LINCS: Leveraging, Integrating, Networking, Coordinating Supplies

SUPPLY CHAIN MANAGEMENT PRINCIPLES

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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Educating and Connecting the World's Supply Chain 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 **Supply Chain Management Principles**. The national certification examination will include questions on both the **Supply Chain Management Principles** 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.

Supply Chain Management Principles Certification Track Table of Contents

Abstract

This certification track, Supply Chain Management Principles, is intended to provide an overview of the supply chain functions. Each function has a corresponding certification track that provides much greater detail than what is presented here. The goal of this certification track is to provide information in a Learning Block format and for the learning blocks to correspond with the additional certification tracks listed below:

- Demand Planning
- Supply Management and Procurement
- Warehousing Operations
- Inventory Management
- Manufacturing and Service Operations
- Transportation Operations
- Customer Service Operations

These functions are presented in the specific order outlined above to enable the student to learn and easily understand the sequence and dependencies within the chain. As students move from Demand Planning to Supply Management and Procurement, and so on, they should think about what they have already learned and apply it as they move through the new learning block. For example, procurement cannot make purchases without receiving requirements in the form of purchase requisitions from the demand planning function, while manufacturing cannot assemble products without having the right materials and inventory available at the right time.

Customer Service Operations is woven into every aspect of the supply chain but is presented *last* in this certification track. While customer satisfaction and customer retention are of paramount importance for every company, actual product and service offerings must be made available for customers from an operational supply chain. These products and services are used to attract customers and therefore demonstrate the need for customer service operations.

The goal of this certification track is to prepare students to successfully pass the supply chain management principles national certification examination. The content of this 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: Demand Planning Overview

Learning Block 1 Description

Supply Chain Management (SCM) is about balancing supply with demand. This learning block provides an overview of **sales and operations planning** (**S&OP**), demand planning, demand forecasting, and **collaborative planning, forecasting, and replenishment** (**CPFR**). Companies are better able to manage the balance between supply and demand when they are able to integrate information and work towards the same goal.

Demand planning is the first link or function in a company to begin the **supply chain** planning process. This learning block provides an overview of demand forecasting, demand planning, and the collaboration required by departments in a company. Companies are better able to manage the balance between supply and demand when they accurately forecast and plan **customer** needs and demands.

Learning Block 1 Learning Objectives

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

- Describe integrated business management
- Explain how **demand shaping** is used to manage demand
- Distinguish between qualitative and quantitative methods of forecasting
- Categorize the different types of **demand patterns**
- Recognize **materials requirements planning** (**MRP**), **capacity requirements planning** (**CRP**), **distribution requirements planning** (**DRP**), and **enterprise resource planning** (**ERP**) as systems that help plan for integrated operations across the supply chain
- Explain the mechanisms and benefits of CPFR

Unit 1: Integrated Business Management

Supply chains are the flow of materials, information, and finances as they move in all directions from supplier to manufacturer to wholesaler to retailer to **consumer**, so managing the supply chain can be complex. As shown in *Figure 1*, supply chains are managed by an integrated business plan based on the strategies, mission, and vision of the firm. The business plan drives the demand plan and the supply plan.

