where a historical database is not available, in this case it can be used to develop a forecast by analogy or by selective use of market research data. There are four of the best known qualitative method:

- Delphi → Forecast developed by a panel of experts answering a series of questions on successive rounds
- Market Surveys →Panels, questionnaire, test markets, or surveys used to gather data on market condition
- Life-cycles analogy →Forecast may be made by a group or an individual on the basis of experience, hunches, or facts about the situation

In general, quantitative methods utilize an underlying model to arrive at a forecast. The basic assumption for all quantitative forecasting methods is that past data and data patterns are reliable predictors of the future. Two categories of quantitative forecasting method are : time-series forecasting and casual forecasting

Time-series methods are used to make detailed analysis of past demand patterns over time and to project these patterns forward into the future, moving average and exponential smoothing method are sample of time-series forecasting

- Moving average: Forecast is based on arithmetic average or weighted average of a given number of past data points. It uses for short-to-medium-range planning for inventories, production levels, and scheduling
- Exponential smoothing: Based on the very simple idea that a new average can be computed from an old average and the most recent observed demand

Casual forecasting methods develop a cause-and-effect model between demand and other variables. Regression method is one sample that uses casual forecasting

- Regression: this method relates demand to other external or internal variables that tend to cause demand changes, ussually uses for short-to medium-range planning for aggregate production or inventory involving a few products.

2.6.4 Selecting A Forecasting Methods (Roger G.Schroeder, 2007, p.232)

The most important factors in selecting a model are as follows:

1. User and system sophistication: the forecasting method must be matched to the knowledge and sophistication of the user
2. Time and resouce available: the selection of a forecasting method will depend on the time available in which to collect the data and prepare the forecast
3. Use or decision characteristics: the use is closely related to such characteristics as accuracy required, time horizon of the forecast, and number of items to be forecast
4. Data availability: the quality of the data available is a concern. Poor data lead to poor forecast. Data should be checked for extraneous factors or unusual points
5. Data pattern: the data in the data will affect the type of forecasting method selected. One way to detect the pattern is to plot the data on a graph