

Aggregate Planning: Meaning, Strategies and Cost

Aggregate planning is the process of developing, analyzing, and maintaining a preliminary, approximate schedule of the overall operations of an organization. The aggregate plan generally contains targeted sales forecasts, production levels, inventory levels, and customer backlogs. This schedule is intended to satisfy the demand forecast at a minimum cost. Properly done, aggregate planning should minimize the effects of shortsighted, day-to-day scheduling, in which small amounts of material may be ordered one week, with an accompanying layoff of workers, followed by ordering larger amounts and rehiring workers the next week. This longer-term perspective on resource use can help minimize short-term requirements changes with a resulting cost savings.

In simple terms, aggregate planning is an attempt to balance capacity and demand in such a way that costs are minimized. The term “aggregate” is used because planning at this level includes all resources “in the aggregate;” for example, as a product line or family. Aggregate resources could be total number of workers, hours of machine time, or tons of raw materials. Aggregate units of output could include gallons, feet, pounds of output, as well as aggregate units appearing in service industries such as hours of service delivered, number of patients seen, etc.

Aggregate planning does not distinguish among sizes, colors, features, and so forth. For example, with automobile manufacturing, aggregate planning would consider the total number of cars planned for not the individual models, colors, or options. When units of aggregation are difficult to determine (for example, when the variation in output is extreme) equivalent units are usually determined. These equivalent units could be based on value, cost, worker hours, or some similar measure.

Aggregate planning is considered to be intermediate-term (as opposed to long- or short-term) in nature. Hence, most aggregate plans cover a period of three to 18 months. Aggregate plans serve as a foundation for future short-range type planning, such as production scheduling, sequencing, and loading. The master production schedule (MPS) used in material requirements planning (MRP) has been described as the aggregate plan “disaggregated.”

Steps taken to produce an aggregate plan begin with the determination of demand and the determination of current capacity. Capacity is expressed as total number of units per time period that can be produced (this requires that an average number of units be computed since the total may include a product mix utilizing distinctly different production times). Demand is expressed as total number of units needed. If the two are not in balance (equal), the firm must decide whether to increase or decrease capacity to meet demand or increase or decrease demand to meet capacity. In order to accomplish this, a number of options are available.

Options for situations in which demand needs to be increased in order to match capacity include:

1. Varying pricing to increase demand in periods when demand is less than peak. For example, matinee prices for movie theaters, off-season rates for hotels, weekend rates for telephone service, and pricing for items that experience seasonal demand.
2. Advertising, direct marketing, and other forms of promotion are used to shift demand.
3. **Back ordering.** By postponing delivery on current orders demand is shifted to period when capacity is not fully utilized. This is really just a form of smoothing demand. Service industries are able to smooth demand by taking reservations or by making appointments in an attempt to avoid walk-in customers. Some refer to this as “partitioning” demand.
4. **New demand creation.** A new, but complementary demand is created for a product or service. When restaurant customers have to wait, they are frequently diverted into a complementary (but not complimentary) service, the bar. Other examples include the addition of video arcades within movie theaters, and the expansion of services at convenience stores.

Options which can be used to increase or decrease capacity to match current demand include:

1. **Hire/lay off.** By hiring additional workers as needed or by laying off workers not currently required to meet demand, firms can maintain a balance between capacity and demand.
2. By asking or requiring workers to work extra hours a day or an extra day per week, firms can create a temporary increase in capacity without the added expense of hiring additional workers.
3. **Part-time or casual labor.** By utilizing temporary workers or casual labor (workers who are considered permanent but only work when needed, on an on-call basis, and typically without the benefits given to full-time workers).
4. Finished-goods inventory can be built up in periods of slack demand and then used to fill demand during periods of high demand. In this way no new workers have to be hired, no temporary or casual labor is needed, and no overtime is incurred.
5. Frequently firms choose to allow another manufacturer or service provider to provide the product or service to the subcontracting firm’s customers. By subcontracting work to an alternative source, additional capacity is temporarily obtained.
6. **Cross-training.** Cross-trained employees may be able to perform tasks in several operations, creating some flexibility when scheduling capacity.
7. **Other methods.** While varying workforce size and utilization, inventory buildup/backlogging, and subcontracting are well-known alternatives, there are other, more novel ways that find use in industry. Among these options are sharing employees with counter-cyclical companies and attempting to find interesting and meaningful projects for employees to do during slack times.