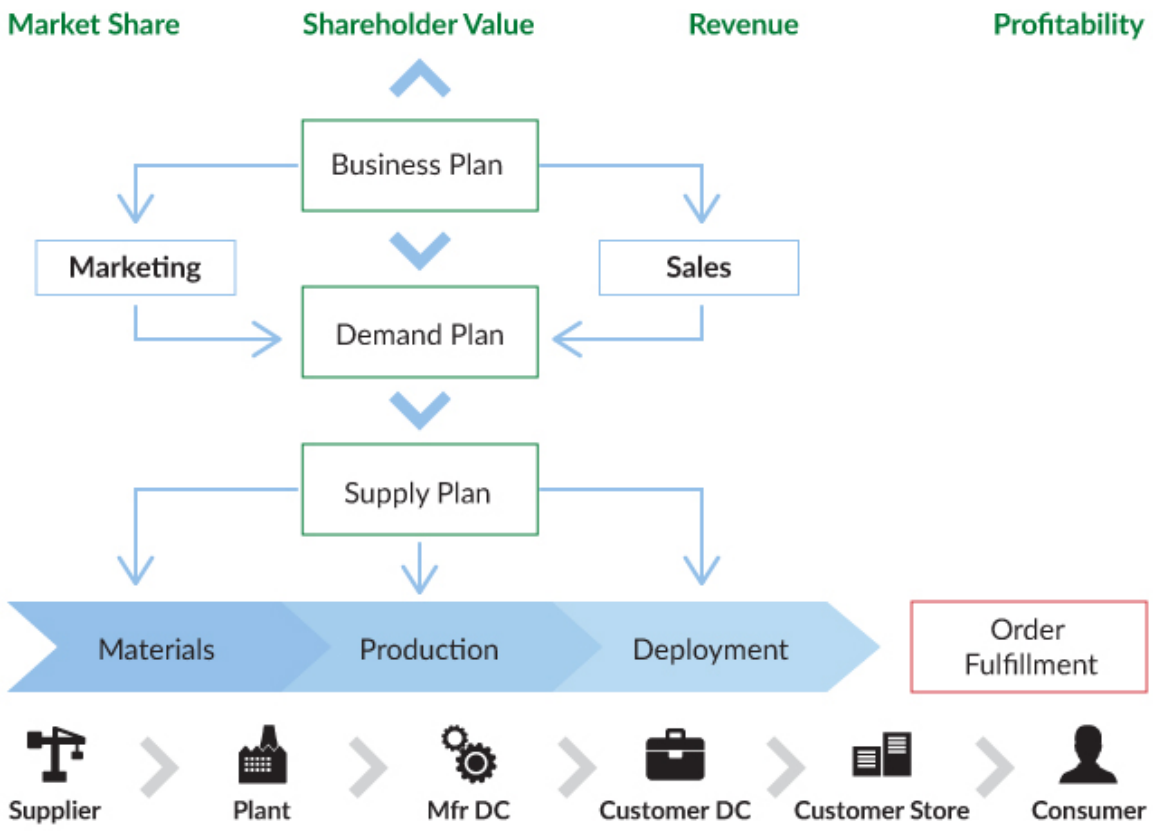

Figure 1. Integrated business management. Developed by LINCS in Supply Chain Management Consortium.

Customer demand is the key driver of the supply chain. Demand management is the **process** by which manufacturers are able to recognize demand through forecasting and customer orders; it can also influence and shape demand through marketing and sales strategies and activities. The supply plan adheres to the agreed-upon demand plan and delivers the targeted revenue, profitability, and cash flow objectives.

Balancing Supply and Demand

Balancing supply with demand is a constant battle, and companies are continually trying to find ways to improve the process. If there is too much demand and not enough supply, business is lost and may never be recaptured. On the other hand, if there is too much supply, companies might have money tied up in **inventory** and storage facilities and run the risk of products becoming obsolete.

The balance between supply and demand can be improved either internally or externally. The internal method for balancing supply and demand means being able to vary how much is produced and how much is stored in inventory. Companies may have production equipment that enables them to change what they are producing quickly, which a key characteristic of lean is manufacturing.

The external balancing method adapts the price and **lead time**. As an adapting price example, if a customer goes online to order a personal computer from Dell with the intent of ordering a 15-inch monitor but sees that the 17-inch monitor is being offered at the same price, Dell may actually be

using the lower price to attract more customers to purchase the 17-inch monitors because they have an abundance of these monitors in inventory.

This concept is also called demand shaping. Dell is able to shape their demand by lowering the price and attracting more demand for their overstock of 17-inch monitors. As an example of changing the lead time, Dell could tell the customer that it will take four days for their preferred laptop to be shipped, but other laptops are available in two days. The customer can then decide the importance of the time spent waiting for their delivery when making the purchase decision. In order to offer the customer these different options, Dell must have information technology that is sophisticated enough to track their available inventory and their assembly schedules.

Figure 2. Adapting price to shape demand. Developed by LINCS in Supply Chain Management Consortium.

Unit 2: Collaborative Planning Process

Demand planning is a comprehensive, collaborative process that requires the consensus of all departments and relevant personnel in a company. Consensus is achieved through collaboration, which is defined as personnel working jointly to achieve an agreed-upon outcome. The outcome in this case is the actual demand plan shown in *Figure 3*. This is also referred to as CPFR, a process of sharing visibility, information, and resources that facilitates planning to satisfy customer demands.

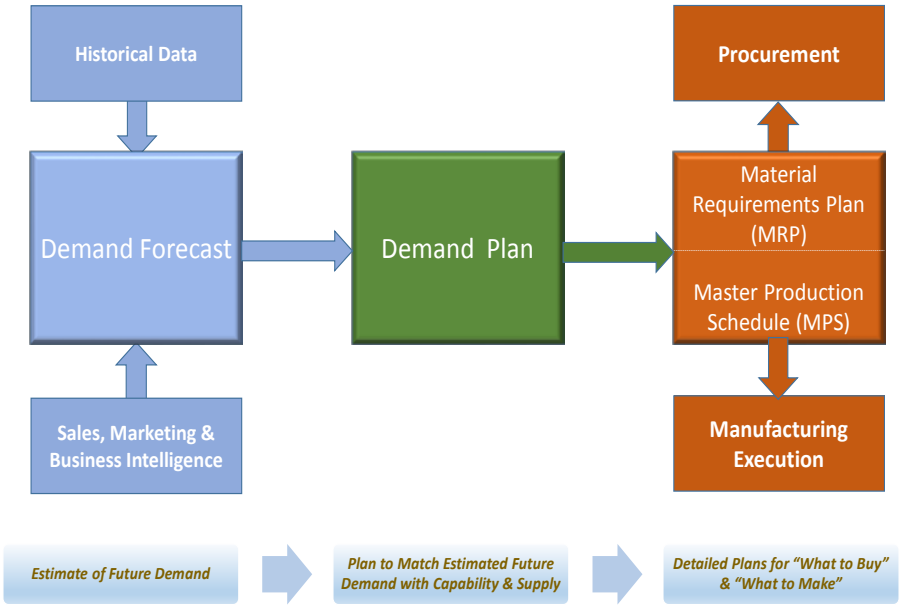

Figure 3. Collaborative Planning Process. Developed by LINCS in Supply Chain Management Consortium.

