

LINCS: Leveraging, Integrating, Networking, Coordinating Supplies

## DEMAND PLANNING CERTIFICATION TRACK

for Entry- to Mid-Level Professionals in Supply Chain Management

Developed by the LINCS in Supply Chain Management Consortium, comprised of the following educational institutions:

Broward College (Lead Institution) Columbus State Community College Essex County College Florida State College at Jacksonville Georgia Institute of Technology Harper College Long Beach City College Northwestern University Rutgers, the State University of New Jersey San Jacinto College St. Petersburg College Union County College

In partnership with the Council of Supply Chain Management Professionals.





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## Title Page

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## Preface

The information in this Preface is an overview of LINCS in Supply Chain Management.

Supply Chain Management (SCM) as a paradigm is nothing new to business and industry. However, academia and employers have recently seen SCM become a major focus. There are currently several industry-recognized certifications in SCM, largely focused on individuals with experience in management through the executive level. The curriculum in the certification tracks listed below is directed at those who have entry- to mid-level experience.

The curriculum for these certification tracks includes eight topics in SCM:

- 1. SCM Principles
- 2. Customer Service Operations
- 3. Transportation Operations
- 4. Warehousing Operations
- 5. Supply Management and Procurement
- 6. Inventory Management
- 7. Demand Planning
- 8. Manufacturing and Service Operations

Each certification track can be taken on its own to earn one certification; multiple certifications can be earned in any order. Each certification track covers the basic elements of the primary certification track, which allows the learner to obtain a foundational understanding of the best practices and processes associated with each topic.

**Common Learning Blocks** accompany each certification track, providing an overview of SCM. It is highly recommended that both the standalone Common Learning Blocks document **and** the certification track document be thoroughly reviewed **prior** to taking a national certification examination.

The content provided within this certification track relates specifically to **Demand Planning**. The national certification examination will include questions on both the **Demand Planning** content and the **Common Learning Blocks** content.\*

\*NOTE: Materials listed under *Optional Supplemental Resources* sections (in some certification track documents only) are not included on the national certification examination.



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## Abstract

The effective anticipation, planning, and management of customer demand are key factors in the success of any organization. Companies strive to provide improved customer service levels at reduced costs, with planning and managing demand being two key components. This certification track is intended to train students in the basics of demand planning so they can quickly familiarize themselves with and become effective contributors to the demand planning processes that are part of SCM.

Key elements of this certification track include aspects of demand planning, interaction between demand and order management, demand planning principles, demand planning tools and techniques, communication and management of demand, and contemporary approaches to demand planning.

The goal of this certification track is to prepare students to successfully pass the demand planning national certification examination. The content of the certification track was developed by LINCS in Supply Chain Management Consortium. SCPro™ Fundamentals Certification examinations are owned and administered by the Council of Supply Chain Management Professionals (CSCMP).





## Learning Block 1: Introduction to Demand Planning

## Learning Block 1 Description

Customers purchase desirable and affordable goods and services to meet their needs and wants. This purchasing power creates demand for particular products and services; demand planning is a critical process that companies use to incorporate various inputs to predict or approximate future customer demand. Without an understanding of customer demand, companies cannot plan accurately for staffing, inventory, finished products, and other support services.

The effective estimation and management of customer demand is a key factor in the success of any organization. Simply put, meeting customer demand can be the difference between company success and failure. Customers have the ability to buy goods and services quickly from companies that can accurately predict demand and utilize logistical channels for single-item fulfillment and same-day shipping.

Several core topics are discussed in this learning block, including the various factors that affect demand, the overall demand planning and management process, the roles and responsibilities in demand planning, and the key metrics of demand planning.

## Learning Block 1 Learning Objectives

Upon completing this learning block, the learner will be able to:

- Define demand planning and why it is important to company success
- Understand the factors that affect demand
- Explain the primary approaches to planning demand
- Apply the key roles and skills required in demand planning
- Analyze the metrics used in demand planning processes

## Unit 1: Supply and Demand Planning

#### **Demand Planning**

Demand planning is a process that incorporates demand forecast inputs from sales, marketing, and customers. It also incorporates supply capacity inputs from manufacturing, inventory management, and suppliers to estimate anticipated demand accurately. **Demand estimates** include anticipated orders, orders received, and adjustments resulting from changes in inventory policies and actions. Demand estimates are used, for example, as a primary data input for manufacturing schedules, procurement



plans, and inventory stocking levels. In fact, demand planning is often a company's most important business process.

#### Demand Planning and Matching Supply and Demand

Perhaps the most important data elements that flow across a supply chain are estimates of product and service demand. Companies that know how to recognize these estimates employ **best practices** and consistently achieve their business goals. Fundamentally, current and anticipated future demand must be compared to current and future capacity to achieve accurate plans that will meet actual customer demand. Companies with best practices know how to seamlessly link their **demand forecasting** capabilities with their **supply planning** capabilities by closely coordinating their efforts and communicating effectively between all demand planning and supply planning functions (see *Figure 1*).



Figure 1. Supply and demand balance. Developed by LINCS in Supply Chain Management Consortium.

Demand Planning	Supply Planning
Demand planning involves estimating	Supply capacity planning, on the other hand, involves
future demand, aligning the entire	ensuring that materials, components, consumables,
organization to satisfy the expected	manufacturing capabilities and capacity, and other
demand, and optimizing all supply chain	resources and services are available to support the
activities to support demand. Planning and	demand plan. Supply planning may take place in one
managing demand is aimed at correcting	department or in many. For example, some firms
inventory level sizes, increasing profits,	conduct supply planning in the manufacturing
and maximizing revenue. According to	department, others supply plan in procurement, and
DePew (2009), demand planning is not a	still others have a separate, formal planning
substitute for sales and marketing, but	department. Unfortunately, in many companies
rather works together with sales and	careful coordination does not always occur between
marketing to understand sales projections	the supply and demand planning functions. In many
and marketing efforts to the greatest	cases, those responsible for demand planning and
degree possible. These efforts are aimed at	those responsible for supply capacity planning work
boosting sales and translating them into	in different functional areas and do not always
demand plans that organizations use as	communicate or coordinate their efforts well. This
foundations for manufacturing and material	shortcoming can be a root cause of inaccurate plans
supply plans.	that can lead to business failure.



## **Unit 2: Factors Affecting Demand**

Several factors affect demand, including market size, complementary products and services, substitute products and services, customer preferences, future expectations, income levels, market forces, and risk events. Although these factors are presented separately in this unit, more than one could occur at any given time, and they are often interrelated.

#### Size of Market



The quantity of potential buyers in a given market for defined products or services will influence demand. If the market size decreases, there may be a lower quantity of potential buyers available to purchase products or services. If the market size increases, however, a higher quantity of potential buyers may be available. For example, a car manufacturer that offers a fuel-efficient car engine might create an increase in its market size, resulting in a higher quantity of potential buyers. On the other hand, firms that manufacture cars with less fuel-efficient engines might find the opposite to be true, resulting in fewer potential buyers and a smaller market size.

#### **Complementary Products and Services**



Complementary products or services are typically associated with, or are natural components of, a company's other products or services. Depending on the demand for complementary products or services, they can impact companies' overall demand because demand and its associated costs may increase or decrease. For a company that makes and sells ice cream, a complementary business would make and sell ice cream cones. If the price of cones increases, that could potentially cause the demand for ice cream to decrease.

#### Substitute Products and Services



Substitute products and services may exist to replace what other companies offer because these substitutes provide competition for companies' usual products and services. For example, consider a company that sells cocoa, for which a substitute might be flavored coffee. If the ingredient prices for cocoa increase, which may affect the selling price, and individuals could switch to flavored coffee. As a result, demand for cocoa would decrease.

#### **Customer Preferences**

Customers' personal preferences for products can change from time to time and be influenced by advertisements, promotions, and customer perceptions of the value of products or services. As customers' wants and needs for products or services change, demand can be affected; as more customers want particular products or services, demand increases, but if fewer customers want particular products or services, demand decreases. For example, if a national chain of grocery stores ran a promotion for a particular brand of a beverage, and the beverage was discounted for a period of time, this could both increase demand for the promoted brand and negatively impact demand for other brands.



#### **Customers' Future Expectations**



If consumers anticipate that the cost of a product or service will increase in the near future, or if they expect it to become scarce for a period of time, they might buy more than usual before the expected price increase or scarcity occurs. These advance purchases might well cause demand and prices to increase. For example, if consumers read about environmental conditions that could lead to lower coffee bean yields in this season's harvest, they might stock up on coffee while they think it will be less expensive, which might increase prices and decrease supply.

#### Income



Consumer incomes, especially income increases and decreases over time, impact demand for products and services. As incomes increase, consumers may have more disposable income, and their demand for certain products and services may increase. If consumer incomes are not increasing, then demand may decrease. For example, if a **downturn** in the economy significantly affected individual incomes and overall consumer buying power, this could reduce demand for products and services.

#### Shifting Commodity Markets



Commodity markets like rubber, corn, gold, copper, and oil are a genuine source of concern for many organizations because they share the primary characteristic that no single industrial buyer controls or even affects prices in these markets. However, cartels of producers can attempt to manipulate world markets. Many commodities operate in markets that economists call pure competition, meaning that prices are entirely dictated by the market forces of supply and demand. For example, an increase in copper demand in China can result in higher prices for copper worldwide and for products that contain copper because of the resulting pressure on the copper supply.

#### **Risk Events**

Global supply chains are vulnerable to many forms of risk, including natural disasters, terrorism, and currency fluctuations. These disasters can completely disrupt a supply chain and force a business to close its doors. Risks can negatively impact supply and demand for certain products, materials, or services by reducing the quantity available for purchase. Reduced availability can lead to increases in costs and reductions in profits. Examples of the broad categories of disruption risks in the supply chain include:

Operational risk such as equipment failure, abrupt supply discontinuities, labor disruptions, and quality issues. For example, a company in the U.S. that has a key supplier in France might experience disruption if strikes impact the French supplier.

**Operational Risk** 



Natural disasters such as earthquakes, hurricanes, and tornadoes. For example, a U.S. company located on the East Coast could be impacted by key suppliers in the Midwest that were affected by flooding of major waterways.

Terrorism and political instability are also sources of risk that can cause supply chains to become vulnerable. Recent world events have served to illustrate the significant impact that these events can have on supply chains. Examples include commercial ship hijacking and the threat of bombs hidden within cargo.

Commercial or market risk includes shifting demand and supply patterns and unexpected price increases. Many supply managers are reluctant to do business in certain parts of the world, including parts of Latin America and Africa, because of the instability of local and regional economies.

#### **Natural Disasters**

#### Terrorism and Political Instability

Commercial or Market Risk

## **Unit 3: The Demand Planning Process**

The demand planning process involves the integration of a demand forecast with the capabilities of the supply chain; it includes analyzing the demand forecast and assessing the manufacturing, procurement, and logistics capabilities and capacity. The demand planning process includes the key steps needed to initiate a forecast: demand forecasting, sensing demand, and shaping demand. These forecasts are then integrated with the supply capacity and capability plan into a draft plan; each task is performed as part of the demand planning process through collaborating across the entire organization. Finally, based on product and service demand increases and decreases, management must implement the necessary actions to meet any unplanned changes.

#### **Forecasting Demand**

The demand planning process is typically initiated by marketing and sales to develop a strategic, company-wide forecast with more detailed steps and processes to arrive at an estimate of anticipated demand. Demand forecasts include anticipated orders, orders received, adjustments resulting from changes in inventory policies and actions, and could involve interacting with customers to obtain their feedback. In reality, the process of **forecasting** demand results in a best guess or prediction of future customer demand, including events that sense and shape that demand.



Figure 2. Forecasting demand. Developed by LINCS in Supply Chain Management Consortium.



#### **Demand Plan Creation**

Most companies employ a central department or group of individuals that are held accountable for collecting inputs and creating the demand plan. However, the creation of an effective, accurate plan requires collaboration across an organization. Communication channels are critical, and once the forecast is integrated with supply capability and capacity data, senior management, financial management, and other key individuals must coordinate and fine-tune the demand plan based on experience, knowledge, and product and market insight that are in line with company-wide goals and objectives. Demand planning is a process of planning anticipated demand for products and services, typically over a future time period of 12-18 months, depending on the company size and the product involved.

Demand planners typically develop the demand plan with input from the forecast initiated by the sales and marketing teams, and must share the plan with other key groups in the company. This data is quantitative in nature, meaning that it is based on actual numbers or statistics about what has happened in the past. In dissecting the data, sales and marketing specialists might look for trends or patterns that explain sales increases or decreases for specific points in time while also considering other factors like sales promotions. A company that makes holiday decorations should expect to see large increases in sales around major holidays, which should be considered carefully when preparing a quantitative forecast.



Figure 3. Demand plan creation. Developed by LINCS in Supply Chain Management Consortium.

Once the demand data are integrated with the supply-side capacity and capability elements of manufacturing, procurement, labor availability, and suppliers, the draft or initial plan is created.

At this point in the process, qualitative inputs are required in order to integrate inputs from knowledgeable senior managers and other subject matter experts to gauge the future. During the process of collaborating on the draft plan, participants have an opportunity to express their opinions and share their knowledge, with the goal of developing the most accurate and reliable demand plan possible.

#### Managing Demand

In the dynamic environment typically found at today's companies, demand management is vital; it involves adjusting the internal operations and plans to match actual customer demand. It also entails managing and prioritizing supply elements in response to changes in the volume, timing, and mix of demand. Demand management requires individuals who are close to customers and have the skills to communicate changes to demand planners and other functional stakeholders.

If demand changes show an abnormal increase in demand, then senior management must decide if risk would be involved in meeting the new, unplanned demand. If management chooses to meet this new demand, then a strategy must be developed to determine the most effective ways to meet that objective from the perspectives of customer service, costs, profits, and impact on personnel.



Conversely, if normal demand is declining, then senior management must choose the best way to stimulate demand or the best approach to adjusting supply operations in response to projected decreases, or a combination of both. According to Crum and Palmatier (2003), methods of increasing demand could include sales promotions aimed at attracting customers, while adjusting operations might involve working fewer hours or producing fewer products.



