M7L6. Demand/Production Planning & Inventory Optimization

Slide #1

In this lecture, we will discuss the application of business optimization to operations planning.

Value Business Analytics

The applications of analytics to business activities
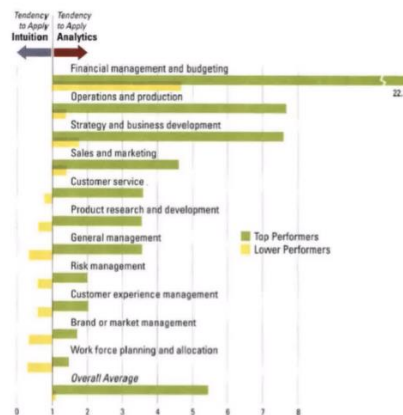
Source of data: Big Data, Analytics and the Path from Insights to Value, MIT Sloan Management Review, 2011

According to the MIT Management Survey of 3,000 professionals about the use of analytics in 30 industries, the top performing organizations tend to use analytics for operations and production activities about 15 times more than lower industry performers.

The chart summarizes top performing organizations tendency to apply analytics to particular activities across the organization compared with lower performers.

A likelihood of 1 indicates an equal likelihood that the organizations use analytical approach or intuitive judgment for decision-making.

For instance, the likelihood numbers of operations and production are 7.5 for top performing organizations and 0.5 for lower performers, respectively.

Since operation and production is the second most-likely area that top performing organizations use analytics, we will discuss the application of business optimization to operations and the production planning.

Industry Best Practice – Demand Driving Production
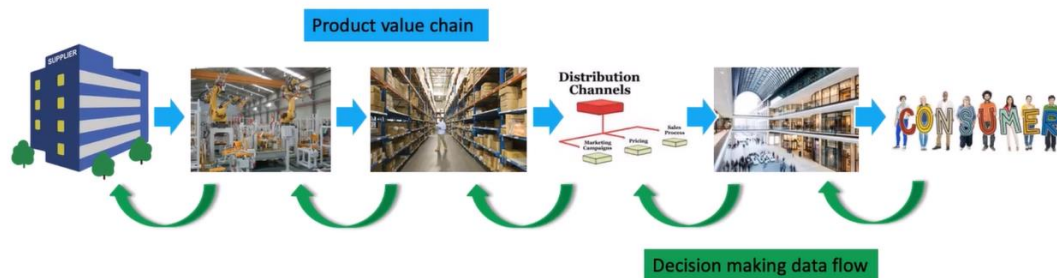
Companies make what they can sell – market pull drives the production

Successful manufacturing companies have several things in common.

They all control costs, minimize inventory, and strive to improve operational efficiency.

But what is that one differentiating characteristic that truly sets the top leaders apart from the rest?

It just might be how successful a company is at becoming data-driven when making operation decisions.

Demand forecasting, production optimization, and inventory management are at the heart of operation and production planning.

Demand driven operation and production planning aims at optimizing the entire production and distribution value chain to maximize a company's profit.

The operation workflow includes the following activities: production, inventory, product distribution, and sales to customers.

At the beginning of this course, you learned that Apple computer's success is based on its business principle of making what they can sell to customers or making what customers want to buy.

So, the data-driven process optimizes the business based on the market demand of your products.

Your operations and production decisions are driven by the market demand.

The decision-making data flows from your marketing team's accurate forecasts of sales through inventory management teams and to production groups.

Strategic Objectives Of Aggregate Planning
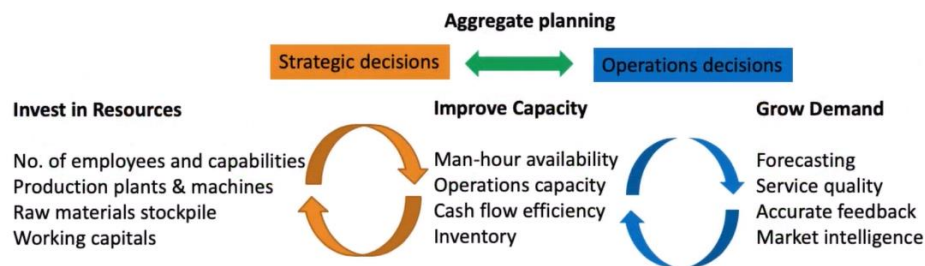
Aggregate planning is a technique for adjusting production to the ups and downs of demand.

An aggregate plan gets its name from the fact that it must include demand, forecasts, resources, and capacity.

You also need to express those elements as an aggregate or combined strategy.

This type of planning covers a period of 2 to 12 months, depending on your company's ability to forecast the demand.

Setting objectives through aggregate planning may help your business run more efficiently.

Let us discuss the three major aggregate planning objectives with a back-forward order of a product value chain.

The planning process begins with projecting market demand on your products.

You need to forecast how many units will be in demand for a short-term.