The process is driven by a demand forecast, which is based on historical sales data and other business intelligence provided by sales, marketing, and business management personnel. Organizations use S&OP to help develop inputs for the forecast. These processes result in a forecast, or estimate, of future demand. Companies cannot work solely from forecasts or estimates; there must be additional

collaboration among other functions to create the most accurate and reliable demand plan possible. The demand plan provides accurate levels of detail by factoring in the demand forecast and matching that with items that need to be procured from suppliers and manufacturing capacities and capabilities. The resulting outputs from the demand plan are the MRP that details what to procure (buy) from suppliers and the **master production schedule** (**MPS**) that specifies which products to make and when to make them. The system that integrates the individual demand forecasts and plans is referred to as the ERP system.

Anticipated customer demand is the real genesis, or baseline, for the demand forecast. The demand forecast is a high-level comprehensive plan initiated by senior-level executives with marketing and sales inputs and is shaped by anticipated customer needs and desires. It also incorporates the business elements of vision and expectations for the company's shareholder value, revenues, market share, and profitability.

Once the demand forecast is finalized, it enables the creation of the demand plan, which more accurately defines resource requirements such as facilities, equipment, materials, and employees. Finally, the MRP & MPS plans are created to define specific **raw materials** and semi-finished goods that are necessary for manufacturing and distribution to achieve the targeted revenue, profitability, and cash flow objectives.

Unit 3: Demand Forecasting Methods

Demand planning acknowledges that demand is generated by the demand forecast and actual customer historical information and customer orders. Forecasting can be accomplished using two methods:

- **Quantitative Forecasting**: When historical data exists and is helpful in calculating future demand or forecasting based on numbers (see *Figure 4*)
- **Qualitative Forecasting**: When there is little historical data to rely on, as when launching a new product or with a product that changes frequently, and intuition or expert judgment is required

Figure 4. Forecasting documentation. Developed by LINCS in Supply Chain Management Consortium.

With each method, it is important to understand the events and conditions that modify demand. The forecasting process focuses on both external and internal inputs. External inputs include current and new customers, the competition, and the overall industry-specific outlook of the economy. Internal inputs to the forecast focus on the pricing and special promotions planned and the existence of any new product launches.

The output of a forecast that focuses on both external and internal inputs will produce a forecast that represents more accurate total demand.

Types of Demand Patterns

Whether a quantitative or qualitative method is used, a model of the demand pattern is determined. Stationary patterns exhibit steady, even demand with very little fluctuation. Random patterns, on the other hand, exhibit changes and variances that are not predictable. Other forecast models include (see *Figures 5 - 8*):

Trend	Seasonal	Cyclical	Trend with Seasonality
Predictable growth or decline	Patterns of increase and decline that repeat cycle after cycle	Patterns that are influenced by external factors such as the broader economy or changes in customer preferences	Predictable growth or decline based on cycles

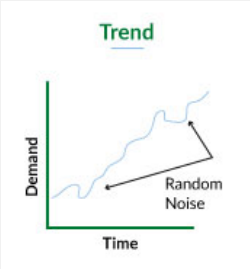

Figure 5. Example of trend demand pattern. Developed by LINCS in Supply Chain Management Consortium.

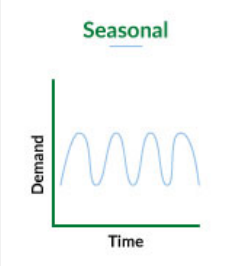

Figure 6. Example of seasonal demand pattern. Developed by LINCS in Supply Chain Management Consortium.

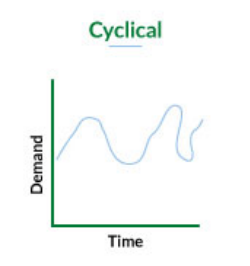

Figure 7. Example of cyclical demand pattern. Developed by LINCS in Supply Chain Management Consortium.

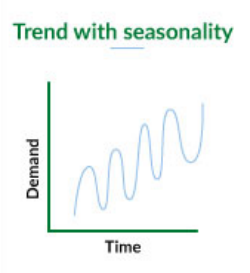

Figure 8. Example of trend with seasonality demand pattern. Developed by LINCS in Supply Chain Management Consortium.

Challenges of Demand Planning

Determining demand for particular products or services can be challenging. One challenge is receiving customer demand data early enough to make a decision, especially if there is a lack of sales force input because of fluctuating demand patterns. Another challenge is determining demand for new products because a highly coordinated effort must be synchronized between departments such as sales, finance, research and development, engineering, and marketing management.

Forecasting is almost never perfect, so plans should consider and allow for potential inaccuracies. Several acceptable methods of measuring forecast error and the actual errors calculated should be shared with key stakeholders. Long-range forecasts tend to have a greater degree of error than short-term forecasts. Short-term forecasts have less uncertainty because of known market conditions, defined customers, and highly accurate materials and production planning. Long-range forecasts run the risk of experiencing larger fluctuations and therefore pose greater risk to the plan.

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

Unit 4: Independent and Dependent Demand

Balancing supply and demand takes many different levels of planning to make sure that the necessary materials are available at the right time. In addition to controlling the inventory in the **warehouse**, it is also essential to have a clear plan for future inventory requirements. This is important to ensure that the available inventory is consumed in conjunction with planning future requirements and thus right-sized new orders.

The finished goods sold by a company are called **independent demand**, which is derived outside the company and is created by customers. The sale of products, or independent demand, creates a **dependent demand** for additional finished goods to be manufactured, such as the demand for the components required to complete the product.

For example...

If a bicycle is being manufactured, the independent demand is the demand for the assembled bike, and the dependent demands are the tires, seats, and other components used by the manufacturing department to assemble the bicycle.