Figure 4. Simplified representation of input from various groups on demand planning. Developed by LINCS in Supply Chain Management Consortium.

# Unit 4: Demand Planner Skills and Typical Reporting Structures

Demand planners are held accountable for the development of demand plans, so they require analytical and other specialized skills. They must also understand the business for which they develop demand plans and be able to work with a broad range of individuals both inside and outside their own organizations, including sales and marketing personnel, managers, and other colleagues, along with suppliers and customers. Demand planners must have the skills to reach agreement and understand compromise.

Demand planners also need specific skills in demand planning and monitoring. If their companies conduct business internationally, they must understand the kinds of events that influence global demand. These skills can be acquired in a number of different ways, including attending training programs, working with other functional groups, and obtaining experience over time. Each of these important skills is outlined in the sections that follow.

#### **Business Knowledge**

Demand planners need business acumen and knowledge about their specific industry. They must understand how marketing activities like promotions or price increases will affect demand and what new products are being planned; they must also know when these products are being introduced along with which products are being phased out and at what rate that will occur. Every demand planning situation requires attention in forecasting and in monitoring demand versus the plan. To gain this knowledge, demand planners must work closely with their colleagues in sales and marketing, business development, engineering, and procurement. Good analytical skills are highly desirable, and attention to detail is critical.

Demand planners must also understand customers: their buying patterns, the product combinations they choose, the period of time over which they buy products, any shifts or changes in buying patterns that could affect demand, and those customers who need particular attention when forecasting demand. For international businesses, demand planners must be well versed in regional events that



could affect demand patterns, such as bank and other public and religious holidays. They must also understand and track other international events that might affect demand, from political unrest or instability to extreme weather conditions and labor disruptions.

Demand planners must also understand the types of raw materials and other inputs that are needed to create specific products. With their procurement colleagues, planners track commodity **lead times** and price changes that might affect the cost of producing and selling goods and track how that might impact demand. For example, if the price of rubber increases significantly, that could affect the cost of producing tires and possibly weaken customer demand.

Demand planners rely on a wide range of data that are typically found in enterprise resource planning (ERP) systems. The data include details about manufacturing and sourcing products. To be effective in managing demand priorities, planners must know which goods have the longest lead times to produce and which products will be most difficult to restock if forecasts are too low, perhaps because they require raw materials that take a longer time to obtain, are produced on lengthy **production runs**, or involve lengthy transitions or setups.



Figure 5. Business knowledge. Developed by LINCS in Supply Chain Management Consortium.

#### **Observational Knowledge**



Figure 6. Influence and feedback affecting demand planning. Developed by LINCS in Supply Chain Management Consortium.

On at least a monthly basis, demand planners must compare actual demand to the demand plan and make and communicate any necessary adjustments. They also monitor demand changes to alert key customers and colleagues when demand increases or decreases, and to recognize when a change of plan is needed.

Demand planners must be able to communicate effectively with colleagues in other groups that are affected by demand such as marketing, sales, manufacturing, and procurement groups. Demand planners need good interpersonal skills to be able to influence and persuade their colleagues when it is necessary. For example, if sales are falling significantly below forecasts and the sales function communicates that sales will meet the target although they are not actually certain—demand planners must provide data to show the level of error between projected and actual sales.

#### Experience in Recognizing Change

The previous description makes clear that one essential skill for a demand planner is the ability to recognize when global changes affect demand. What occurs at the macro level, or internationally, affects supply conditions at the micro level, or individual companies and local markets. Events that



impact supply and demand include the effects of fluctuating exchange rates, surges in demand in emerging countries, new trade agreements or restrictions, geopolitical conflicts and terrorist activities, nationalization of companies or entire sectors, and government finances, and global demands for commodities and services.

Demand planners must use this experience and knowledge to be proactive in developing and adjusting demand plans. For example, Singh (2009) notes that, in severe downturns, businesses are sometimes slow to react by reducing their forecasts, which can result in holding excess inventory and increase costs.

#### Organizational Structures

Organizational structures define the reporting hierarchy that make clear to whom individuals report within a company. In an ideal situation, demand planning management would involve a single executive responsible for demand and supply planning activities rather than having responsibility distributed across several managers.

#### For example...

A company's vice president of SCM might be responsible for worldwide supply planning and replenishment, demand and finished goods forecasting, inventory planning, primary customer order fulfillment and logistics, and integration of supply chain activities with operational positions. However, in many cases, demand planners report to marketing or sales managers, while in other companies, demand planners report to forecasting and inventory control managers.

According to Crum and Palmatier (2003), successfully communicating demand information requires individuals to be tasked with the primary responsibility for managing and communicating demand information. Demand planners and managers are responsible for gathering information about demand timing, demand volume, and changes or anticipated changes to demand, and then communicating this information to other key groups within the company. In a similar fashion, demand planners or managers are responsible not only for obtaining information from the various groups within the company to ensure that the demand plan is accurate but also for updating the demand plan as necessary.



Figure 7. Change. Developed by LINCS in Supply Chain Management Consortium.

Figure 8. Organizational structure. Developed by LINCS in Supply Chain

Management Consortium.



## Learning Block 1 Summary

The most important information that flows across a supply chain includes customer estimates of product and service demand. Demand planning involves all steps and processes needed to arrive at estimates of anticipated demand. Several factors affect demand, including market size, complementary products and services, substitute products and services, customer preferences, income levels, future expectations, market forces, and risk events. The demand planning process involves balancing customer requirements with the capabilities of the supply chain, including forecasting demand and synchronizing it with production, procurement, and distribution capabilities.



Figure 9. Demand planning. Developed by LINCS in Supply Chain Management Consortium.

The demand planning process consists of these key steps: planning demand, sensing demand, communicating demand, shaping demand, and managing demand.

Demand planners require a broad set of skills. Starting from an analytical foundation, they must understand in detail the business for which they develop demand plans, monitor actual demand against planned demand, adjust plans accordingly, and recognize and act on changes that can impact demand. To understand whether demand planning is effective, companies use key metrics, including demand plan accuracy, customer satisfaction, and inventory performance measures.

## Learning Block 1 Practice Questions

#### 1. Demand planning:

- a. Incorporates inputs to predict or approximate future customer demand
- b. Includes the steps and the process to arrive at estimates of profitability
- c. Is very seldom practiced by companies
- d. Only involves demand planners
- 2. The number of potential buyers in a specific market for a given product or service will influence demand. If the market size:
  - a. Increases, this can mean a lower quantity of potential buyers may be available to purchase products or services
  - b. Decreases, this can mean a lower quantity of potential buyers may be available to purchase products and services
  - c. Decreases, this can mean a higher quantity of potential buyers may be available to purchase products or services
  - d. Decreases, this can mean that no potential buyers are available to purchase a company's products or services



#### 3. Complementary products or services are those products and services that:

- a. Are substitute products and services that may exist for what a company offers
- b. Are given to customers to complement other products that they purchase
- c. Are typically associated with, or are natural components of, a companies' products or services
- d. Cannot have an impact on demand

#### 4. Consumer income and its increases or decreases over time:

- a. Do not impact demand for products and services
- b. Have no impact on a company
- c. Can impact demand for products and services
- d. Do not matter to the demand planner

#### 5. A good demand planning process enables a company to link:

- a. Reactions to changes in demand with warehouses
- b. Unanticipated demand with customers
- c. Anticipated demand with financial charts
- d. Demand forecasting capabilities with supply planning capabilities

#### 6. Examples of risk events that have the potential to impact the demand plan are:

- a. Changes in management and leadership
- b. Introduction of a new purchase requisition and purchase order process
- c. Natural disasters, terrorism, and currency fluctuations
- d. Internal organizational consolidation and changes

#### 7. Demand management involves:

- a. Selling products to customers
- b. Placing orders for products
- c. Adjusting internal operations and plans to match actual customer demand
- d. Providing discounts to customers

#### 8. A demand planner must have thorough knowledge of:

- a. Detailed warehousing operations
- b. Purchasing tools and techniques
- c. Specialized political agendas
- d. Customers and their buying patterns

## 9. Demand planners are held accountable to develop demand plans but do not require which type of skills?

- a. Analytical
- b. Collaborative
- c. Business acumen
- d. Advanced calculus



#### 10. Which factor below affects demand?

- a. Frequency of financial disclosures
- b. Manufacturing's proximity to consumers
- c. Variety of transportation options
- d. Market size





## Learning Block 2: Interaction between Demand Management and Order Management

## Learning Block 2 Description

The demand planning process is designed to create a plan that ultimately reduces uncertainty about when customer orders will occur in a defined period of time. The customer order management function is primarily concerned with managing customer orders and involves managing the customer order cycle from the time an order is placed until that order is received. Demand management and customer order management must work well together to ensure the effectiveness of both processes.

This learning block provides an overview of the order management function and process, the customer order and replenishment cycle, order enabling technologies, and the relationship between order management and demand management.

#### Learning Block 2 Learning Objectives

Upon completing this learning block, the learner will be able to:

- Recognize the key aspects of the order management function
- Explain the key steps in the customer order and replenishment cycle
- Compare the key links between demand management and order management
- Implement the key technologies that enable ecommerce
- Evaluate the role of ecommerce technologies in enabling effective demand management

#### Unit 1: Overview of Order Management

The customer order management function involves the handling of customer orders and managing the customer order cycle. The order management process begins with customer requests, which can range from broad questions to specific requests about particular products or services. For example, customers may call, write, email, make an Internet inquiry, or ask in-person questions about subjects such as:

- Product specifications
- Merice
- Mathematical Availability
- Potential discounts



These queries could be followed by requests for follow-up information that result in actual customer orders. In many organizations, customers' orders are manually entered into order entry systems, which are computerized systems that are a part of an order management system (OMS) that can be found in a number of industries. Many organizations' encourage their customers to place orders directly through the Internet, after which they are automatically entered into an OMS.

#### Customer Order Fulfillment

Customer order fulfillment includes the steps that ensure that customers receive the correct products, in the correct quantity, at the correct time, and at the appropriate level of quality (see *Figure 10*). This fulfillment process includes entering orders, filling orders, invoicing customers, shipping orders, tracking orders, handling returns, and providing after-sale services, each of which has its own sets of steps and outputs.



Figure 10. Customer order fulfillment/processing flows. Developed by LINCS in Supply Chain Management Consortium.

#### The Objective of Order Fulfillment

The ultimate objective of order fulfillment is completing customer orders by the promised delivery dates at the right quantities and conditions, all while managing total costs. There is no standard model of customer order fulfillment. It is the part of the supply chain in which planning and execution meet directly, so performing well in the demand and supply planning processes enables more effective customer order fulfillment.

As with supplier selection and new product development, customer order fulfillment, if performed quickly and responsively, can aid a company's competitiveness. For example, a maker of a variety of beverage and ice dispensers might forecast and build a base product to anticipate customer orders. Final product configuration occurs only after actual orders are received; this process might take only three days, compared to four to six weeks for a competing product. Therefore, product lead time—the period of time needed to fulfill an order—is a critical factor when performing demand planning.



## Unit 2: The Customer Order and Replenishment Cycle

The customer order and replenishment cycle occurs when customers interact with suppliers such as wholesalers, retailers, or material suppliers and includes the work directly involved in receiving and fulfilling customers' orders and in replenishing inventories. Normally, customers begin this cycle by placing orders, and the goal of the cycle is to fulfill those customers' demands in the shortest possible timeframe. The key steps involved in the customer order and replenishment cycle are described in the following sections.

#### **Customer Request or Arrival**

The order management cycle begins when a customer requests information from potential suppliers. These inquiries might be about pricing, product specifications, availability, or delivery or lead times. To make their queries, customers could enter a retail clothing store, call the clothing company to ask about an item, or use the Internet to order clothes online.

In a business-to-customer (B2C) supply chain, the key starting point is the customer's arrival. Here, customer service will focus on providing customers with a potential selection of appropriate products in the hope of creating a customer order, or sale. Using the clothing store example, this request and arrival step may involve working one-on-one with a customer by looking at a range of clothing options and providing product-related advice.

In the business-to-business (B2B) supply chain, however, the order process may begin in various ways:

- Sales representatives may call or visit customers to discuss their needs.
- Customers may access suppliers' websites or catalogs to learn about their products. For key customers, suppliers may tailor their websites and create portals with information customized for those customers to optimize their ordering experiences.
- Customers may visit showrooms or distribution centers to place orders.

Whether companies are involved in B2C or B2B supply chains, the main objective of the customer request and arrival process is to ensure that customers are treated with courtesy and helped in an efficient manner. In the long run, this courtesy and professionalism ensures good customer experiences and may lead to more orders and greater satisfaction among customers.



Figure 11. Retail store. Developed by LINCS in Supply Chain Management Consortium.



#### **Customer Order Entry**

During the customer order entry process, customers inform retailers and suppliers about the products that they wish to purchase. At a clothing store, customers place the items that they wish to purchase into shopping carts and take them to the check-out counter to complete their purchases. Order entries can also include customers' informing suppliers of the products and quantities they want to purchase online; orders are then transmitted to suppliers through the Internet. The main objective of the order entry process for customers, according to Chopra and Meindl (2003), is to ensure that order entries are accurate, carried out in a timely fashion, and communicated throughout the supply chain.



Figure 12. Shopping cart. Developed by LINCS in Supply Chain Management Consortium.

#### **Customer Order Fulfillment**

Customer order fulfillment includes the steps to ensure that customers receive the correct products, in the correct quantity, at the correct time, and at the appropriate level of quality. This process entails entering orders, filling orders, invoicing customers, shipping orders, tracking orders, handling returns, and providing after-sale service, with each process having its own sub-processes and outputs. According to Chopra and Meindl (2003), the main goal of the customer fulfillment process is to ensure that orders are provided to customers on time and at the lowest cost, while also maintaining product quality.