Concept of Aggregate Planning

Aggregate Planning Strategies

There are three types of aggregate planning strategies available for organization to choose from. They are as follows.

1. Level Strategy

As the name suggests, level strategy looks to maintain a steady production rate and workforce level. In this strategy, organization requires a robust forecast demand as to increase or decrease production in anticipation of lower or higher customer demand. Advantage of level strategy is steady workforce. Disadvantage of level strategy is high inventory and increase back logs.

2. Chase Strategy

As the name suggests, chase strategy looks to dynamically match demand with production. Advantage of chase strategy is lower inventory levels and back logs. Disadvantage is lower productivity, quality and depressed work force.

3. Hybrid Strategy

As the name suggests, hybrid strategy looks to balance between level strategy and chase strategy.

Long-Term Decisions

The size of the company will determine the length of your long-term decisions made through the aggregate planning concept. Long term aggregate planning usually involves a time frame of two to 10 years. Long-term decision making should start with the company examining goals and objectives for the time period.

The term of this decision relates to product and service selection and includes all aspects of production. Long-term aggregate planning includes product and market planning, financial planning and resource planning. The resource planning identifies facilities and personnel needed to accomplish the long-term production objectives.

Intermediate Decisions

Intermediate decisions affect the level of employment within the organization. Specifically, through intermediate aggregate planning the organization will examine the output capacity of the workforce. This planning also affects the capacity of short-term decision making.

Intermediate aggregate planning also covers many additional aspects of the company, including production planning and stipulating output requirements. Further, intermediate aggregate planning looks at the major product groups and quantifies the labor hours needed to manufacture the product groups. Intermediate aggregate planning will typically look at time horizons totaling 12 to 18 months.

Short Term Decisions

Once a company has made long-term and intermediate decisions, it should create its short-term aggregate plan. Short-term aggregate planning decisions include materials planning, capacity requirement planning, final assembly scheduling and production activity control. Short-term decisions help the organization to ensure the end product is manufactured without delay to meet the projected goals of the intermediate and long-term aggregate plans.

Capital Intensive

Prof. Harvey Leibenstein, Paul Baran, Rostow, Hirschmann Maurice Dobb and Mahalanobis are the chief advocates of **capital intensive technique**. They consider that this technique is indispensable for accelerating the process of growth. Prof. Paul Baran has the strong opinion about the necessity of using the capital intensive in less developed countries.

He observed that such countries should make use of their ability to draw upon the scientific and technological advancement of the more developed countries if they want to industrialize at a faster rate. Capital intensive technique refers to that technique in which larger amount of capital is comparatively used. In such a technique the amount of capital used per unit of output is larger than what it is in case of labor intensive technique.

To quote Prof. Myint, “the capital intensive or labor intensive methods of producing a particular commodity are classified by the modern factory methods of producing consumer goods and mechanized methods of constructing roads, irrigation works and other projects. Here, because of lower labor costs and higher productivity, the net output per unit of capital may be comparatively higher.” Capital intensive technique has been shown in diagram 2.

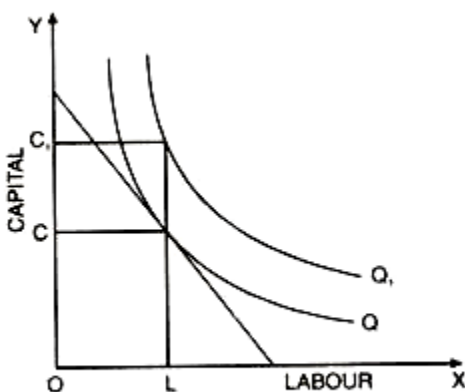


Fig. 2

In this diagram isoquant Q represents the initial level of output, using OL amount of labor and OC amount of capital. With the introduction of new technique a higher level of output is shown

by labor (OL) but with greater dose of capital (OC_1). Therefore, capital intensive technique is using more capital with the same amount of labor.