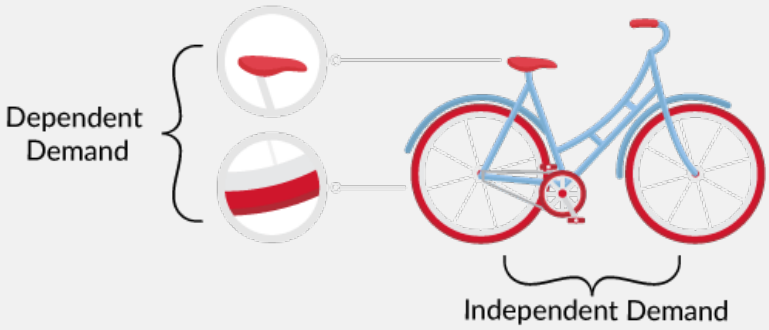

Figure 10. Independent and dependent demand. Developed by LINCS in Supply Chain Management Consortium.

The MRP system uses specialized software; some examples of the more popular packages are Oracle, SAP, and i-2. These packages calculate what is needed for **manufacturing operations**: consumables (rags, shop supplies, chemicals), raw materials, semi-finished goods, and any other items needed to complete the finished product. The Materials Requirement Plan (MRP) is driven by the demand plan and the MPS. The MPS is also created from the demand plan; it tells manufacturing how many end-item products are needed and when they will be required. These systems and many others are generally integrated as part of a company-wide ERP system so that the available forecasting and planning data is available on one platform that enables everyone to see and utilize the same data *(see Figure 11).*

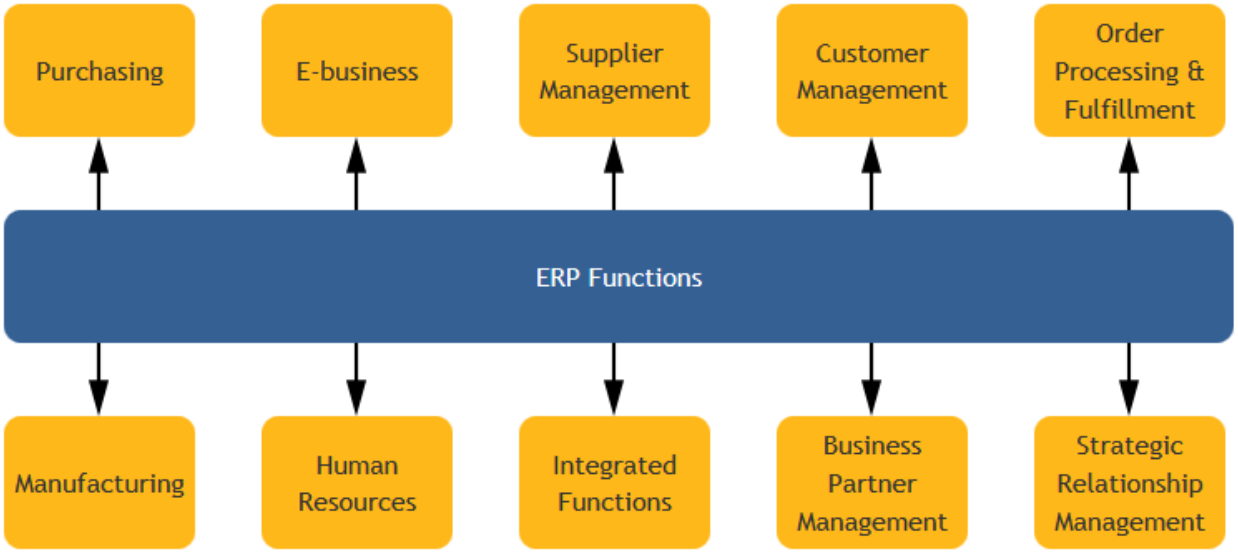

Figure 11. ERP Functions with a company. Developed by LINCS in Supply Chain Management Consortium.

Learning Block 1 Learning Summary

Companies strive to understand consumer demand and to determine supply availability accurately to meet both individual and market demands. Demand planning is the internal process used by companies to develop the actual forecasts and the demand plan, which includes more detailed plans to procure material (MRP) and plans for manufacturing products (MPS).

Figure 12. Supply Chain Management Principles. Developed by LINCS in Supply Chain Management Consortium.

Collaboration among company stakeholders is critical to achieving consensus and ensuring that plans are accurate, achievable, and can be revised as market and consumer preferences change. The level of systems integration is also critical in ensuring that the individual planning forecast and plan elements are linked and hosted on a single ERP. This enables one data source for employees and avoids differing data sets that could corrupt the planning process.

Learning Block 1 Practice Questions

1. A consumer's desire and willingness to pay for a specific product or service is defined as:

a. Economic demand
b. Excess supply
c. Wage increases
d. Product obsolescence

2. Demand is best divided into which two kinds?

a. Competitive and non-competitive
b. Individual and market
c. Short-term and long-term
d. Collaboration and consensus

3. Finished goods that will be sold are referred to as:

a. Assembly
b. Expedited freight
c. Independent demand
d. Customer service

4. The best approach to achieve consensus for creating and finalizing the demand plan uses which approach?

a. Management directives
b. Collaboration
c. Email
d. Social media

5. An estimate of future demand is defined as:

a. Demand forecast
b. Good customer service
c. Materials planning
d. Production planning