#### **Customer Order Receipt**

Customer order receipt occurs when customers actually receive and accept their orders. During this process, customers check the quantity and quality of delivered products, and any incomplete or damaged orders are recorded by the customer; in a B2B environment, this is typically done using a computerized system to log orders that were received incomplete or damaged, with suppliers then notified electronically or by telephone. If incomplete or damaged orders are received, customers might withhold payment until deficiencies and shortages are corrected. B2B customers may also require a corrective action report from the supplier to indicate the deficiencies that occurred and the corrective actions taken and preventive actions planned to avoid a recurrence of the issue(s). If orders are received in the correct quantities and at the required level of quality, customers record that they have received their orders correctly.



Figure 13. Order check. Developed by LINCS in Supply Chain Management Consortium.

#### **Customer Invoicing**

When customers place orders, they receive invoices. At check-out counters, invoices are often presented as electronic invoices on computer screens. However, when orders are shipped to customers,



paper invoices normally accompany the goods. Invoices state amounts owed and payment terms (e.g., number of days that customers have to pay the invoice, deductions for early payment or penalties for late payment, and the form of payment required). Then, invoices are received by customers, checked against the terms and conditions agreed between customers and suppliers, and paid accordingly.

#### **Inventory Replenishment**

Replenishment is the process of determining when to make or buy more inventory and the volume to make or order and of considering cost and customer service trade-offs. Techniques exist for determining when to make or buy more stock and how many items to make or buy. The techniques that help make these decisions are covered in Learning Block 3.

Ideally, when items are sold to customers, they should be replenished with new items so that the future customers can obtain the items they need, which would ensure a constant availability of product for both new and repeat customers. However, this ideal situation is difficult to implement in practice. For example, it would be extremely expensive and unrealistic to send a truck or parcel shipment to deliver a single replacement television to Best Buy every time one of that model is sold.

Many customers search for products in stores or on websites, but their particular choices might not be available. This is known as an out-of-stock situation or stock-out. While that is undesirable, companies also want to avoid the opposite of a stock-out, because carrying too much inventory is expensive. It is not realistic to achieve the ideal situation of replenishing an item every time one is purchased, but companies must certainly strive to make sure that they do not carry too much inventory.

Inventory replenishment is the part of the larger inventory management process in which companies strive to balance not having excess quantities of product on hand against the risk of a stock-out condition. This is done by determining the need and timing for additional inventory. Fundamentally, the inventory replenishment process is used to decide how much inventory to ship to refill inventory requirements *and* when it should be shipped.

#### **Stocking Policies**

Companies often base their inventory stocking and replenishment policies on their desired service levels.

#### For instance...

If a company wants a 98% service level, they must have enough inventory on hand to ensure that customers receive the product they want in 98 of every 100 visits to a store or website.

Marketing, sales, and inventory personnel should work together to determine the correct service levels for particular companies and products. Most marketing and sales personnel would like to have a 100% service level so that the company never runs out of any product. However, this optimal service level is not always feasible because it generally requires holding too much inventory at high cost.



## Unit 3: Demand Management and Order Management

Demand planning includes the steps and processes needed to arrive at estimates of anticipated demand. Demand management, however, progresses beyond simple demand estimation or planning and includes reactions to demand changes. Companies that excel in demand planning processes attempt to be proactive by influencing demand patterns through actively managing demand, rather than simply reacting to changes.

Demand management attempts to influence customer orders while also trying to reduce the uncertainty of when those orders will occur. Demand management involves understanding demand levels as they occur, adjusting demand plans accordingly, and transmitting this information throughout the organization so that changes can be made in areas manufacturing and supply plans; these are further described in Learning Block 5.

Again, the order management process starts with customer requests, which can be followed by requests for more information or by order placements. When orders are submitted to companies, it is important that they are filled, shipped, and received as quickly as possible, and they must have the correct products in the correct quantities without any damage. Order management is the process of taking, organizing, tracking, and fulfilling customer orders. The next section details how demand management and order management relate to each another.

## The Relationship between Demand Management and Order Management

To be successful in performing demand planning, sales personnel need to work closely with demand planning personnel. During the planning period, the sales organization needs to provide demand planners with details about expected orders from customers: total amount, size, product mix, expected timing of order receipt, customer due dates, and changes to orders should they occur.

If sales personnel recognize a change in the timing for a significant order or notice that an order might be delayed, failure to communicate that development to the demand managers could have a serious negative impact for the company.

#### For example...

If an order arrives late and it was not effectively communicated when the sales organization knew it would be late, the product may have been produced in advance to ensure on-time delivery to the demand plan. In this case, money would have been spent too early on materials and product manufacturing; those expenses could have been delayed and the manufacturing capacity used to produce that order could have been used to produce other orders. According to Crum and Palmatier (2003), the net result of this example is that sales revenue could be delayed.

Demand management's work with order management can promote a balanced flow of goods across supply chains. In another example, Trent (2015, pp. 15-16) describes the aftermarket (i.e., spare parts) division of an automotive company. The distribution centers for this company processes orders every evening for replacement parts ordered through the company's vast dealer network. However, the demand for replacement parts processed during a given week is not consistent. Monday evening's



orders are usually heavy because they include dealer orders from Saturday, Sunday, and Monday, as these facilities do not ship over the weekend. Conversely, orders received at the end of the week are usually lower. These short-term demand fluctuations are addressed by creating different types of orders and pricing structures.

**Daily orders**, which are the main type of order processed by these facilities, are picked, packed, and shipped the day they are received. Dealers use this type of order when they have an immediate need and cannot satisfy that demand from their internal inventory. **Stock orders** are less urgent, priced at a 15% discount, and submitted once a week by dealers to replenish their own inventories.

These orders help the automotive company's distribution centers balance their daily workload from two perspectives. First, dealers are assigned specific weekdays on which to submit their stock orders. Historical demand data also help these facilities determine when best to schedule each dealer's stock order day.

Second, each center has up to two days to ship a stock order from the submission date. On nights with lower daily demand, a facility can pick any outstanding stock orders on their first day. On other nights, the automotive facility might defer a few orders until the second day, if it helps balance the overall workload. Segmenting orders does not completely level out day-to-day demand, but it does help make volume fluctuations more consistent, which supports easier workforce management and logistical concerns like the scheduling of warehouse workers and the assignment of delivery vehicles.

#### **Unit 4: Ecommerce Order Fulfillment Strategies**

Electronic commerce, or ecommerce, is the term for a wide range of tools and techniques used to conduct business electronically (see *Figure 14*). This form of commerce involves selling and buying goods and services by using the Internet to transmit information and transfer funds. Additionally, ecommerce systems help companies improve **order processing**, track inventory, sell products online, and provide many other services. Using ecommerce technology, companies are able to automate the process of moving all the documents involved in a business relationship between suppliers and customers so that the entire process is handled electronically.

With the increased use of the Internet and the ability to transfer information cheaply and instantly throughout the world, ecommerce has become a standard business process for many companies. Using the Internet represents a significant opportunity to speed up receiving, tracking, and



Figure 14. Ecommerce connecting the world. Developed by LINCS in Supply Chain Management Consortium.

fulfilling orders. Various technologies can be used to support the order management process within organizations, including telephone, fax, mail, Internet, electronic data interchange (EDI), barcoding, point of sale (POS) technology, radio frequency identification (RFID), and OMS technologies.

## Telephone, Fax, and Mail

Telephone, fax, and mail are traditional means of taking, confirming, querying, tracking, and fulfilling orders that have long been used by companies. Today, telephones are still used heavily; however, faxing and mailing are being largely superseded by companies' use of the telephone and especially the Internet.



Internet	The Internet is a worldwide system of networks linked by a number of technologies that combine to offer a wealth of resources for businesses. It is often used for placing and tracking orders. Additionally, the Internet is used to facilitate B2B or B2C sales, purchases, and other information transfers, all of which form part of ecommerce.
Electronic Data Interchange (EDI)	<ul> <li>EDI involves the direct exchange of information between computers. In many companies, EDI has been used to replace faxing and mailing paper documents and, in a wide range of industries, to improve efficiencies. As technologies advance, the Internet is rapidly replacing the need for EDI. However, many companies still require their suppliers to use EDIs. Examples of EDI transactions include: <ul> <li>A buying company transmits order specifications (e.g., product numbers, quantities, and desired receipt dates) to a selling company.</li> <li>A selling company transmits order invoice information (e.g., cost and payment terms) to a buying company.</li> </ul> </li> </ul>
Barcoding	Barcodes present information in visual patterns that machines can read. Barcode scanners read a pattern of black and white bars that represent a set of characters. This pattern is then turned into lines of text that computers can understand. Many companies use barcodes in stores, at check-out counters, and throughout their supply chains, from areas like vehicle manufacturing, document tracking, time control, and security access. The use of barcodes promote accuracy by eliminating manual data entry through the use of keystrokes, a process known to have a much higher error rate.
Point of Sale (POS) Technology	POS technology is used to complete sales transactions and enable customers to make payments and obtain sales receipts. Retailers use weigh scales, scanners, and electronic and manual cash registers in conjunction with this technology. For example, grocery stores use scales at the POS to weigh produce and determine prices. Information provided from the POS stage is translated into prices for products, shown on a screen at the register, and printed out on receipts. POS technologies are routinely used to update inventory levels as goods are purchased and to relay this information to other parts of organizations (e.g., warehouses and suppliers) so that inventory can be replenished as it is consumed.





#### How Ecommerce Can Support Demand Management

The ecommerce tools outlined previously are used to support order fulfillment. However, several of these tools are also used to support demand management. Many companies have made becoming more demand-driven a top priority. Demand-driven companies want to sense market changes as they occur and respond to demand quickly by aligning their operations and resources to demand. As a result, companies around the world have invested in ecommerce systems that support and enable demand management.

A key aspect of effective demand management is the timely receipt of and reaction to customers' **demand signals**, which are messages that customers have used up products and require resupply. For example, demand signals might consist of inventory consumption data from a distribution center or of POS transactions from a retail store. According to Keifer (2010), demand planning can be supported by ecommerce technology to ensure the uninterrupted flow of real-time demand signals from **downstream** partners. These signals can come through telephone, fax, the Internet, or POS technology information, as noted previously.



#### For example...

Ecommerce can be used to support demand management in a hospital that uses suppliermanaged inventory to support daily delivery of surgical kits to nurses' work stations. Suppliermanaged inventory is a supply chain model in which the external supplier is responsible for maintaining purchasers' inventory levels. In the hospital example, as surgical kits are used, signals are transmitted to distribution. Once a certain number of kits have been consumed, a reorder trigger signal is initiated to acquire more inventory. Demand planners use this information for demand management functions to adjust internal operations and plans to match demand, such as ensuring that inventory management has allocated sufficient stock for replenishment.

#### Learning Block 2 Summary

The customer order management function is concerned with managing customer orders and includes all steps in ensuring that customers receive the correct products, in the correct quantity, at the correct time, and at the appropriate level of quality. The key steps involved in the customer order and replenishment cycle include customer request or arrival, customer order entry, customer order fulfillment, customer order receipt, customer invoicing, and inventory replenishment.

DEMAND PLANNING

Demand management seeks to influence customer orders while trying to reduce the uncertainty about when those orders will occur. Leading demand planning companies do

Figure 9. Demand planning. Developed by LINCS in Supply Chain Management Consortium.

not simply react to changes in demand patterns; they try to influence these patterns by managing demand. Demand management working together with order management can promote a balanced flow of goods across the supply chain. Ecommerce describes the wide range of tools and techniques used to conduct business without the use of paper; ecommerce systems can be used to support and enable demand management in a number of different ways.

#### Learning Block 2 Practice Questions

- 1. The customer order management function is primarily concerned with:
  - a. Managing internal customers only
  - b. Developing production plans
  - c. Managing the customer order cycle
  - d. Managing suppliers



- 2. Which of the following defines successful customer order fulfillment?
  - a. Orders are filled and sent to suppliers on time, in the correct quantities, with no damage, and within the specified delivery date
  - b. Orders are filled and sent to the distribution center on time, in the correct quantities, with no damage, and within the specified delivery date
  - c. Orders are filled and sent to transportation on time, in the correct quantities, with no damage, and within the specified delivery date
  - d. Orders are filled and sent to customers on time, in the correct quantities, with no damage, and by the specified delivery date

#### 3. Which of the following is the key starting point of the customer order management cycle?

- a. Customer order entry
- b. Customer request or arrival
- c. Customer invoicing
- d. Customer receipt of orders

#### 4. Order entry occurs when a customer performs which of the following?

- a. Receives an invoice for products and services
- b. Receives and accepts orders
- c. Complains about customer service
- d. Informs retailers or suppliers about the products they wish to purchase

#### 5. After a sale, the replacement of an item previously held in inventory is called:

- a. Demand planning
- b. Selling
- c. An order receipt
- d. Replenishment

#### 6. Demand management attempts to:

- a. Influence customer orders while trying to reduce the uncertainty of when those orders will occur
- b. Reduce customer orders while trying to increase the certainty of when those orders will occur
- c. Influence customer orders while trying to increase the uncertainty of when those orders will occur
- d. Influence customer orders while trying to reduce the certainty of when those orders will occur

#### 7. Working in unison, demand management and order management can be:

- a. Detrimental to the company's success
- b. A way to promote a balanced flow of goods across a supply chain
- c. Stressful
- d. A way to promote a limited flow of goods across a supply chain



- 8. Ecommerce is best described by which of the following responses?
  - a. A wide range of techniques used to conduct business without paper
  - b. Only EDI exclusively
  - c. Events that could affect demand patterns
  - d. Commerce that uses electricity
- 9. Which technology features the direct exchange of information between computers?
  - a. Internet
  - b. EDI
  - c. Fax machines
  - d. Telephone
- 10. Which response describes when customer order receipt occurs?
  - a. When customers actually receive and accept their orders
  - b. When the order is placed
  - c. When the invoice is paid
  - d. When the order is shipped





## Learning Block 3: Demand Planning Principles

## Learning Block 3 Description

When companies forecast accurately, they will be more likely to meet the needs of their customers without having to absorb the cost of holding excessive inventory, thus promoting maximum profits through higher sales and cost reductions. This learning block provides an overview and definitions of key terms in forecasting, including types of demand and techniques to improve demand planning.