Labor Intensive

In simple words labor intensive technique is that which uses comparatively larger amount of labor and small doses of capital. It is that technique by which more of labor and less of capital is required for the process of production. However, it can be defined as one in which a large amount of labor is combined with a smaller amount of capital. According to Prof. Myint, “labor intensive methods of production are those that require a large quantity of labor with a given unit of capital.” With this method of production, it is possible to raise output by using the same amount of capital but greater amount of labor.

This technique fulfills two objectives of capital formation and skill. It raises agriculture production through the use of minor irrigation, better seeds, manure, implements and the introduction of short duration crops. Labor intensive technique has been illustrated with the help of diagram I. In this diagram, isoquant Q shows the initial level of output which is being produced by using OL labor and OC amount of capital. With the adoption of new technology a higher level of output is represented by the isoquant Q_1 , can be produced by the same amount of capital i.e. OC. In this case, greater amount of labor is OL_1 . This shows that the technique is labor intensive.

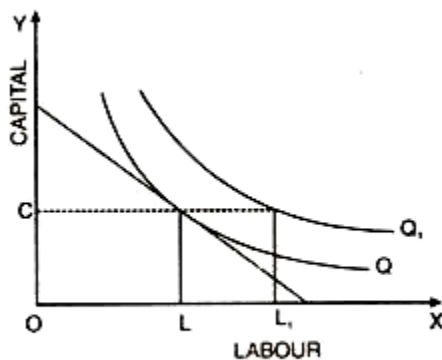


Fig. 1

Fashion Industries Aggregate Planning

The selection of merchandise is a critical part of retail management. Assortment planning aims to ensure that an appropriate mix and quantity of retail inventory is stocked to meet customer demand. It involves gathering and evaluating historical data related to customer demand for various categories of goods to reduce inventory out-of-stock and overstock problems. The collaborative efforts of retailers and vendors assist in synchronizing the market orientation process in assortment planning for the garment or apparel industry.

Strategic Business Objectives

Strategic business objectives (SBO) play a key role in assortment planning. SBOs are the specific, measurable goals and objectives set by a business. This is developed at various levels within an organization and is generally tied to a clearly discernible target market. Market research related to an apparel retailer's target market will impact the inventory selection process. Keep in mind that SBOs and product assortment planning also will be shaped by budgets.

Product Category

Merchandising categories for the garment industry include basics, fashion basics and fashion. The procedures generally used for assortment planning differ between each category. For example, the "basics" category in ladies apparel might represent products with extended life cycle, such as a traditional black skirt. "Fashion basics" represents standard seasonal variations in color and fabric. The "fashion" category includes the newest designs and trends. The fashion basics and fashion categories typically have shorter demand windows.

Style Placeholders

The early process for assortment planning generally involves creating style placeholders, which are established within each product category to allow forecasting prior to the completion of final product specification. This defines the further assortment attributes that might be included, such as style, price points, sizes, colors, units and SKU counts.

Forecasting

Financial and sales reports provide a garment retailer with historical performance data segmented by product category that can be analyzed to identify historical, current and future trends. Analyze data variances, for example, based on historical sell-through data by category, to uncover order patterns and the fill rates for product categories. Retailers may also track gross margin, inventory turns and end-of-season excess inventory to assist in planning for effective inventory assortment.

Aggregate planning involves projecting market demand and evaluating production capacity to ensure that a firm is sufficiently equipped to meet demands for a given period. Production rates for a range of products or services are generally examined in the aggregate planning process, which also seeks to influence demand for overall outputs. Workforce size and financial resources are both key variables in this inventory management process.

Informal Tools

The aggregate planning process, which compares market demand projections against existing and potential inventory capacity, uses basic tables, charts and other graphics aligned to data processing systems. These tools are used in aggregate planning to compare an assortment of alternative ways of achieving a company's supply management goals. When using these types of informal methodologies alone, one disadvantage identified is that they might not provide the most optimum aggregate plan, according to Lin Pan and Brian H. Kleiner in their essay "Aggregate Planning Today."

Mathematical Techniques

Mathematical techniques are used in the aggregate planning process. For example, production rates and human resource requirements might be evaluated as linear program problems. This involves choosing and expressing values for known and unknown variables, quantities to be minimized or maximized and constraints. One of the disadvantages with using mathematical techniques, such as the linear programming method, in aggregate planning is the assumption of determinism generally factored into its application.