6. **Identify the system that integrates the individual demand forecasts and plans.**

a. Materials Requirements Planning (MRP)
b. Enterprise Resource Planning (ERP)
c. Capacity Requirement Planning (CRP)
d. Distribution Requirement Planning (DRP)

7. Two of the key systems that receive inputs from the demand plan are:

a. Customer Relationship Management (CRM) and MPP
b. Materials Requirements Planning (MRP) and Master Production Schedule (MPS)
c. Enterprise Resource Planning (ERP) and Forecasting
d. Master Production Schedule (MPS) and PMS

8. Identify which planning duration that has the least uncertainty and lowest risk.

a. Long-term
b. Mid-term
c. Short-term
d. Strategic

9. Identify the type of forecasting method that uses historical data for calculating future demand.

a. Qualitative
b. Quantitative
c. Demand planning
d. Sales

10. A collaborative process used to create an accurate demand plan enables a company to:

a. Achieve a competitive edge
b. Increase inventory
c. Increase the sales force
d. Expand its ERP system

Learning Block 2: Supply Management and Procurement Overview

Learning Block 2 Description

The role of **procurement** in the supply chain is to identify, contract, and collaborate with suppliers to provide the needed parts, raw materials, semi-finished products, and other items required by a firm in order for it to meet the needs of the customers. This is a critical role in any organization since purchased goods and services usually account for a significant percentage of any product's total cost.

The goal of procurement in the supply chain is to help balance supply with demand while creating value for the organization. This learning block provides an overview of procurement, the procurement process, and supplier evaluation and approval.

Learning Block 2 Learning Objectives

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

- Recognize the importance of procurement
- Describe the procurement process
- Understand the application of a **weighted scorecard**
- List key procurement terms
- Understand different types of buyer-supplier relationships
- Define the concept of **strategic sourcing**
- Understand the importance of the total cost of ownership

Unit 1: Procurement Overview

Procurement Overview

The procurement process is a key function in the supply chain that is responsible for buying, or procuring, goods and services. Purchasing is the act of buying; the procurement process involves the planning, **negotiation**, and administration associated with the eventual placement of purchase orders with suppliers. The procurement department receives requirements from MRP (or other systems that calculate requirements) called purchase requisitions and, as discussed in the previous learning block, MRP is built on inputs from the demand plan. The procurement process encompasses the following:

- ☑ Receiving requirements from MRP via purchase requisitions
- ☑ Sourcing, or finding, suitable suppliers

- Obtaining pricing and delivery data via requests for quotes (RFQs) and requests for pricing (RFPs)
- Conducting negotiations with suppliers, as necessary
- Creating weighted scorecards to justify awards
- Placing purchase orders
- Tracking and expediting purchase orders
- Processing supplier invoices (payments)

Procurement Adds Value

Procurement is viewed by most companies as a strategic business function in the supply chain. In the past, many organizations viewed procurement within a narrow context, with the function relegated to simply finding low-cost suppliers for the firm's required materials and services.

Today, procurement organizations are linked closely with other supply chain functions and make awards based on best value versus lowest price. Best value includes a wide variety of factors, or attributes, such as price, delivery, quality, supplier reputation, and other environmental factors. An important element of the procurement process is **supplier relationship management**, which focuses on initiating, maintaining, and expanding relationships with key suppliers. This enables companies to treat suppliers as an extension of the organization so that suppliers become viewed as real partners.

Depending on the size of an organization, procurement may be managed by a chief procurement officer or a senior vice president of procurement that is accountable for the department's functions (see *Figure 13*).

Figure 13. Procurement hierarchy defined by size of organization and mission. Developed by LINCS in Supply Chain Management consortium.

Unit 2: Supplier Relationships

Suppliers and buyers interact in a variety of relationships. For example, if a buyer needs to purchase a simple item from a catalog with a published price list that does not require any added value, the amount of time and effort that either side puts into the buyer-supplier relationship is likely minimal.

For example…

If an auto manufacturer needs memory sticks for its administrative staff, it might well buy them from a corporate office products supplier using an established price sheet. However, if that same auto manufacturer were planning to procure welded auto frames for a new line of automobiles, then the buyer (and technical team) would likely form a strategic relationship with the frame supplier to ensure that varying requirements could be met over time and that price reductions could be achieved as experience warrants.

Strategic Sourcing

Strategic sourcing describes the concept of win-win relationships, implying that the buyer-supplier relationship is good and will continue to improve and expand. Strategic sourcing relationships develop when suppliers and buyers work to achieve common goals; one well-known example is Apple's relationship with its suppliers who make the specialized glass for iPhones and iPads.

Figure 14. Strategic sourcing. Developed by LINCS in Supply Chain Management Consortium.

Techniques often used by companies in the strategic sourcing process include supplier base consolidation, spend leveraging, and periodic symposiums or conferences that communicate annual operating plans and other strategic business initiatives. Consolidating the supplier base can help achieve improved relationship and communication processes and ensure that goals are met. Spend leveraging is often applied to provide a smaller population of suppliers with a higher percentage of orders so as to achieve greater pricing discounts, expedited deliveries, and greater overall value.

Total Cost of Ownership

Total cost of ownership measures all of the costs associated with planning the procurement, making the award and other post-award processes. Costs occur

before the transaction

- the time to process requisitions,
- obtaining proposals, negotiating, and
- drafting legal contracts

during the transaction

- actual price paid for the item or service,
- transportation costs, and
- inspection of the item

after the transaction

- storing the purchased items,
- returning defective items, and
- maintaining the items

Procurement Decision-Making: Make or Buy

Sourcing decision management is another critical role in procurement. Sometimes, companies have the option either to make (source items from within the company) or to buy (look outside the company to purchase items).