## Learning Block 3 Learning Objectives

Upon completing this learning block, the learner will be able to:

- Discuss the definitions of forecasting and inventory control
- Recognize the difference between independent and dependent demand
- Explain the key components of a demand plan

#### Unit 1: Forecasting Demand

A forecast involves making a calculation or prediction about a future event or condition, usually as a result of studies and analyses available from pertinent data (Forecast, n.d.). This is precisely what companies do in forecasting demand; they calculate what they think will be needed in advance of the actual need. More accurate forecasts allow for potentially higher company revenue and, hopefully, lower costs. Increases in revenue result from having products in stock when customers request them, and decreases in costs result from not holding excessive inventory to compensate for inaccurate forecasts.

#### **Forecasting Demand**

Demand forecasting refers to companies' estimates of future needs for finished goods in order to meet projected customer demands over a defined period of time. Developing accurate forecasts for finished goods also enables companies to develop support forecasts for raw materials, consumables, packaging supplies, and other required goods and services. Accurate demand forecasting (further detailed in Learning Block 4) helps prevent companies from oversupplying and undersupplying inventory, while avoiding the associated negative impacts on business. Oversupplying inventory results in costs related



to increased inventory holding. Undersupplying inventory, however, can result in lost sales and lost goodwill from the inability to meet customer demand.

Another element of forecasting is defining and updating product lead times. Demand forecasts show how much companies think they will sell of particular products over a specified period of time. Lead time forecasts show the length of the time it takes to obtain and replenish products that are consumed and sold. Lead times often have a wide variation and depend on the availability of raw materials, manufacturing resources, and transportation operations. For example, the amount of time it takes a company to obtain an item might normally be three weeks but, in the face of a disruption in the availability of one key raw material used to manufacture that product, the lead time could increase to, say, five weeks.



Figure 15. Forecasting target areas. Developed by LINCS in Supply Chain Management Consortium.

#### Forecasting, Forecast Error, and Inventory Requirements

Forecasting and inventory control are directly related; more accurate forecasts result in a company's having to hold less inventory to make up for forecast errors. Unfortunately, forecasts are never 100% correct, because it is difficult to predict demand at a 100% accuracy level. Instead, companies try to minimize forecast error to keep costs down. Companies determine the accuracy of their forecasting by measuring how inaccurate their forecasts are in general; this technique is known as forecast error.

Another key aspect of forecasting is the timeframe that is measured in a forecast: a year, a month, or even a day. When forecasts are developed for short periods of time (between the creation of the forecast and the demand it is predicting), the forecast results are likely to be more accurate, because it is generally easier to predict demand over the near term than having to account for unknown events as much as a year in the future.

## Unit 2: Independent and Dependent Demand

The two types of demand are independent demand and dependent demand. According to the online Management Study Guide (2013), inventory items have independent demand when the demand for these items is not dependent upon the demand for other items. Finished goods that are manufactured for stock and sale to satisfy current and projected customer orders are called independent demand items. For instance, completed cars at a car dealership are independent demand items.

Dependent demand items, by contrast, do depend on the sale of other items. Raw materials and component inventories depend on the demand for finished goods and are, therefore, described as dependent demand inventories.



#### For example...

Every new automobile has at least four tires. Therefore, the demand for tires is partly dependent on the demand for assembled cars. Another type of dependent demand includes product protection and packaging. For example, many items are shipped in bubble wrap for protection, and the demand for bubble wrap is dependent on the demand for the items with which it is shipped. Using independent demand to help predict dependent demand saves companies time and resources in forecasting the demand for dependent items, rather than having to predict the demand for each dependent part or material on its own.

In some instances, items can represent independent or dependent demand based on where they are consumed in the supply chain. For instance, tires sold to car manufacturers represent dependent demand that is related to new car sales, but tires sold to retail tire stores would represent independent demand, so car manufacturers would need to decide how many tires to stock based on their forecast of the number of cars they forecast selling.

#### Bill of Materials (BOM)

A bill of materials (BOM) is closely tied to the concept of dependent demand; it is essentially a structure for finished products. For cars, BOMs show how many of each part is needed to make one car. For example, the BOM shows the precise number of lug nuts on a wheel, which depends on the number of wheels needed, which depends in turn on the number of cars that are to be made.

In manufacturing environments, design engineers draw the finished product; the drawing is accompanied by a BOM. That BOM shows, in line item format, all items (detailed by part number, quantity, item description, and more) needed to assemble the finished product. With many consumer products, it is not unusual to find an exploded (detail) drawing and list of items needed to assemble the finished product. This list of items is called the BOM.



Figure 16. Bill of materials is closely tied to dependent demand. Developed by LINCS in Supply Chain Management Consortium

#### **Overview of Planning Levels**

Companies can generate forecasts at different levels or for different categories of products. The highest possible level is overall demand for products worldwide. The smallest or most detailed level of forecast, is for stock keeping units (SKUs), which includes individual, specific products of particular



sizes or colors. For example shirts often come in a range of sizes and colors; each color-size combination would represent a unique SKU.

The highest level of forecast is used to determine overall levels of supply of raw materials required over specified time periods. However, the lowest levels of forecasts, for example, are used to drive daily and weekly production manufacturing schedules. Most companies generate forecasts at multiple levels for planning and customer support. Here are a few examples of forecast levels at a men's shirt manufacturer, moving from the most general to the most detailed:

Total company demand across all products and regions. This represents forecasts of demand for shirts of all colors, sizes, and types that the company sells worldwide.

Total demand by specific region, such as total sales within the United States. This represents forecasts of demand for shirts of all colors, sizes, and types that the company sells in the U.S.

Total demand for a product family or category. This represents forecasts of demand for dress shirts in all colors, sizes, and types that the company manufactures worldwide.

Total demand for a product category in a region. This represents forecasts of demand for dress shirts in all colors, sizes, and types that the company sells in the U.S.

> Total demand for a specific product or SKU. This represents forecasts of demand for dress shirts that are of a specific color, size, and type.

Total demand for an SKU by location. This represents forecasts of demand for dress shirts that are of a specific color, size, and type in a particular American city.

As with forecasting at different levels, companies must plan inventory requirements at those same levels. Companies should calculate how much inventory is needed to support their forecasts, including the stock required for normal sales levels and safety stock, which is stock allocated to cover forecast error and lead time variation, which is an allowance made for lead times that vary from the lead time promised from suppliers.

#### Unit 3: The Demand Plan

Demand plans are generated based on forecasted demand by determining how much of each product will be sold across the entire company in all regions by timeframe (e.g., year, month, week, or day) and how much inventory will be needed to meet the demand. The demand plan should balance



projected needs with the accompanying desired inventory levels down to the SKU level, such as specific sizes and colors.

#### Creating the Demand Plan

Demand plans can be top-down or bottom-up. **Top-down plans** are a common method of creating corporate forecasts; they begin with an overall number to be broken down into particular products and regions, as shown in the Overview of Planning Levels section.

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If there were a forecast to sell 100,000 units across the entire company for a year, that number would be broken down into how much of each product family will be sold, then broken down even further into the number of each SKU expected to be sold across the entire company. Additional breakdowns could reflect the items to be sold in particular areas or locations.

A bottom-up plan, meanwhile, does the opposite. A forecast is created for the smallest possible breakdown of demand: a particular SKU in a particular location over a particular timeframe. These detailed forecasts are added together across the company to obtain totals.

#### Key Components of the Demand Plan

Demand plans are made up of several key elements or components. Demand planners complete the demand plan by using the key components that follows:





Companies typically forecast how much of each item will sell in each location per time period. Based on these data, they then determine if inventory needs meet forecast and safety stocks (more information about safety stock appears in Learning Block 4). Many companies generate both top-down and bottom-up plans so as to ensure that they are consistent in their forecasts. If there are serious inconsistencies, they must be reconciled, with adjustments made as necessary.

#### Learning Block 3 Summary

Demand forecasting estimates companies' future needs for the raw materials, finished goods, and components needed to meet projected customer demand over a certain period of time. Accurate demand forecasting helps prevent oversupply and undersupply of inventory and their associated negative impacts. Forecasting and inventory control are directly related; the more accurate the forecast, the less inventory companies have to carry to make up for forecast error.



Figure 9. Demand planning. Developed by LINCS in Supply Chain Management Consortium.

There are two types of demand: independent demand and

dependent demand. The former refers to items that do not depend on demand for another item. If the demand for an item, such as a car tire, does depend on another item, such as a new car, the demand for tires is dependent demand. The concept of a BOM is closely tied to the idea of dependent demand. A BOM lists every item to create a finished product. Companies can generate forecasts at different levels or for different categories, from very general to SKU-specific.

Demand plans are generated based on the forecasted demand by determining how much of each product will be sold across the entire company in all regions over a given timeframe, such as a year, a month, a week, or a day, and on how much inventory will be needed to meet this demand. Companies can create either top-down or bottom-up demand plans, though some use both to ensure accuracy. Demand plans are made up of a number of key elements.

#### Learning Block 3 Practice Questions

- 1. The two main types of demand are:
  - a. Independent and dependent
  - b. Constant and fluctuating
  - c. Known and unknown
  - d. Short term and long term


#### 2. Which of the following are components of a demand plan?

- a. Demand forecast
- b. Locations
- c. Timeframe or horizon
- d. Demand forecast, locations, and timeframe

#### 3. Which of the following describes a bill of material?

- a. It describes manufacturing schedules
- b. It lists items needed to assemble a finished product
- c. It documents sales history
- d. It defines timeframes
- 4. If a company is producing cars and it has to predict how many spark plugs are needed, the demand for cars would be \_\_\_\_\_\_ demand and the demand for spark plugs would be \_\_\_\_\_\_ demand.
  - a. Dependent; independent
  - b. Stable; unstable
  - c. Independent; dependent
  - d. Reliable; unpredictable
- 5. What is one way to make forecasts more accurate?
  - a. Analyze what was sold last year
  - b. Let marketing create their own forecast
  - c. Reduce the time between creating a forecast and the event that is being predicted
  - d. Hold more inventory

#### 6. Which of the following is the most detailed forecast?

- a. Total company demand across all products and regions
- b. Total demand by specific region
- c. Total demand for an SKU by region
- d. Total demand for a product category

#### 7. A top-down plan starts with:

- a. The smallest breakdown of demand
- b. Manufacturing
- c. Suppliers
- d. Aggregate demand



#### 8. The demand plan should:

- a. Balance current needs with the desired inventory down to the SKU level
- b. Balance projected needs with the desired inventory down to the SKU level
- c. Balance current needs with the desired inventory level at the aggregate level
- d. Balance projected needs with the desired inventory level at the aggregate level

#### 9. What is a common method for creating corporate forecasts?

- a. Department-department
- b. Top-down
- c. Company-company
- d. Supplier-customer

#### 10. Which of the following is an accurate statement?

- a. The more accurate the forecast is, the more inventory will be required
- b. The more accurate the forecast is, the less inventory will be required
- c. The less accurate the forecast is, the less inventory will be required
- d. The less accurate the forecast is, the more inventory will be required





# Learning Block 4: Demand Planning Tools and Techniques

# Learning Block 4 Description

This learning block provides an overview of the uncertainty that can result from even the best demand planning processes, along with tools and techniques to manage demand, supply, and lead time variability. Variability tends to be costly for companies in the supply chain, so this learning block also includes ways to minimize variability and reduce costs. Lastly, this learning block reviews other supply chain concepts, such as safety stock, reorder points, and order quantities.

# Learning Block 4 Learning Objectives

Upon completing this learning block, the learner will be able to:

- Recognize the various types of uncertainty related to demand planning in terms of demand, supply, and lead times
- Explain the causes and impacts of variability or uncertainty
- Apply the basic types of forecasting techniques, such as reorder points, economic order quantity (EOQ), lead times, and technology uses

# Unit 1: Uncertainty in Demand Planning

Uncertainty is the quality or state of being uncertain, or something that is itself doubtful or unknown (Uncertainty, n.d.). In the case of demand planning, uncertainty occurs in demand, supply, and lead time. While demand can be forecasted, it is virtually impossible to know *exactly* what will be needed to meet customer requirements.

### Uncertainty in Demand

Uncertainty in demand means not knowing the precise amount that will be needed. In retail stores, an uncertainty may be not being sure about how many units of a particular item will be bought by customers on a particular day. Stores usually retain a history of daily sales for each item, but this does not mean that the same number of sales will occur every day. Forecasts are never 100% correct, and not knowing precisely how incorrect a forecast is creates uncertainty.



Uncertainty in Supply	Sometimes, there is also uncertainty in supply. A source of supply can be uncertain due to the instability of suppliers, potential shortages in raw materials, or reliability of transportation. Suppliers might not have enough supply on hand to fill every order that companies place without delay, or there might be a worldwide shortage of a particular material that affects all supplies. Labor disruptions could also occur, or there might be a shortage of certain critical skills. Finally, uncertainty might occur in the transit time or due to an inability to secure the combination of transportation modes needed to complete a given shipment.
Uncertainty in Lead Time	Uncertainty can also exist due to the lead times needed to receive products. Lead time, or order cycle time, is the time from order placement to order receipt. Uncertainty can be a result of differing processing times, picking times, and shipping or transportation times. Manufacturers might experience machine breakdowns, causing interruptions in the manufacturing processes, while warehouses might have labor shortages and not be able to pick all goods on time to fill all orders. Transportation carriers could also be delayed in delivering products to customers from suppliers because of bad weather, equipment failure, or labor disruptions.

# Unit 2: Addressing Causes of Uncertainty and Variability

Uncertainty can lead to variability in the supply chain. While there are numerous definitions of variability, the most common explanation is the range of possibilities or outcomes for a specific situation.

If companies understand the causes of variability (or the range of possible outcomes) and counteract or plan for those causes, they can work on reducing variability. For instance, companies can improve the forecasting process by using better forecasting techniques, which are described in this learning block. Another way to reduce variability is to work more effectively with suppliers and customers through collaborative planning, forecasting, and replenishment (CPFR).