As we discussed in the forecasting module, the demand projection involves regression calculation for annual trend and moving average analysis for seasonal index based on a previous demand during a comparable time period.

Also, you can factor in economic environment, your company's strategic goals, as well as marketing activities to adjust your demand estimate.

The demand forecasting objective is crucial to aggregate planning.

Then adjust the production capacity to meet demand.

You optimize production and inventory to meet the demand.

If your demand figures are not in line with your capacity, decide how to increase capacity for the short-term.

You may need more resources such as temporary employees and small equipment.

You also optimize inventory to smooth operations.

Examine the areas in which you can make improvements and add near-term capacity to meet projected demand.

The ultimate objective of aggregate planning is matching capacity to demand.

The third element is to determine investment in resources.

The strategic objective of aggregate planning is to determine your capital resources and investment.

Capital resources include the total number of full-time workers and production plant capacity.

You may also invest in the stockpile of critical raw materials.

As we discussed in the previous business optimization case, you also need to decide financial activities in an analytical manner to minimize financing expense.
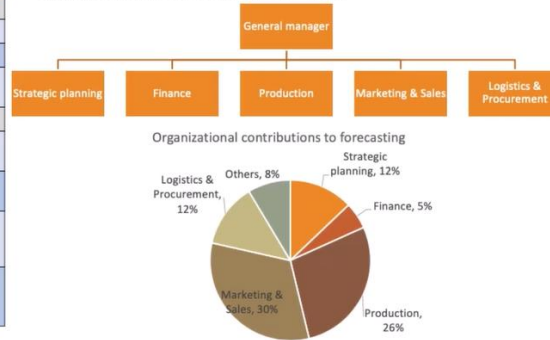
Demand Forecasting

Method	Accuracy	Cost of forecasting	Time required	Data required
Qualitative methods				
Market survey	Good	$$	months	limited
Panel consensus	Fair	$	weeks	minimum
Historical analogy	Fair to good	$	days	Several year's of historical trend
Quantitative methods				
Moving average	Fair to very good	$	days	At least 2 years
Regression model	Good to very good	$	weeks	Several years of data
Time series with seasonable analysis	Very good	$	weeks	Multiple years of data
Economic model	Excellent for long-term	$$	months	Several years of data

An integrated forecasting model involves the collaboration of multiple functions of the organization

General manager

Strategic planning | Finance | Production | Marketing & Sales | Logistics & Procurement

Organizational contributions to forecasting

Strategic planning, 12%
Finance, 5%
Production, 26%
Marketing & Sales, 30%
Logistics & Procurement, 12%
Others, 8%

Demand forecast is the foundation of aggregate planning.

The assumption of your analytical business decision is that your demand forecast is accurate.

You have learned quantitative forecasting tools in the previous module.

This table summarizes some qualitative and quantitative forecasting methods.

Qualitative methods rely on managerial judgment and experience.

Different individuals can obtain different results from the same information.

Qualitative methods are used only when data are unreliable, or in limited quantity, or when time is limited.

One popular qualitative forecasting method is high-level market study, which uses statistically designed surveys of current customers and potential customers to gather information on market conditions of future products.

You can also ask several industry experts to collectively predict the short-term market demand.

Another method is life cycle analogy, which forecasts based on the position of the product in its life cycle and the performance of similar products in the past.

Each phase of product life, from introduction through growth, maturation, and decline, has a different demand outlook and market and manufacturing characteristics.

The qualitative methods are inexpensive, but their accuracy is poor.

They are appropriate for a short-term, for example, monthly to quarterly forecast only.

Quantitative methods rely on mathematical models and assume that past data and other relevant factors can be combined into reliable predictions of the future.

Two types of methods are in use. Statistics model or economic model.

Each type is suited to different conditions.

Statistics models use historical data to project the future performance to estimate trends and rates, such as time-series moving average analysis, which is the simplest auto projection method.

The regression method is used to project the long-term trend of market demand of a product, while seasonality models can be used to handle the seasonal patterns.

They are good for quarterly or annual forecast.

Economic methods are an extension of regression analysis.

The relationship between the variables must be expressed in economic equations and analyzed simultaneously.

The cost of a sophisticated model is relatively high, and they are good for long-term forecast.

One example of the economic models is the BP Energy Outlook.

An integrated forecasting model involves collaboration of multiple functions of an organization.

According to some studies about the contribution of different functions to an organization's forecasting activities, marketing and sales department is a leading contributor and accounts for 30% of forecasting activities followed by production functions.

Strategic planning and logistics, each contribute 12%.

Finance's share is 5%.

Given the importance of forecasting to business decisions, and the collaboration requirements for accurate forecasting, it might be worthwhile to appoint a senior executive as chairman of the forecasting committee of an organization.

From a business optimization perspective, 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 forecast, production levels, and inventory levels.

This schedule is intended to satisfy the demand forecast and maximize profit.