The analysis of whether to make or buy a product or service can be complex because many factors are often involved. The advantage of buying from another company is that any resources that would be used to make the product can now be invested elsewhere; furthermore, the purchased product may be of better quality, and the supplier may be able to make it more inexpensively due to economies of scale. However, companies generally like to make products and provide services that they consider to be proprietary or want to protect from competition. Procurement is often part of a make-or-buy team that is chartered to determine which items should be manufactured internally and which items should be procured from suppliers.

In some cases, a company may **outsource** their **core competencies**, critical items that require specialized product development resources and might best be produced by a supplier with existing capacity and capability. In today's competitive environment, companies rarely have the resources to excel in everything, so they are likely to outsource and purchase complex goods and services from suppliers that already have the necessary expertise.

Unit 3: Supply Planning with Suppliers

Integrated SCM is about balancing supply with demand. As shown in *Figure 15*, ensuring supply is available requires three different levels of planning; suppliers need to be involved in the three levels to ensure that they will be equipped to satisfy all requirements when the time comes:

1. **Long-Term Planning**: **Strategic supply plan**
2. **Mid-Term Planning**: **Production plan**
3. **Short-Term Planning**: MPS

The strategic supply plan includes decisions about major capital expenditures and how to rationalize various assets. These items are generally very expensive, have long delivery times (sometimes three or more years), and often require suppliers' design inputs.

The production plan requires a one- to two-year planning horizon and also needs to be developed in conjunction with suppliers.

Finally, the MPS deals with parts that are available and can be readily obtained. This element can have planning periods from a few weeks to a year.

The bottom line is that the procurement department needs to involve suppliers when planning purchases. Suppliers need time to plan factory layouts, machinery orientation, and labor; involving them in the planning process will ensure that purchased items are available when they are needed.

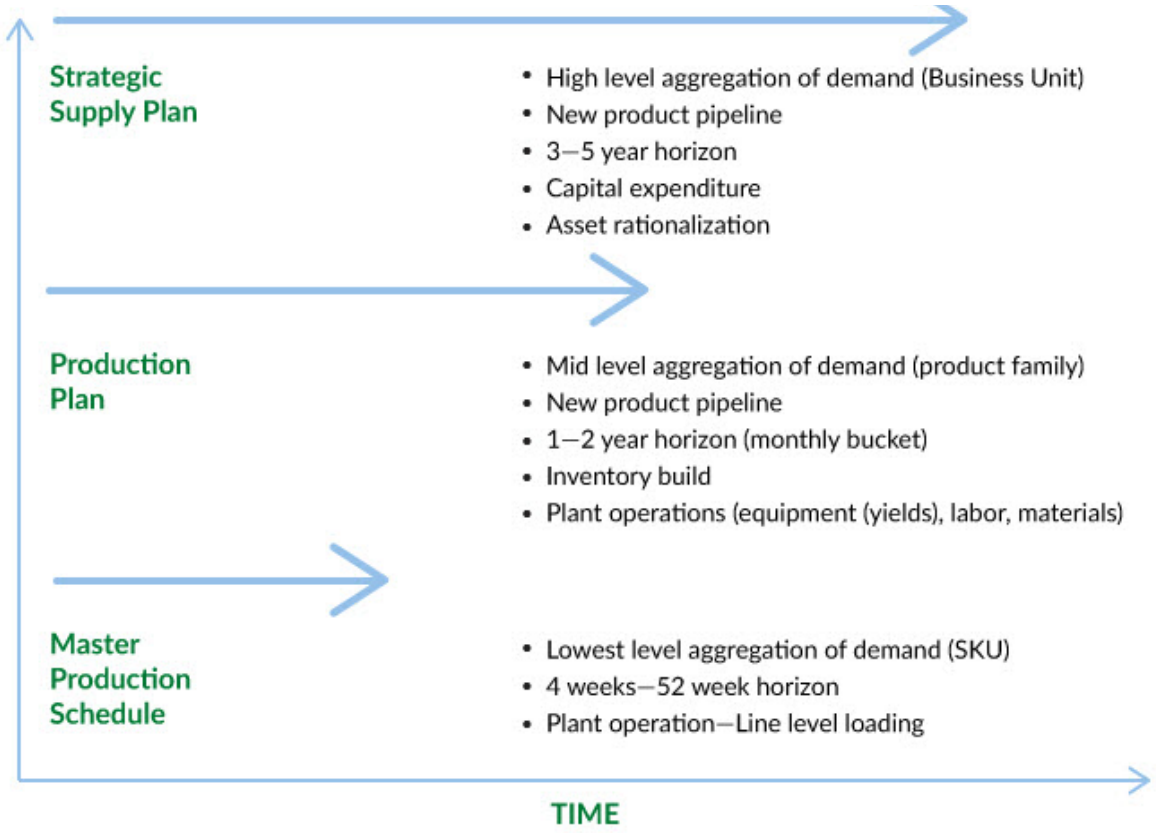

Figure 15. Levels of planning to ensure supply. Developed by LINCS in Supply Chain Management Consortium.

Unit 4: Executing the Procurement Process

Overall Responsibilities

The procurement department is responsible for the management of a company's procurement processes: the acquisition and delivery of goods, services, and equipment necessary to sustain the firm's manufacturing and distribution objectives.