CPFR includes sharing sales data and forecasts and any other known issues that might affect the supply chain (see Learning Block 6). If companies can obtain customers' actual demand for their products, they can prepare to meet those needs more efficiently. This can be achieved, among other techniques, by electronically sharing demand data in real time.

### Impacts of Variability

Variability in supply chains can increase operating costs. When companies cannot be confident in how much product they will need, they must carry more in order to cover any potential variability. Therefore, increased variability in demand, supply, or lead time could result in increased levels of inventory to cover the variations to prevent stock-outs and lost sales.



To counteract variability and uncertainty, manufacturing companies hold more inventory of raw materials and packaging materials to make finished products. If they are uncertain of their suppliers' ability to deliver on time, or if suppliers might not ship all products ordered, then a company might have to carry additional raw material inventory to ensure that it can keep production lines running. Similarly, companies must stock the appropriate amount of packaging supplies to complete and ship finished products, such as boxes and stretch wrap.

### Safety Stock

Safety stock is the additional inventory that is needed to cover variability or uncertainty. It is also referred to as **buffer stock**, because it is a buffer against uncertainty. For instance, if the forecast is to sell 100 units of an item in a week, but potential sales could be as high as 150 units, then 50 units of safety stock would be needed to cover uncertainty in the forecast.

If there is 100% certainty about the amount of product a company will sell, then safety stock would not be needed. Similarly, if a product's lead time is known with absolute clarity, safety stock will not be needed to cover for any uncertainty in demand during the lead time period. However, if the lead time is five days for a given order but the order arrives in six days, then the company could be out of stock

for an entire day. In this scenario, the company would need to determine the potential sales on a single day and then add enough safety stock as a buffer for late deliveries.

Unfortunately, actual lead times have variability, and other issues may arise such as late deliveries, incorrect quantities, and incorrect items. These factors require almost all companies to carry at least some amount of safety stock.



Figure 17. Safety stock. Developed by LINCS in Supply Chain Management Consortium.

# Unit 3: Tools and Techniques to Reduce Uncertainty

Companies can use many types of techniques to reduce uncertainty in the supply chain. When more uncertainty can be eliminated, smaller amounts of inventory will be required to cover for contingencies and companies' costs will be lower. Next are several ways to reduce uncertainty in demand planning, each of which is covered in this unit:





### Statistical Forecasting Techniques

The use of statistical forecasting techniques is one way to reduce forecast uncertainty by using available data to improve accuracy. Higher levels of accuracy result in less uncertainty or variability, which also results in achieving optimal inventory levels. Many sophisticated techniques are available, but this unit explores one basic technique and a variation on that technique: the simple moving average and the weighted moving average.

### For example...

With a simple moving average, historical data are used to predict a future demand need. For example, a simple moving average forecast for April would use the demand history from January, February, and March. Here is a hypothetical list of historical data:

- January sales: 200 units
- February sales: 300 units
- March sales: 400 units

The simple moving average calculated from this data to predict April sales is (200+300+400)/3, or (900/3), or 300 units.

This type of forecast can be carried out using any time horizon, such as weeks, month, quarters, or years. If forecasts are continually generated for the next future time period by dropping the oldest demand observation when a new one is added, this is called a rolling forecast. For example, in a three-month rolling forecast for the time period of January-March, January data would be eliminated and April sales data would be added to create a sales forecast for May, the forecast for which would be based on actual sales from February to April. A variation of the simple moving average is to calculate a weighted moving average. Weighted moving averages are similar to simple moving averages but place more weight or emphasis on some time periods than on others. Usually, more weight is placed on the most recent sales, and less weight is placed on older sales.

For this technique, weights are assigned to each period in the data. Continuing with the January-March historical data example used before, the weights have to add up to 100%. Therefore, 60% of the weight might be assigned to the most recent month of March, 30% might be assigned to February, and the remaining 10% assigned to January. Now, the forecast is calculated as follows:  $(0.6 \times 400 \text{ (for March)}) + (0.3 \times 300 \text{ (for February)}) + (0.1 \times 200 \text{ (for January)}); or (240 + 90 + 20); or an April forecast of 350 units.$ 

If the simple moving average forecast for April (300 units) is compared with the weighted moving average (350 units), the results show that the weighted moving average is closer to the most recent month of March than to the oldest month of January. This three-month set of data shows an increase in sales, and using a weighted moving average shows a higher level of confidence in predicting the demand for April than by using the simple moving average.

Where there are clear trends in sales over a period of time, the weighted moving average process accounts for differences in actual versus forecast sales better than the simple moving average. Additionally, the weighted moving average method of forecasting emphasizes the most recent sales results in predicting future sales, which can lead to more accurate demand forecasts.

Two other types of forecast methods can be used: causal forecasts and expert forecasts. Causal forecasts use specific factors to determine future demand; for example, if the price is lowered, the amount of product that will be sold will increase. Expert forecasting uses inputs from subject matter



experts (SMEs) to generate forecasts. SMEs are select personnel that possess special skills and knowledge of a particular subject.

### **Reorder Points**

The reorder point occurs, or is tripped, once the inventory of an item reaches a predetermined level that sets off a new order to replenish the level to a predefined quantity. According to Coyle, Bardi, and Langley (2003), there are two types of reorder points that inventory controllers or warehouse managers employ: fixed order quantity and fixed order interval.

Fixed Order Quantity	Fixed Order Interval
Fixed order quantity occurs when the same	Conversely, the fixed order interval approach
amount of product is reordered in every	occurs when the amount ordered varies, but the
instance, but the order timing varies.	time between orders remains the same. For each
Inventory of items is monitored regularly, and	product, the inventory level is noted when
when the amount on hand reaches the	reorder time arrives. The on-hand inventories are
predetermined reorder point, the same	not continually reviewed; instead, they are
quantity is ordered each time for	reviewed to place an order that would make the
replenishment purposes. The reorder point	inventory reach the desired level. For example,
quantity is the amount of inventory needed to	the inventory level might be checked every two
cover demand for the typical lead time. So, if	weeks and have a predetermined maximum
the daily demand were 10 units and the lead	amount of inventory (e.g., 50 units). If the item is
time were five days, then the reorder point	reviewed and there were only 30 units, the
would be 50 units; at that point a replenishing	difference between the maximum and what is
order would be triggered.	currently on hand (20 units) would be ordered.

*Figure 18* shows the concept of reorder points (also referred to as a sawtooth replenishment model). As shown, as beginning inventory is consumed and the reorder point is reached, a new order is placed to replenish the inventory to the beginning inventory level.



Figure 18. Sawtooth replenishment model. Developed by LINCS in Supply Chain Management Consortium.

It is important to decide which reorder point technique is best to use with particular products and inventories. For example, the fixed order quantity approach is usually applied to items that are more



critical or characterized as an A item in the ABC classification. ABC classification labels A items as the most critical and highest-selling items, B items as the next level of importance below A items, and C items as the least important items in inventories.

The fixed order quantity approach is more expensive to administer because it requires very frequent or even constant monitoring of inventory levels. Typically, this approach would be used for the most critical, or A, items. The fixed order interval approach, by contrast, is more suitable for B and C items because they do not need to be monitored as often, which saves time and thus money.

# Economic Order Quantity (EOQ)

EOQs help companies determine how much to reorder for the fixed quantity model. The EOQ determines the best quantity to order for replenishment that balances costs of ordering in a procurement process and setup costs in a manufacturing environment.

In a procurement process, ordering costs are incurred each time orders are placed, which combines the time and effort of procurement personnel along with other related costs (e.g., administrative costs, information-processing costs, etc.) for processing procurement requisitions and orders. In the manufacturing process, costs are involved in setting up machines, which combines the personnel time and effort and other costs like tooling and energy expenses so that the machines can produce the desired items.

**Inventory carrying costs** are separate from the value of the actual goods in the inventory. Other inventory costs include the cost of space to store the inventory, the cost of personnel to manage inventory, the cost of obsolescence, and the cost of any potential damage to inventory.



Additional key assumptions about the simple EOQ model are:

- Demand rates that are continuous, constant, and known, such as 100 units
- Replenishment lead times that are constant and known, such as three days
- That all demand will be satisfied by the quantity ordered; for example, 100 units will cover demand until the next order
- Costs per unit purchased and transportation costs remain the same, no matter what quantity is purchased



#### EOQ COST TO DETERMINE OPTIMUM QUANTITY



Figure 19. Graph A: The order cost decreases as the quantity increases; at the same time, the holding costs increase as the quantity increases. The combined cost shows the lowest cost when taking both into account. Developed by LINCS in Supply Chain Management Consortium.

#### EOQ INVENTORY LEVELS 50,000 UNITS EVERY 2 MONTHS



Figure 20. Graph B: Shows a fixed order quantity of 50,000 with a consistent, even demand. Purchases are received, bringing inventory to the fixed max level. The inventory is then consumed until it reaches zero. At the consistent point of two months, a new order arrives, bringing inventory back to the max. Developed by LINCS in Supply Chain Management Consortium.

### Calculating EOQ

For a gym equipment dealer, the annual demand for gym mats is 3,600 per year, and each gym mat costs \$100. The annual holding cost per unit is 25%, and the cost to place an order from the gym mat supplier is \$200. Using the information in this example, the values used in the formula would be as follows:

V = \$100 per unit

W = 25% (or 0.25 in the formula)

A = \$200 per order

R = 3,600 units per year

2(3600)(200) (100)(0.25)

The EOQ in this case is the square root of (1,440,000/25), or 240 gym mats. This means that the EOQ using the fixed quantity model is **240** gym mats.



### Lead Time Analysis

Another way to reduce uncertainty is through lead time analysis and corrective action based on that analysis. Lead time analysis involves analyzing the various components of lead time to see if the times required can be reduced or if each component can be made more consistent in order to minimize uncertainty.

Components of lead time may include the time taken to receive an order, the time to transmit an order to a supplier or to a warehouse, the time to prepare or pick an order in a warehouse, the time to pack an order, and the time to transport an order to a customer. Longer lead times result in the need for larger inventories to cover demand during the lead time. Therefore, if lead time can be shortened, inventory can usually be reduced.

The variability in lead time can also be minimized to reduce the need for safety stock inventory. According to Coyle et al. (2003), lead time, or replenishment time, consists of several parts: order transmittal, order processing, order preparation, and delivery. Each of these items would be evaluated for opportunities to shorten or reduce the variability.

### Role of Technology

The techniques and calculations discussed in this unit can be applied easily, and there are several software applications used to automate the processes. Software applications can also offer multiple forecast options to improve accuracy. These applications will set target inventory levels and replenishment quantities. The main purpose of this type of software is to automate and streamline the process of forecasting.

Advancements in software and computer technology have revolutionized the business, providing demand planners with desktop access to powerful computing capability. The forecasting software available has built-in capability that has made complex algorithms accessible by incorporating several automated features (Tashman &

Leach, 1991). Forecasting software for demand planning uses built-in statistical models to forecast sales and demand based on the use of extensive data about past sales, helping to provide a more accurate idea of what to expect in the future.

# Learning Block 4 Summary

In demand planning, three types of uncertainty exist: demand, supply, and lead time. When the uncertainty of any of these elements increases, higher levels of inventory need to be carried to avoid stock-outs. Uncertainty leads to variability in the supply chain, and if companies can understand the causes of variability and address them, they can reduce variability.



Figure 21. Lead time. Developed by LINCS in Supply Chain Management Consortium.



Figure 22. Computer forecast. Developed by LINCS in Supply Chain Management Consortium.



Several forecasting techniques exist, including the simple moving average and the weighted moving average. These techniques are examples of time series forecasts in which historical data is used to create forecasts. The reorder point is the time at which the amount of inventory is reached to satisfy

demand until the next order is received. Reorder points determine when another order needs to be placed to replenish product. Two common types of reorder points are fixed order quantity and fixed order interval.

EOQs help companies determine how much inventory to reorder. EOQs determine the best quantity to order for replenishment by balancing the costs of ordering or setup costs for production with inventory carrying costs. Lead time analysis involves analyzing the various components of lead time to see if the time required can be reduced or if any component can be made more consistent in order to reduce uncertainty.



Figure 9. Demand planning. Developed by LINCS in Supply Chain Management Consortium.

# Learning Block 4 Practice Questions

- 1. Which is not a component of lead time?
  - a. Order transmittal
  - b. Order preparation
  - c. Order receipt
  - d. Marketing forecasts
- 2. Which replenishment method results in the same amount of product being ordered each time?
  - a. Safety stock
  - b. Fixed order interval
  - c. Fixed order quantity
  - d. Moving average
- 3. What type of forecasting technique emphasizes certain time periods over others?
  - a. Linear regression
  - b. Simple moving average
  - c. Weighted moving average
  - d. Expert forecast
- 4. Which of the following is NOT an assumption used to calculate EOQ?
  - a. A changing rate of demand over time
  - b. A constant and known replenishment
  - c. The satisfaction of all demand
  - d. A constant cost that is independent of the order quantity or time



#### 5. What is the benefit of using specialized demand planning software?

- a. It enables software companies to increase sales
- b. It is better for predicting causal forecasts
- c. There are built-in statistical models to forecast sales and demand
- d. It eliminates the need for demand planning personnel

#### 6. EOQ balances the costs of ordering with:

- a. Inventory carrying costs
- b. Procurement costs
- c. Inventory ordering costs
- d. Manufacturing costs

#### 7. Which of the following inventory review approaches is best for fast-selling items?

- a. Lead time analysis
- b. Fixed order interval
- c. Fixed order quantity
- d. Safety stock analysis
- 8. Businesses have to carry \_\_\_\_\_\_ because there are variations in demand, supply, and lead time.
  - a. Safety stock
  - b. Obsolescence stock
  - c. Seasonal stock
  - d. Raw Materials
- 9. What can be calculated by multiplying daily demand by the length of the lead time?
  - a. Reorder point quantity
  - b. EOQ
  - c. Order processing time
  - d. Picking time
- 10. What might a manufacturing company need to have as additional inventory if there is a problem with late supplier deliveries?
  - a. Finished goods
  - b. Raw materials
  - c. Work in process inventory
  - d. Reorder point





# Learning Block 5: Communicating and Managing Demand

# Learning Block 5 Description

The effective management of demand planning processes is a key factor in the success of any organization. Companies must have processes in place for effectively gauging changes in demand, communicating these changes, managing demand, and prioritizing demand as necessary. It is important for supply chain personnel to understand these key aspects of demand management, each of which is outlined in this learning block.