Heuristic Methods

Heuristic methods can accelerate the aggregate planning process based on the experience and knowledge of the planning team. Examples of heuristic techniques include making judgments based on past experience or using known industry best practices. It is used in aggregate planning because the process is driven by the organization's decision-makers who draw upon their knowledge and experience. For example, the framework used for planning production might involve heuristic techniques to, in part, establish production ratios based on production management's experience with specific inventory areas at varying production levels.

Budget Considerations

A firm's budget significantly shapes estimates for production capacity. Generally, budgets are developed using factors that are also used in the aggregate planning process — for example, existing inventory levels and valuations, historical purchasing patterns and human resource production capabilities. Additionally, aggregate plans must operate within the constraints imposed by the revenue allocations earmarked for production of various products or services. In this sense, aggregate planning and preparing budgets are closely related business functions.

Materials requirements Planning (MRP I)

In manufacturing, developing a plan for your resources is vital to your operation. Without resource planning, your operation will have a much more challenging time managing various areas within your supply chain such as inventory, production, and output. This is why utilizing a **materials requirement planning (MRP)** system can efficiently manage materials within production, making it much easier for project managers to order and organize materials waiting to be assembled.

Through materials requirement planning (MRP), the need for manual materials planning is eliminated and the system is able to successfully carry out an efficient strategy. MRP has become a vital component in allowing manufacturers to keep up with a consistently growing demand.

Material Requirement Planning (MRP) Functions

Utilizing a systemic approach, the system is able to efficiently keep production up to schedule through data analysis and simple integration. Although the system cannot run a production facility all on its own, it still is able to maintain a steady flow of materials throughout the supply chain through decision-making capabilities. Various functions of an MRP system include the following:

- **Inventory Management:** Arguably the main objective of an MRP system, the feature is to ensure that materials are available at a moment's notice. This eliminates the need for manual-entered data and is able to carry out material orders with ease. It also is able to alert the facility when products are ready to be delivered.
- **Cost Reduction:** In correlation with inventory management, cost is reduced significantly. Through ensuring a steady flow of inventory, holding and untimely-delivery cost are reduced, ultimately bringing more revenue into the operation.
- **Production Optimization:** Although the main goal of MRP is to oversee and manage materials, it benefits the rest of the system as well. As materials are flowing throughout the supply chain, equipment and employees are able to work at a much faster and efficient rate as well.

Implementing an MRP system can be extremely beneficial to your production facility, but as mentioned previously, the system is not enough by itself. As manufacturers are looking for ways to enhance production, many are coming to the same solution – advanced planning and scheduling software (APS).

Advanced Planning and Scheduling (APS) with Materials Requirements Planning (MRP)

Advanced planning and scheduling software (APS) can be integrated with an MRP system with ease. Through diverse features, APS software offers as an extension of your MRP system and

can efficiently optimize production within your facility. Various features of APS include the following:

- Resource Scheduling
- Schedule Optimization
- Capacity Planning
- Order Management

Manufacturing resource planning (MRP II)

Manufacturing resource planning (MRP II) is a comprehensive type of planning for manufacturing companies. It is a sort of extension to the original material requirements planning (MRP) concept. It emerged in the 1980s to help companies deal with dynamic processes. Both of these, MRP and MRP II, are related to the enterprise resource planning (ERP) system, which is a top-level business information system that helps companies to plan better and work more efficiently.

Manufacturing resource planning may include various software tools as well as support processes. It is an overarching concept for business management. The tools may include master production schedules, advanced invoicing, production resources, inventory tools and more. The support processes may include contract management, shop floor data collection, sales analysis and more.

Through the use of diverse new technologies, companies can adjust how they work to improve productivity and efficiency. Inventory control systems are a good example — by aggregating big data and analyzing them for business intelligence, companies can reduce warehouse inventory levels, to save on maintenance cost. This is just one way that MRP works for businesses; another way involves improving supply chains as well as other parts of the production cycle.

Master Production Schedule

A Master Production Schedule is a Schedule of the completions of the end items and these completions are very much planned in nature. Master production schedule acts as a very distinct and important linkage between the planning processes. With the help of this schedule, one can know the requirements for the individual end items by date and quantity. In companies, MPS are generally produced in order to know the number of each product that is to be made over some planning horizon. This schedule forms a very unique part of the company's sales program which deals with the planned response to the demands of the market.