Supplier Evaluation and Approval

Procurement plays a key role and acts as the intermediary between a company and its suppliers. Procurement is staffed with buyers, or procurement specialists, who are ultimately responsible for performing negotiations and awarding purchase orders. Prior to awarding purchase orders, buyers have to perform a variety of sourcing tasks to locate, evaluate, and approve suitable suppliers. In many companies, the buyer acts as the focal point for sourcing by convening a small team of experts from other functions to evaluate and approve potential suppliers in anticipation of making awards. Some of the sourcing tasks, or supplier evaluations, are:

- ☑ **Suitability**: Assurance of strategic alignment as a trading partner
- ☑ **Reputation**: Review of ethical, social, and environmental commitments

- **Capability**: Ability to provide quality, reliability, size, adaptability, flexibility, throughput, and to support audits
- **Stability**: Review of financial strength and historical performance
- **Location**: Placement of facilities and proximity to transportation services
- **Certifications**: Adherence to legal local, state, and national requirements

Once the team agrees that suppliers are acceptable based upon the outcome of the evaluation process, the buyer or procurement specialist will generally enter the supplier into an approved supplier database. This database features the supplier's name, location, what goods or services they have been approved to provide, and any other special attributes.

Issuing Requests for Quotes (RFQs) and Requests for Pricing (RFPs)

Once the approval of a supplier has been documented in the database, RFPs and RFQs can be issued for specific purchase requisitions. Purchase requisitions are generated from the MRP system and sent to buyers for processing. The purchase requisition and any accompanying documents such as engineering drawings specifically define what needs to be procured, including quantities, colors, and required date of delivery. Based on particular circumstances, the buyer may elect to send an RFP or RFQ to one supplier or to multiple suppliers, depending on the complexity of the requirement. RFPs are used for simple procurements in which pricing and delivery inputs are required. RFQs, on the other hand, are used when many inputs beyond pricing and delivery information are required. When soliciting multiple suppliers, buyers need to evaluate or weight the responses to determine which supplier should receive the award.

Once suppliers have been identified and approved, purchase orders might be issued to fill the requirements from requisitions without the need for an RFQ or RFP process. These processes can be omitted for routine procurements of material that is readily available and for which pricing methodologies have been agreed to, based on published price lists or other pre-approved pricing documents.

Weighted Scorecard

Generally, the best objective method to evaluate responses is to develop a weighted scorecard, which allows for criteria to be measured and valued independently based on different supplier inputs. The criteria (what is important to the company) in this example are defined and listed in the far left column, followed by determining the weight for each of the criteria. In the example, quoted cost has the greatest weight (50%) followed by lesser-weighted criteria (see *Figure 16*).

As suppliers responses are received, they are scored and the data is entered into the appropriate columns. These scores are then mathematically calculated into points for each supplier; the points are totaled to determine the award. In the example shown in *Figure 16*, Supplier A scored the highest value at 280, followed by supplier B, with supplier C having the lowest score.

WEIGHTED SCORECARD	Weight	SCORE	SCORE	SCORE	POINTS	POINTS	POINTS
CRITERIA	%	Supplier A	Supplier B	Supplier C	Supplier A	Supplier B	Supplier C
Quoted Cost	50%	3	2	1	150 (50×3)	100 (50×2)	50 (50×1)
Delivery Lead Time	20%	2	3	1	40	60	20
Quality	30%	3	1	2	90	30	60
TOTAL	**100%**				280	190	130

Figure 16. Example of weighted scorecard for the selection of suppliers. Supplier A scored highest, and Supplier C scored lowest. Developed by LINCS in Supply Chain Management Consortium.

Awarding Purchase Orders

After supplier responses are scored, it may be obvious which supplier should be awarded the purchase order. In other cases in which it is not clear, as for example if all prices are deemed too high, negotiations with suppliers may be necessary. Negotiation is used to describe the discussions that enable both buyer and supplier to reach a formal agreement about sale terms.

The next responsibility of the buyer or procurement specialist is to place the actual purchase order. In doing so, the buyer ensures that the required elements that were part of the solicitations and negotiations are included in the purchase order. Elements to consider include the following:

- Definition of terms: Freight, legal, payment, and discounts
- Clear identification of products (engineering drawings, sketches, etc.)
- Quantities
- Final pricing
- Shipping directions, such as ship-after, ship-by or arrival dates

1

Purchase orders are binding contracts and therefore must be accurate. Once purchase orders are received by suppliers, they are entered into their systems and become their sales orders. In today's business environment, almost all purchase orders and other documents are exchanged between buyer and supplier electronically.

2

After purchase orders are placed, the purchasing department continues to track progress. Occasionally, procurement buyers and expediters communicate with suppliers to ensure delivery dates will be met, especially on critical, time-sensitive orders. Buyers also must work to resolve any issues that arise if there is a change to the requirements on the original purchase order.

3

Finally, buyers and procurement specialists are involved in overall purchase order administration, meaning they make sure that information is accurate for open orders, closed orders, cancelled orders, changed orders, and backorders (i.e., partially received and due at a later date). Sometimes, backorders become cancellations, after which suppliers are advised by procurement specialists that certain items are no longer needed.