# Learning Block 5 Learning Objectives

Upon completing this learning block, the learner will be able to:

- Recognize the key aspects of communication
- Understand the key aspects of gaining demand consensus in organizations
- Apply the key metrics used in demand management
- Analyze the key aspects of managing and prioritizing demand

# Unit 1: Communicating Demand

Accurately and effectively communicating demand in a timely fashion is vital for companies and requires structured and integrated processes. Once the demand plan has been developed, it should be communicated to other groups within companies, normally by those who have developed this plan. This unit explores demand communication in more detail.

### **Effective Communications**

Demand management cannot be accomplished effectively without clear, continuous, and timely communication between the demand manager and other key groups at all levels within a company, including marketing, sales, manufacturing, and procurement groups. The demand communication process should focus on communicating the true state of demand, the actions that need to be carried out to accomplish the demand objectives, and the actions needed to keep supply and demand coordinated. If demand and demand changes are not communicated quickly after they arise, then companies' responses may be too late.



### For example...

A sales group in a company might determine that an increase in demand is likely for a specific product over the next few months, and communicate that to the demand manager. If this information is not communicated quickly to the manufacturing organization, there may not be time to adjust manufacturing schedules to manufacture the products in time to meet the increase in demand. As a result, sales might be lost.

Feedback and communication must take place continuously because demand changes with time and can be affected by the various factors outlined in Learning Block 1 (e.g., market size, complementary and substitute products and services, customer preferences, future expectations, income levels, market forces, and risk events). According to Crum and Palmatier (2003), this feedback and performance monitoring involves various groups; the nature of feedback to and from each of the affected groups is shown next:

Sales	Marketing
The purpose of this feedback is to alert the sales force of expected sales and products that will be available to sell. Feedback from sales alerts demand managers to changes or anticipated changes in demand and timing so that the necessary actions can be carried out to prioritize accordingly.	The purpose of this feedback is to communicate any changes that are required in the company to meet demand objectives and any expectations for marketing in stimulating or slowing demand.
Procurement	Master production scheduler
The purpose of this feedback is to communicate the demand plan to procurement so they can input the necessary products, such as ensuring raw materials and components are available when needed. Feedback from procurement alerts demand managers of changes or anticipated changes in the timing or quantities of procured goods; then, any necessary changes can be made to factor in material availability and prioritize accordingly.	The purpose of this feedback is to quickly alert master production schedulers of changes in demand mix or volumes so that any necessary changes can be made to the master production schedule.

According to Crum and Palmatier (2003), effective demand management fundamentally entails quickly communicating changes in demand to various groups in companies and encouraging them to respond effectively to these changes. Collaborative efforts are essential here, and various scenarios can exist when changes in demand occur:

• The supply capacity should be managed to meet increases and decreases in demand. Examples of changing demand include changes to order sizes, expediting orders, and



changes to production schedules.

• The demand forecast should be managed and prioritized to meet supply capacity. Demand management techniques can include employing marketing techniques to decrease demand, such as increasing prices to decrease demand to match supply capacity.

As noted, communication processes must be continuous because demand changes constantly. Customers change their minds about what they wish to buy, the timing of when orders are submitted can change, demand quantities can vary from order to order, and marketing promotions may create more demand than what had been previously planned.

# **Unit 2: Demand Planning and Gaining Consensus**

Often, companies establish multiple demand plans based on expected demand in various, isolated groups that develop their own demand projections and plans. Sales, marketing, and brand management groups may have their own projections of demand and their own sets of projected sales numbers and plans from which they operate. For example, finance groups may use their own set of financial plans, typically based on yearly budgets, while procurement groups may use their own set of demand projection numbers for the supply planning process. The end result of this lack of coordination and agreement on a single set of demand figures can result in an ongoing struggle to fulfill customer demand in the timeframes and volumes required.

Therefore, establishing consensus throughout the organization is vitally important. This can be accomplished by conducting regular demand consensus review meetings, which are normally carried out monthly. At this meeting, the various groups mentioned previously come together to agree on a single demand plan. Consensus is reached by reviewing the overall demand plan as well as the individual products that make up this plan. Demand planners then complete the demand plan using the agreed-upon figures. The demand plan is reviewed for volumes of anticipated product demand and the revenue that will be generated over time, such as 12 to 18 months, broken down for each month.

The agreed-upon demand plan can also be used to update projected revenues and costs for financial planning. The forecast is evaluated and modified as necessary through ongoing reporting and consensus meetings. Results from demand consensus meetings are used for deploying the right product, at the right place, at the right time, and for the right customer (Crum & Palmatier, 2003).

# **Unit 3: Demand Metrics**

### **Key Demand Metrics**

Metrics are instrumental for properly understanding the effectiveness of the demand management process and how accurately the demand plan reflects reality. As outlined in Learning Block 1, a key overall metric used to measure the effectiveness of the demand management process is demand plan accuracy, or how closely the demand plan matches real demand as it occurs.

According to Crum and Palmatier (2003), other key metrics that focus on how well the demand planning and management process achieves overall company goals include:



### Market share

Market share is the percentage of an industry or market's total sales that is earned by a particular company over a specified time period (Market share, n.d.). Market share is calculated by taking a company's sales for a defined period of time and dividing it by the total sales in the industry over the same period. This metric is used to provide a general idea of a company's size to its market and its competitors.

#### **Customer retention**

This is the ability of a company to retain its customers over time, and is measured by the amount of repeat business received from customers over an extended period of time.

### Inventory metrics

These are measures used to determine whether a company is managing inventory effectively and efficiently. Many key inventory metrics have been developed and are commonly used by companies to measure inventory management effectiveness and efficiency.

#### **Demand Plan Accuracy**

This is a measure of the accuracy of demand plans over time. It is applied to determine how closely plans match actual demand and the degree of variation of actual demand compared to demand plans.

### Customer satisfaction

Satisfaction measures how products and services supplied by a company meet or surpass customer expectations. It can be based on the number of customers that express satisfaction with a company's products and services according to specified satisfaction goals; it can also be based on the amount of repeat business a company receives from customers.

### Overall or gross profit margin



This is a financial metric used to assess a firm's financial health by determining the proportion of money left over from revenues after accounting for the cost of goods sold (Gross profit margin, n.d.).

### Cost and profit per customer

These are the costs required to service a given customer and the profit from a given customer. Costs include attracting, selling, and servicing each customer, while profits include any profit the firm makes from serving a customer over a specified period of time.

A useful measurement for demand planning effectiveness is to see how well the demand plan correlates with the previously mention metrics. As demand plan accuracy improves, there should be related improvements in several company functions, such as **inventory turns**, customer retention, and customer satisfaction levels (Crum & Palmatier, 2003). Measuring the accuracy of the demand plan is covered in the next section.



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### Measuring the Accuracy of the Demand Plan

Companies should understand how closely their demand plan predicts actual demand over time. From this examination, companies should be able to determine if the demand plan is acceptably reliable and if accuracy is improving or worsening; in the latter case, corrective action could be taken. For the accuracy of this measure, the demand plan must be broken down into individual item levels so that projected demand is being measured for individual products.

### For example...

A 12-pack of hand lotion would be broken down into the individual bottles of hand lotion, making it possible to pinpoint which items' demands are being more accurately predicted and the degree of difference in each case. The degree of difference includes both products in which demand has fallen short of projections and products in which demand has exceeded projections. Based on this measurement, demand management can work with the marketing and sales groups to determine possible causes and take appropriate steps such as adjusting future demand plans based on the degree of accuracy or inaccuracy of past and current demand plans.

The frequency of measurements should ideally allow sufficient time to understand the reasons for demand variation from the plan and permit meaningful actions to adjust to any changes in demand (Crum & Palmatier, 2003). Typically, demand plan accuracy should be measured at least once a month, as should actions taken to improve accuracy accordingly (Crum & Palmatier, 2003).

The typical goals for overall demand plan accuracy are 95% at the product family level. A product family is a group of related goods that are manufactured by a single company (Product family, n.d.). For example, a company might manufacture and sell suntan lotion. The company might sell different sizes and SPF factors of a particular brand of suntan lotion, all of which form part of a product family of suntan lotions. Accuracy goals should also be set by level of sales volume, according to the ABC classification, as follows:

- A items are the ~20% of items that account for ~80% of the sales volume.
- B items are the ~30% of items that account for ~15% of the sales volume.
- C items are the remaining ~50% of items that account for ~5% of the sales volume.

Different demand plan accuracy levels and objectives should be developed and set for each category. The most time and management attention should be spent on evaluating demand plan accuracy for A items, somewhat less should be spent on B items, and the least amount of time should be spent on C items that represent only 5% of sales volume.

# Unit 4: Prioritizing Demand

A key aspect of the demand management function is prioritizing demand, which requires deciding which products need the most focus in demand prioritization. Focusing on certain products can mean allocating more or fewer resources as demand increases or decreases, or is projected to increase or decrease.



### When is it Necessary to Prioritize Demand?

There are several situations in which it is important to prioritize demand. The volume, timing, and mix of demand change constantly, so it is necessary to re-evaluate priorities on a regular basis. In manufacturing and supply departments, there are typically constraints on manufacturing capacities, lead times, and available funds. These constraints can prevent the production of goods that meet the exact volumes, timing, and mix contained in the demand plan.

Because of this, processes are necessary to manage and prioritize demand, which is typically the responsibility of demand planners or demand managers. It can become necessary to manage and prioritize demand when production or supply constraints impact the demand plan and make it necessary to shift priorities between products. Similarly, when demand increases or decreases, changes have to be made to prioritize the production and supply of goods, such as re-



Figure 23. Prioritizing demand. Developed by LINCS in Supply Chain Management Consortium.

allocating the necessary resources by adding machine capacity or reducing production, dedicating additional funds for supply or reducing spending on supply, etc.

### **Best Practices**

According to Crum and Palmatier (2003), best practices exist for managing and prioritizing demand. Managing and prioritizing, or reprioritizing, should occur when it becomes evident that the volume, mix, and timing of actual demand is different from the demand plan or the company's ability to meet the actual demand.

Another best practice to ensure that demand planners and managers work closely with the sales, marketing, manufacturing, and supply groups. They will then have a better understanding of the ramifications of changing the demand plan and allocation of resources.

Demand planners and managers can also use best practices to identify and prioritize demand changes as soon as these changes become clear. Whether these changes will occur tomorrow or several months in the future, they can and must be quickly and effectively communicated throughout the organization. Companies must also have a process in place to prioritize demand continually and communicate any changes throughout the organization.

# Learning Block 5 Summary

Management should strive to communicate the true state of demand, the actions that need to be carried out to accomplish demand objectives, and the actions needed to keep supply and demand coordinated. Obtaining consensus in the demand plan is vital, which happens through regular demand



consensus review meetings. To gauge how effective the demand management process is and how accurately the demand plan reflects reality, a series of metrics must be in place.

Companies should understand how well the demand plan matches actual demand. Demand management may start with estimation and planning, but it also involves working together with several elements in an organization. Successful demand management requires not simply reacting to changes in demand patterns but also trying to influence these patterns. Additionally, the volume, timing, and mix of demand constantly change, so re-evaluating priorities on a regular basis is crucial. A process must also be in place within companies to prioritize demand continually and to communicate this prioritization throughout the organization.



Figure 9. Demand planning. Developed by LINCS in Supply Chain Management Consortium.

# Learning Block 5 Practice Questions

- 1. One metric designed to assess a firm's financial health is:
  - a. Customer satisfaction levels
  - b. Impossible to carry out
  - c. Seldom practiced by companies
  - d. Gross profit margin
- 2. The demand communication process should be aimed at:
  - a. Decreasing costs
  - b. Communicating the true state of demand
  - c. Communicating the actions needed to accomplish supply objectives
  - d. Calculating economic order quantities
- 3. The purpose of feedback to the marketing group is to:
  - a. Alert the master production scheduler to changes in demand mix or volumes
  - b. Advise the group of the sales that occurred over the last year in a company
  - c. Communicate what is expected with regard to stimulating or slowing demand
  - d. Have no impact on demand
- 4. Gaining consensus on the demand plan is vital, and is achieved through:
  - a. Infrequent communication between the groups concerned
  - b. Zero communication
  - c. Regular demand consensus review meetings
  - d. Review meetings without the demand planner



#### 5. As demand plan accuracy improves, there should be a related:

- a. Increase in costs
- b. Increase in meetings to discuss the demand plan
- c. Improvement in inventory turns
- d. Improvement in salaries

#### 6. Demand planning metrics are necessary to:

- a. Identify who developed the demand plan
- b. Anticipate risk events
- c. Evaluate the success and accuracy of the demand planning process
- d. Enable the placement of purchase orders with suppliers
- 7. How often should the demand plan accuracy evaluation and adjustment typically take place?
  - a. Every hour
  - b. Once a year
  - c. From time to time
  - d. At least once a month

#### 8. Demand planning can be a powerful way to:

- a. Get suppliers to reduce costs
- b. Increase sales
- c. Increase inventory
- d. Promote a balanced flow of goods across a supply chain
- 9. A key aspect of successful demand management is the attempt to:
  - a. Influence patterns by managing demand
  - b. Influence patterns by managing supply
  - c. Reduce demand
  - d. Increase demand

# 10. Which of the following is a typical situation in which it becomes necessary to manage and prioritize demand?

- a. When production or supply constraints impact the demand plan
- b. When there are no production or supply constraints
- c. When there is a change in management and a new demand plan is required
- d. When no demand plan exists





# Learning Block 6: Contemporary Approaches to Demand Planning and Management

# Learning Block 6 Description

Relatively recent developments have been made in supply chain processes to improve demand planning and management. One of these developments is CPFR, a system for helping suppliers and customers work together to increase service and reduce costs. In addition to CPFR, **demand shaping** and the difference between **pull systems** and **push systems** will be reviewed. Demand shaping is a concept in which companies try to influence what customers purchase. Lastly, some key best practices in demand planning will be outlined.