A master production schedule is also in management language referred to as the master of all the schedules as this schedule provides the production, planning, purchasing & top management, the most needed information required for planning and control of the whole manufacturing process or the operation.

Master production scheduling plays an important role in the balancing of demand with the supply i.e. satisfying customers according to the limits of the factory and the supplier's base. MPS is used to know the number of the items that are to be produced, the planned inventories of raw materials, finished products and parts etc.

MPS tells the company what is to be made or produced and also refers to the time in which this production of the products is to be completed. It must be kept in mind that MPS does not act as a sales forecast or as a manufacturing schedule or a wish list or a final assembly schedule. MPS can be linked only with the final products and not with the planning involving the production of parts or the components, as these listings require very detailed planning – so these are left to the other plans that will follow this schedule.

In MPS, inputs are used to draw a master production schedule and the inputs used are – orders from customers, production plan from aggregate planning, forecast, resources that are available, inventory levels and the capacity constraints. While drawing a MPS, quantities of individual items must be equal to the aggregate quantities from the production plan and also the total requirements for a product must be allocated overtime in a very good manner.

MPS outputs include – the amounts that are to be produced, due dates, quantity that is available to promise with the projected available balance. MPS is a schedule that expresses the operations plan of production for a specific period of time only and is stated in terms of the end items, which may be either shippable products or the highest level assemblies used to make them.

The main steps in master production schedule can be summarized as –

1. Forming a preliminary MPS.
2. Performing rough – cut capacity planning.
3. Resolving differences.

Objectives of Master Production Schedule (MPS)

1. Keeping the inventories at the desired level by making perfect use of the resources that are available with the company.
2. Setting up due dates for the availability of the end items and also providing the required information regarding resources and also the materials – which act as the supporting pillars of the aggregate planning.
3. Maintaining properly, the desired level of customer service.
4. Setting particular schedules for the production of the parts and the components that are used as the inputs to materials requirements planning, in the end items.

Enterprise Resource Planning (ERP)

Enterprise resource planning (ERP) is a process used by companies to manage and integrate the important parts of their businesses. Many ERP software applications exist to help companies implement resource planning by integrating all of the processes it needs to run a company with a single system. An ERP software system can integrate planning, purchasing inventory, sales, marketing, finance, human resources, and more.

You can think of an enterprise resource planning system as the glue that binds together the different computer systems for a large organization. Without an ERP application, each department would have its own system optimized for that division's particular tasks. With ERP software, each department still has its own system, but all of the systems can be accessed through one application with one interface.

ERP applications also allow the different departments to communicate and share information more easily with the rest of the company. It collects information about the activity and state of different divisions, making this information available to other parts, where it can be used productively.

ERP applications can help a corporation become more self-aware by linking information about production, finance, distribution, and human resources together. Because it connects different technologies used by each individual part of a business, an ERP application can eliminate costly duplicate and incompatible technology. The process often integrates accounts payable, stock-control systems, order-monitoring systems, and customer databases into one system.

ERP offerings have evolved over the years from traditional software models that make use of physical client servers to cloud-based software that offers remote, web-based access.

Special Considerations

An ERP system doesn't always eliminate inefficiencies within the business. The company needs to rethink the way it's organized, or else it will end up with incompatible technology.

ERP systems usually fail to achieve the objectives that influenced their installation because of a company's reluctance to abandon old working processes that are incompatible with the software. Some companies are also reluctant to let go of old software that worked well in the past. The key is to prevent ERP projects from being split into many smaller projects, which can result in cost overruns.

ERP Solutions Providers

Some familiar names are leaders in ERP software. Oracle Corp. (ORCL) originally supplied a relational database that integrated with ERP software developed by SAP (SAP) before entering the broader enterprise market in a big way in the early 2000's. Microsoft (MSFT) has long been an industry leader, with many customers using multiple software applications from the company.

As cloud-based solutions have grown in popularity in recent years, the traditional ERP industry leaders have seen challenges from upstarts such as Bizowie and WorkWise.

- ERP software can integrate all of the processes needed to run a company.
- ERP solutions have evolved over the years, and many are now typically web-based applications that users can access remotely.
- An ERP system can be ineffective if a company doesn't implement it carefully.