# Learning Block 6 Learning Objectives

Upon completing this learning block, the learner will be able to:

- Understand CPFR, its operation, and its benefits
- Compare pull systems versus push systems
- Describe the key aspects of demand sensing
- Explain the concept of demand shaping
- Apply some key best practices in demand planning

# Unit 1: Collaborative Planning, Forecasting, and Replenishment (CPFR)

CPFR is a fairly recent development in SCM that has significantly affected demand planning. CPFR is a method of cooperation between suppliers and customers to align forecasts, production, and orders more accurately so as to reduce the amount of inventory. CPFR follows a defined framework that combines the intelligence of multiple trading partners with the planning and fulfillment of customer demand.

CPFR has the objective of increasing product availability to customers while reducing inventory, transportation, and logistics costs. CPFR involves collaborative forecasting, which entails collecting and reconciling information from both inside and outside organizations and working together with other supply chain partners in order to come up with a single demand projection. CPFR is being used more by companies partly because it helps reduce the bullwhip effect, which is outlined in the next section.





Figure 24. CPFR. Developed by LINCS in Supply Chain Management Consortium.

# The Bullwhip Effect

The bullwhip effect was first noted by an MIT systems scientist named Jay Forrester. The bullwhip effect (Logistics & Materials Handling Blog, 2012) reflects the fact that, when businesses are situated further back in the supply chain, inventory swings occur in larger waves in response to customer demand, so that the largest impact of the whip hits suppliers of raw materials, who feel the greatest demand variation in response to customer demand variation. The result is that supply chain participants build and maintain buffer or safety stocks to compensate for swings in orders.

### The Bullwhip Effect: An Example

The actual demand for a particular consumer product is forecasted at 20 units per week. Even so, a retailer might order 25 units from the distributor to protect against a stock-out. In turn, the distributor might order 30 units from the manufacturer to prevent future unfilled orders from the retailer. The manufacturer receives the order for the 30 units and orders enough raw materials to build 40 units, as an added safety margin.

Forty units will now be manufactured when there was only customer demand for twenty units, creating a potential oversupply of twenty units. Repeating this process puts unnecessary demands on raw material suppliers, who are furthest back in the supply chain, and might eventually force manufacturers, distributors, and retailers to collaborate on increasing demand by reducing prices and employing other marketing techniques to sell excess inventory (see *Figure 25*). This example uses only one retailer; the effect when orders from multiple retailers are exaggerated back through the supply chain could be enormous.





Figure 25. Impact of the bullwhip affect creating excess demand through the supply chain. Developed by LINCS in Supply Chain Management Consortium.

### Contributors to the Bullwhip Effect

There are numerous factors that contribute to the bullwhip effect; some of the most prevalent are described next. The one key factor that can prevent the bullwhip effect and smooth out the flow of products is by having all trading partners in the supply chain collaborate using accurate data and sharing updates as they arise.



Lack of communication: links in the supply chain do not communicate effectively or are comfortable in sharing information.



**Inconsistent demand information:** demand information is not continuously updated and relies too much on past data to estimate current demand.



**Disorganization**: a lack of clarity and communication within and among businesses in the supply chain results in smaller and larger product quantities than what is needed.





Lack of trust among supply chain partners: businesses pad their real requirements because accurate data is not shared among partners and companies fear being caught short.

**Inaccurate lead times**: as conditions like raw material availability change and transportation networks are revised, product lead times need to be updated accordingly, and assuming that previously accurate lead times are still valid could lead to overestimating or underestimating demand and future orders.

Figure 26. Contributors to the bullwhip effect. Developed by LINCS in Supply Chain Management Consortium.



Figure 27. The bullwhip effect. Developed by LINCS in Supply Chain Management Consortium.

### How CPFR Works and Produces Results

Companies use CPFR processes to manage inventory, provide inventory visibility, order products, and replenish products throughout the supply chain. Information is often shared among partners in the supply chain during regular meetings and via secure Intranet links. Information sharing helps supply chain partners plan for and meet customer demand, including variability due to anticipated and actual customer demand, lead times, forecasts, and production levels. Sharing information also allows supply chain partners to receive real-time updates about inventory and demand, which reduces uncertainty, mitigates the bullwhip effect, and helps lower carrying unnecessarily large amounts of inventory.

For example, a major retailer might discover that one of its suppliers, a personal care products company, is not able to meet its buyer's requirements for holding enough stock to satisfy demand on a regular basis. The two companies then meet to see how the problem can be resolved and to develop a process to link customer demand with replenishment needs throughout the entire supply chain. They develop a test run, or pilot effort, in which they look at the forecast demand for toothpaste at the retail firm that was routinely running out of stock.

They first test the collaborative concept on paper and then demonstrate in a lab that the Internet can be used for the information exchange. The retailer and supplier then set up a joint planning group to forecast demand and a real-time system for sharing demand through a secure Internet link. The supplier is then able to see demand in real time and adjust its planning and delivery schedules



accordingly. This information results in a substantial increase of toothpaste stock at the retailer's stores, reduced lead times, and increased overall sales for both companies.

According to the Voluntary Inter-industry Commerce Standards (VICS), the benefits of implementing CPFR include:

- Increased sales by 10% to 30% by having product in stock more often
- Increased margin rate by 2% to 6% by reducing inventory costs
- ☑ Increased in-stock percentages by 2% to 7% from better stock planning
- Decreased inventory by 10% to 30% by lowering safety stock levels
- Improved forecast accuracy by 20% to 30% from sharing data
- Decreased logistics and operating costs by 10% to 28% from all of the above

# Unit 2: Pull Systems and Push Systems

Inventory management approaches generally distinguish between pull systems and push systems. Sometimes called a reactive system, the pull approach relies on customer demand to pull product through a supply chain. By contrast, the push or proactive approach uses inventory replenishment to anticipate future demand.

### **Differences between the Systems**

A key advantage of pull systems is their ability to respond quickly to sudden or abrupt changes in demand. A push system, meanwhile, meets system-wide inventory needs in an orderly and disciplined way based on a master production plan. The trigger to initiate an act in a push environment originates **upstream** (with customers), and downstream entities (suppliers) respond accordingly. The trigger is often a forecast of anticipated demand that sets the supply chain in motion. Pull systems sometimes involve only one-way communication between point of need and point of supply, while push systems involve more two-way communication between point of need and point of supply.

### For example...

Fast food restaurants operate on pull systems, but bakery services operate on push systems. Fast food restaurants make hamburgers and sandwiches in response to current demand because individual purchases trigger more food item production. On the other hand, bakeries attempt to anticipate what customers will need and push food items to where customers need them ahead of time.





In traditional push operations, most manufacturing operations are concerned with equipment utilization. Most companies that invest capital in equipment want to see that equipment used as much as possible and as efficiently as possible. Performance measures within these centers focus on efficiency, pieces produced per hour, and equipment utilization. However, having idle equipment is better than producing unneeded components, assemblies, and finished products. This means that many manufacturing operations, or work centers, will produce items to anticipate demand, sometimes to ensure high equipment utilization, which essentially means that they are pushing items into the supply chain.

The U.S. operations of Hyundai is a famous example of a push mentality (Welch, Kiley, & Ihlwan, 2008). Hyundai had a history of building factories to produce vehicles without any orders placed for specific vehicles, thus anticipating future demand (Welch et al., 2008). At one point, Hyundai had about 32,000 unsold Sonata sedans located at its Alabama assembly plant (Welch et al., 2008).

The company established its sales targets based on what it could produce rather than what it could sell (Welch et al., 2008). A Korean professor of auto economics commented that Hyundai's "productionoriented style of pushing all the time won't work anymore" (Welch et al., 2008). As seen before, pushing production without any concrete immediate demand, and often in excess of the actual eventual demand, can result in high inventory carrying costs, with products waiting to be sold, and can result in decreased profits if products have to be sold below normal prices.

# Unit 3: Sensing Demand and Shaping Demand

### **Sensing Demand**

Demand sensing is a tactic used to prepare the demand forecast; it involves the collection of information about real-time changes in demand. Demand sensing uses a broad range of demand signals, including current data from the supply chain and analytics to create an accurate forecast that responds to real-world events like changes in markets, extreme weather events, and consumer buying behavior.



A variety of technological tools are used to collect data, including POS data and social media activity. Demand sensing is generally the responsibility of sales and marketing when forecasting is undertaken.

### Sor example...

A sporting goods footwear manufacturer may follow social media to investigate trending products and sales locations. More specifically, the manufacturer may follow social media to look for communication about their products, to determine what various customers and potential customers are saying about those products, and to determine if this indicates a potential increase (or decrease) in demand for those products.



Figure 29. Statistical data from a range of sources impacts the demand plan. Developed by LINCS in Supply Chain Management Consortium.

### **Shaping Demand**

In another element of preparing a forecast, sales and marketing may plan to shape demand by influencing customers with price discounts or other promotional incentives. For example, a company can provide a discount on its products over a specified period of time to increase, or shape, demand. This company could also increase prices to decrease demand, if needed, when demand is greater than supply. Demand shaping involves influencing customer orders while also reducing the uncertainty of when those orders will occur.





Figure 30. Forecasting projects future demand. Developed by LINCS in Supply Chain Management Consortium.

Demand shaping, or influencing demand, is the main task of sales and marketing groups; it can have a significant impact on demand forecasts. This is not a simple task because as markets change, customers' preferences change, economies change, and competition changes. For demand shaping to work efficiently, companies must understand customers' needs and wants and have a way of communicating their shaping strategies throughout the organization.

### **Demand Plan Impact from Shaping and Sensing**

Shaping and sensing demand activities must be communicated with demand planners and all other relevant groups within a company. Communication allows demand planners to update the demand plan, work with key partners inside the firm, ensure the demand plan is met, and confirm that all tasks are being undertaken by the appropriate groups in line with the demand plan.

For example, once the demand planner ensures that the procurement group knows that demand for substitute products is being shaped or will be stimulated, the procurement group must adjust its supply plans accordingly to make sufficient numbers of the substitute product available and reduce the stocking of other items as necessary. Fulfilling these tasks includes the manufacturing group's knowing the demand for a particular product is being shaped and adjusting its schedules by reducing or increasing particular production runs as necessary.

# Learning Block 6 Summary

CPFR aids in cooperation between suppliers and customers to align forecasts, production, and orders more accurately and reduce inventory amounts. Supply chain factors, demand and supply variations, lack of communication, and disorganization can result in the bullwhip effect, while CPFR can help reduce the bullwhip effect. With CPFR, supply chain partners create plans to reduce variances between supply and demand and share the benefits of a more efficient and effective supply chain.



Inventory management approaches generally distinguish between pull and push systems. Sometimes called a reactive system, the pull approach relies on customer demand to pull product through the supply chain. In contrast, the push or proactive approach uses inventory replenishment to anticipate future demand. Pull systems feature actions taken in response to direct requests rather than anticipating needs or requests that may never arise.

Demand sensing is a method of obtaining information about demand that focuses on real-time changes in demand and demand management. To be genuinely effective, methods are needed for sensing demand and



Figure 9. Demand planning. Developed by LINCS in Supply Chain Management Consortium.

changes to demand as soon after they arise as possible. Demand management cannot be accomplished effectively without clear, continuous, and timely communication between demand managers and key groups at all levels within companies.

Demand shaping can influence demand and inventory planning. Demand shaping occurs when companies try to influence what customers will buy; one of its key principles is encouraging customers to buy alternative products or delaying purchasing products. A common tactic to increase demand is offering price discounts. All attempts to shape demand must be communicated with demand planners and all other relevant groups within companies.

# Learning Block 6 Practice Questions

#### 1. CPFR is:

- a. Also known as demand shaping
- b. A way of supplying products as they are needed
- c. A proactive method of sharing information among key supply chain partners
- d. A formula used to calculate safety stock
- 2. CPFR is defined as:
  - a. Collaborative forecasting, which involves collecting and reconciling information from inside and outside an organization to come up with a single demand projection
  - b. Non-collaborative forecasting, which involves collecting and reconciling information within an organization to come up with a single demand projection
  - c. Collaborative forecasting, which involves collecting and reconciling information from inside and outside an organization to come up with multiple demand projections
  - **d.** Collaborative forecasting, which involves collecting and reconciling funds from inside and outside an organization to come up with a single demand projection



- 3. With Collaborative Planning, Forecasting, and Replenishing, supply chain partners coordinate plans in order to:
  - a. Increase variance between supply and demand and share the benefits of a more efficient and effective supply chain
  - b. Reduce variance between supply and demand and share the benefits of a more efficient and effective supply chain
  - c. Increase variance between supply and demand and share the costs of a less efficient and effective supply chain
  - d. Reduce variance between supply and demand and share the benefits of a less efficient and effective supply chain
- 4. Several factors are critical to the success of, Collaborative Planning, Forecasting, and Replenishing including:
  - a. Excluding supplier inputs
  - b. Ignoring variability
  - c. Disallowing incentives
  - d. Sharing sales information

#### 5. A key principle of demand shaping is:

- a. Encouraging customers to buy alternative products or delay purchasing
- b. Encouraging customers to buy a competitor's products or to delay purchasing
- c. Discouraging customers from buying alternative products or delaying purchasing
- d. Encouraging suppliers to buy alternative products or to delay purchasing
- 6. When a company has a fixed capacity and demand exceeds supply, the company may:
  - a. Encourage customers to check availability at competing firms
  - b. Do nothing to change demand
  - c. Decrease prices and increase marketing spending
  - d. Encourage customers to buy alternative products of which there may be a greater supply available
- 7. Another tactic used to increase demand is to:
  - a. Offer price discounts
  - b. Increase prices
  - c. Reduce the number of suppliers
  - d. Do nothing
- 8. One issue with the type of demand shaping described in Question 7 is that, if used on a regular basis:
  - a. Sales will plummet
  - b. Demands will be more difficult to forecast
  - c. Customers may delay purchasing goods until prices are increased
  - d. Buying behaviors may change



- 9. Sometimes called a reactive system, the pull approach relies on:
  - a. Customer demand to pull a product through the logistics system
  - b. Supplier demand to pull a product through the logistics system
  - c. Top management demands to pull a product through the logistics system
  - d. Customer demands for reduced prices
- 10. Management and prioritization, or reprioritization, of demand should occur when it becomes evident that:
  - a. All other actions have failed
  - b. The company has become insolvent
  - c. Demand is steady
  - d. The volume, mix, and timing of actual demand differs from the demand plan



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# Practice Questions Answer Key

Learning Block 1	Learning Block 4
1. A	1. D
2. B	2. C
3. C	3. C
4. C	4. A
5. D	5. C
6. C	6. A
7. C	7. C
8. D	8. A
9. D	9. A
10. D	10. B
Learning Block 2	Learning Block 5
1. C	1. D
2. D	2. B
3. B	3. C
4. D	4. C
5. D	5. C
6. A	6. C
7. B	7. D
8. A	8. D
9. B	9. A
10. A	10. A
Learning Block 3	Learning Block 6
1. A	1. C
2. D	2. A
3. B	3. B
4. C	4. D
5. C	5. A
6. C	6. D
7. D	7. A
8. B	8. D
9. B	9. A
10. B	10. D



# Demand Planning Certification Track Glossary

\*: Indicates terms coming, in part or in whole, from the Supply Chain Management Terms and Glossary from August 2013.

#### <u>A</u>

ABC Classification\*: A method of classifying inventory items relative to their impact on total control. ABC typically uses movement and cost data to calculate the value of stock usage over the prior period, and uses the result as an element in ranking items under an 80/20 Pareto rule for cycle counting purposes to focus efforts on those selected items and possibly reduce the cost associated with frequent counting of slow moving items. The group is divided into classes called A, B, and C (and sometimes D). The A group represents the highest value and 10 to 20% by number of items. The B, C, and D (if used) groups are each lower values but typically higher populations. Items with higher usage value (the 20%) are counted more frequently. Specific bars to be used in setting ABC levels will vary by organization as they will impact the financial control applied to inventory and the level of effort spent counting.

#### B

**Best Practice\*:** A specific process or group of processes that have been recognized as the best method for conducting an action. Best practices may vary by industry or geography, depending on the context. Best practices methodology may be applied with respect to resources, activities, cost objectives, or processes. Note: Best practices that are generally available from any source should be analyzed to determine their applicability to given situations before being used as guidelines or benchmarks.

**Bottom-Up Plan\***: A manual technique of resource planning that allows users to interact with the system at much lower levels of detail using disaggregated demand and supply orders and tracing the demand of a lower level component to higher level assemblies and products.

#### Buffer Stock\*: See Safety Stock.

**Bullwhip Effect\*:** Also known as the whiplash effect, it is an observed phenomenon in forecast-driven distribution channels. The bullwhip effect creates disruption and expense within organizations and has a ripple effect for customers and suppliers. The oscillating demand magnification upstream in a supply chain is reminiscent of a cracking whip. The concept has its roots in J. Forrester's *Industrial Dynamics* (1961) and is thus also known as the Forrester Effect.

#### <u>C</u>

Capital\*: The resources, or money, available for investing in assets that produce output.

**Causal Forecasts:** Forecasts that use specific factors to determine future demand. For example, if prices are lowered, causal forecasts determine how much more product will be sold.

**Collaborative Planning, Forecasting, and Replenishment (CPFR)\***: A concept that aims to enhance supply chain integration by supporting and assisting joint practices. CPFR seeks cooperative management of inventory through joint visibility and replenishment of products throughout the supply chain.



**Corrective Action Report\*:** A change implemented to address a weakness identified in a management system. They are usually brought to the company's attention by a customer complaint of nonconformities identified during an internal audit or adverse or unstable trends in product and process monitoring identified by statistical process control.

**Costs of Ordering:** In the EOQ model, costs of ordering are the incremental costs of processing an order of goods from a supplier. Examples of order costs include the costs of preparing a requisition, a purchase order, and a receiving ticket; stocking the items when they arrive; processing the supplier's invoices; and remitting the payment to the supplier.

CPFR: See Collaborative Planning, Forecasting, and Replenishment.

**Customer Order Cycle:** The process from the time the order is placed until the time the order is received.

Customer Order Management Function: Primarily concerned with managing customer orders, involves managing the customer order cycle from the time the order is placed until the time the order is received.

Customer Service\*: Activities between buyers and sellers that enhance or facilitate the sale or use of sellers' products or services.

#### D

**Daily Orders:** A type of order that is picked, packed, and shipped the day it is received. Dealers use this type of order when they have an immediate need and cannot satisfy demand from their internal inventory. See also *Stock Orders*.

**Demand\*:** What customers or users actually want. It is typically associated with the consumption of products or services as opposed to a prediction or forecast.

**Demand Estimates:** Include anticipated orders, orders received, and adjustments resulting from changes in inventory policies and actions. Demand estimates are used as a primary data input for manufacturing schedules, procurement plans, and inventory stocking polices.

**Demand Forecasting:** A key responsibility in inventory management by forecasting the amount of inventory that will be required over a set period of time to meet customers' needs. Several forecasting tools and techniques are used for this. Accurate demand forecasting is important as both oversupply and undersupply of inventory can have adverse business impacts and result in excessive costs. The more accurate the forecast can be, the better a company can service its customers.

**Demand Management\*:** The proactive compilation of required information regarding demand (i.e., customers, sales, marketing, and finance) and the firm's capabilities from the supply side (i.e., supply, operations, and logistics management); the development of a consensus regarding the ability to match the requirements and capabilities; and the agreement upon a synthesized plan that can most effectively meet customer requirements within the constraints imposed by supply chain capabilities.

**Demand Plan Accuracy:** The measure of the accuracy of the demand plan over time. This measure is used to determine how closely the plan matches actual overall demand along with demand by key customers and the degree of variation of actual demand from the plan.

**Demand Planning\***: The process of identifying, aggregating, and prioritizing all sources of demand for the integrated supply chain of a product or service at the appropriate level, horizon, and interval.


Demand Rate: The rate of demand for stock that can vary over time.

**Demand Sensing\*:** Using channel data to reduce latency in sensing customer buying trends.

**Demand Shaping\*:** Using programs, including pricing, new product launch, trade and sales incentives, promotions, and marketing programs, to increase what customers want to buy.

**Demand Signal\*:** A signal from a consumer, customer, or user operation that triggers the issue of product or raw material. The demand signal is most efficiently an electronic data transmission, but it could be a physical document or telephone call.

**Dependent Demand:** A term in economics in which demand for one good or service occurs as a result of demand for another. This may occur when the former is an integral part of producing the latter.

**Downstream\***: Referring to the demand side of the supply chain. One or more companies or individuals who participate in the flow of goods and services moving from the manufacturer to the final user or consumer.

Downturn: A situation in which a business or economic activity decreases or becomes worse.

E

**Ecommerce:** Electronically communicating with and handling customers, whether through email, phone, different means online, or another source using electronic devices.

Economic Order Quantity (EOQ)\*: An inventory model that determines how much to order by determining the amount that will meet customer service levels while minimizing total ordering and holding costs.

EOQ\*: See Economic Order Quantity.

**Expert Forecasts:** Uses the input from experts to generate forecasts. The Delphi method is an example of an expert forecast; it uses the opinions of several experts to agree on a future demand.

**Financial Plan:** In many organizations, the financial plan is developed separately, like the supply plan. The financial plan is often a reflection of the overall business plan and financial forecasts that are often different from the planned demand.

**Fixed Order Interval\***: A re-ordering strategy in which orders are placed on a fixed order schedule, while the quantity ordered is adjusted from order to order to accommodate actual consumption or forecast requirements.

**Fixed Order Quantity**\*: An inventory reorder method that causes all replenishment orders to be at a predetermined size, or a multiple thereof. This is typically introduced to accommodate price breaks, packaging, or shipping requirements.

**Forecasting\***: Predictions of how much of a product will be purchased by customers. Relies on both quantitative and qualitative methods.

Independent Demand\*: The finished goods that will be sold.



**Inventory\*:** Inventory includes components, raw materials, work-in-process, finished goods, and supplies required for the creation of goods and services. Inventory can also refer to the number of units or value of the stock of goods held by a company.

**Inventory Carrying Costs\*:** One of the elements comprising a company's total SCM costs. These costs consist of: hurdle rate, insurance and taxes, inventory risk costs, and storage space costs.

**Inventory Control**: The output of processes and procedures that ensure that the amount of material on hand equals the amount of material recorded in the computer systems.

**Inventory Performance**: A term used to represent the results on a set of inventory performance metrics.

**Inventory Turns\***: This ratio measures how many times a company's inventory has been sold (turned over) during a period of time; the cost of goods sold divided by the average level of inventory on hand. Operationally, inventory turns are measured as total throughput divided by average level of inventory for a given period; how many times a year the average inventory for a firm changes over or is sold.

#### L

Lead Time\*: The total time that elapses between an order's placement and its receipt. Lead time includes the time required for order transmittal, order processing, order preparation, and transit. Variants are supplier lead time, manufacturing or assembly lead time, and customer order lead time.

#### Μ

Manufacturing Schedules: The timetable for the use of resources and processes required by a business to produce goods or provide services.

Market Size: The number of individuals in a certain market who are potential buyers or sellers of a product or service.

**Master Production Schedule\***: The master level or top-level schedule used to set the production plan in a manufacturing facility. Sometimes shortened to MPS, it is created from the demand forecast and tells the factory how many end item products are needed by a certain timeframe.

**Metrics\***: Specific areas of measurement. A metric must be quantitative, must support benchmarking, and must be based on broad, statistically valid data. Therefore, it must exist in a format for which published data exists within the enterprise or industry.

#### 0

**Order Entry\***: The process of receiving orders from customers and entering them into companies' order processing systems. Orders can be received through phone, fax, or electronic media. Activities may include examining orders to ensure an orderable configuration and to provide accurate prices, checking customers' credit and accepting payments (optionally), identifying and reserving inventory (both on hand and scheduled), and scheduling and committing to a delivery date.

**Order Processing\*:** Activities associated with accepting and filling customer orders. The trigger for the distribution process; it includes order entry, scheduling, invoicing, status inquiries, tracing, expediting, information requests, credit checking, and accounts receivable processing and collection.

Order Transmittal: The act of sending an order or causing an order to be transmitted.



**Outputs:** The amount of energy, work, goods, or services produced by a machine, factory, company, or individual within a certain period.

P

**Procurement\*:** The activities associated with acquiring products or services. The range of activities can vary widely between organizations to include all of parts of the functions of procurement planning, purchasing, inventory control, traffic, receiving, incoming inspection, and salvage operations.

**Procurement Groups:** The group in organizations responsible for the act of obtaining or buying goods and services.

**Production Runs:** A group of similar or related goods produced by using a particular group of manufacturing procedures, processes, or conditions.

**Pull System**\*: A system in which each warehouse controls its own shipping requirements by placing individual orders for inventory with the central distribution center. This is a replenishment system where inventory is pulled into the supply chain (or demand chain) by POS systems or ECR programs, and it is associated with build-to-order systems. See also *Push System*.

**Push System\*:** A situation in which a firm makes inventory deployment decisions at the central distribution center and ships to its individual warehouses accordingly. See also *Pull System*.

<u>R</u>

**Reorder Points\***: The reorder point is the point at which a company reaches the amount of inventory to satisfy demand until the next order is received. Reorder points determine when a company needs to place another order to replenish product. There are two types of reorder points: fixed order quantity and fixed order interval.

#### <u>S</u>

**Safety Stock\***: The inventory a company holds above normal needs as a buffer against delays in receipt of supply or changes in customer demand.

SCM\*: See Supply Chain Management.

Service Level\*: A metric shown as a percentage that captures the ability to satisfy demand or responsiveness. Order fill rates and machine or process up-time are examples of service level measures.

Setup Costs\*: Expenses incurred in setting up a machine, work center, or assembly line, and switching from one production job to another.

### SKU\*: See Stock Keeping Unit.

**Stock Keeping Unit (SKU)\*:** A category of unit with a unique combination of form, fit, and function (i.e., unique components held in stock). A package that contains a number of individual items identified by UPCs. If two items are indistinguishable to the customer, or if any distinguishing characteristics visible to the customer are not important to the customer, so that the customer believes the two items to be the same, these two items are part of the same SKU.

**Stock Orders:** An order type that receives a 15% price discount and is submitted once a week by a dealer to replenish internal inventory. See also *Daily Orders*.



Supplier Selection: The process by which firms identify, evaluate, and contract with suppliers.

**Supply Chain Management (SCM)\*:** The design and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Notably, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party logistics providers, and end customers.

**Supply Planning\*:** The process of identifying, prioritizing, and aggregating, as a whole with constituent parts, all sources of supply that are required and add value in the supply chain of a product or service at the appropriate level, horizon, and interval. Includes decisions about major capital expenditures and how to rationalize various assets.

Time Horizon: Also referred to as timeframe; the time period used to determine product need.

**Top-Down Plan**: Strategy used in corporate planning in which top management personnel sets the goals and controls planning activities for all lower levels of management.

U

**Upstream\***: Refers to the supply side of the supply chain. Upstream partners are the suppliers that provide the organization with goods and services needed to satisfy demand that originate at point of demand or use, as well as other flows, such as return product movements or payments for purchases.

V

VICS\*: See Voluntary Inter-industry Commerce Standards.

**Voluntary Inter-industry Commerce Standards (VICS)\*:** Association that aims to enhance supply chain integration by supporting and assisting joint practices.



# **Notes Page**



## Addendum

The previous document version was V2.17 (file name LINCS.DP.v2.17.08192016).

Current version is v2.20 (file name LINCS.DP.v2.20.03272017) and contain the following updates:

- Replaced all CanStockPhoto images
- Replaced all unnecessary instances of "above" and "below".
- The abstract page was corrected to match all other tracks
- All non-working links were replaced or deleted
- Updated reference page