Learning Block 2 Summary

Procurement has taken on a critical role in strengthening the supply chain. It no longer focuses purely on the lowest price but rather on defining new relationships with suppliers. This learning block discussed how the relationship of supplier and buyer is based on negotiations and how agreements in the process focus on building, maintaining, and developing relationships for the future of each company. Today, an emphasis is placed on developing a win-win relationship between buyers and suppliers. Key procurement terms were also defined, the make-or-buy procurement decision was outlined, and the key duties of purchasing departments were enumerated.

Figure 12. Supply Chain Management Principles. Developed by LINCS in Supply Chain Management Consortium.

Learning Block 2 Optional Supplemental Resources

The optional supplemental resources listed below may be used to reinforce the content covered within this learning block.

Benton, W. C. (2009). *Purchasing and supply chain management* (2nd ed.). Boston, MA: McGraw-Hill/Irwin.

Bowersox, D., Closs, D., & Cooper, M. B. (2012). *Supply chain logistics management* (4th ed.). Boston, MA: McGraw-Hill.

Monczka, R. M., Handfield, R. B., Giunipero, L. C., & Patterson, J. L. (2011). *Purchasing and supply chain management* (5th ed.). Mason, OH: South-Western.

Procurement Academy (Producer). (2012, March 19). *Total cost of ownership TCO: Importance of understanding total cost—Procurement training*. Available from https://www.youtube.com/watch?v=VtEYwdOSTpY

Zycus (Producer). (2014, February 24). *12 steps to strategic sourcing part 1*. Available from https://www.youtube.com/watch?v=pkOWIr3au3Q

Learning Block 2 Practice Questions

1. What is the supply chain function that receives inputs from the demand plan to procure materials, equipment, and services?

a. Procurement
b. Customer service
c. Inventory management
d. Warehousing operations

2. Which of the following is considered to be a binding contract?

a. Purchase requisition
b. Purchase order
c. Engineering drawing
d. Supplier response to an RFP

3. In many cases, procurement awards purchase orders to suppliers based on:

a. Product quality regardless of price
b. Lowest price regardless of lead times
c. Frequency of sales calls
d. Best value

4. Strategic sourcing is based on which type of relationship?

a. Adversarial
b. Cooperative
c. Competitive
d. Distant

5. Procurement initiates RFPs and sends them to suppliers. RFP stands for:

a. Requirements for packaging
b. Request for proposal
c. Recurring forward pricing
d. Realization factor prices

6. Discussions between buyers and sellers to reach agreements are called:

a. Conversations
b. Negotiations
c. Suppliers
d. Dialogs

7. RFQs are used to obtain pricing and delivery inputs from suppliers. RFQ stands for:

a. Request For question
b. Request For quantity
c. Request For quotation
d. Request For quality

8. Procurement employees are often part of a team to determine which type of decision management process?

a. Bid or auction
b. Pass to make
c. Make or buy
d. Store and distribute

9. Short-, mid-, and long-term planning are collectively used to ensure a balance of supply and demand and to:

a. Ensure that supply is available
b. Obtain additional inventory
c. Place purchase orders on time
d. Check accuracy of sales data

10. After purchase orders are awarded to suppliers, buyers have the additional role of ensuring that:

a. Suppliers' pricing is accurate
b. Purchase orders are tracked for on-time delivery
c. Disposal costs are invoiced correctly
d. Demand and sales plans are correlated

Learning Block 3: Warehousing Operations Overview

Learning Block 3 Description

This learning block provides an overview of warehouses and the operations that enable them to function as a basic warehouse or **distribution center** (**DC**), as at Walmart, sometimes referred to as a fulfillment center, as at Amazon. Warehouses are used to process and store goods and materials purchased from suppliers. In addition, warehouses store products that have been assembled and manufactured to fill customer orders. After material is procured (see previous learning block), warehousing operations are often necessary to receive, store, retrieve, and process the procured goods and materials.

Learning Block 3 Learning Objectives

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

- Understand the difference between a warehouse and a DC
- Communicate the characteristics of a warehouse and a DC
- Articulate the key operations of a warehouse (e.g., receiving, storage, product placement, filling orders, and order-picking processes)
- Review the key shipping documents

Unit 1: Warehouse and Distribution Center (DC) Overview

Definition and Role of Warehouses and Distribution Centers (DCs)

Warehouse and DCs are the key connection between incoming items from suppliers and manufacturing on one side and between manufacturing and customers on the other. Warehouses act as the interim staging location for purchased goods, providing availability for production and manufacturing to produce at efficient levels. Warehouses also store finished products to ensure availability to satisfy customer demands. Warehouses generally provide basic functionally for the receipt of goods, storage, retrieval, and preparation for shipment. When services are added to the warehouse environment, in a process known as value-added services, the basic warehouse can be transformed into a DC or a fulfillment center. Examples of value-added services are cross-docking, marking, labeling, and light final product assembly.

Cross-docking occurs when incoming goods from various sources are immediately prepared for an outbound shipment to a customer so that no storage is required. Cross-docking may be carried out to sort material intended for different destinations or to combine material with different origins into transport vehicles with the same or similar destinations.

Marking and labeling is performed to satisfy unique customer requests for product identification, while light final product assembly might occur when customer options are combined to fulfill a specific customer requirement. Dell uses this process in their warehouses when a customer orders a specific configuration in a computer order.

Figure 17. Warehousing. Developed by LINCS in Supply Chain Management Consortium.

Basic Warehousing Operations

In their basic role as processing and storage locations for products in transit, warehouses' primary operational activities include:

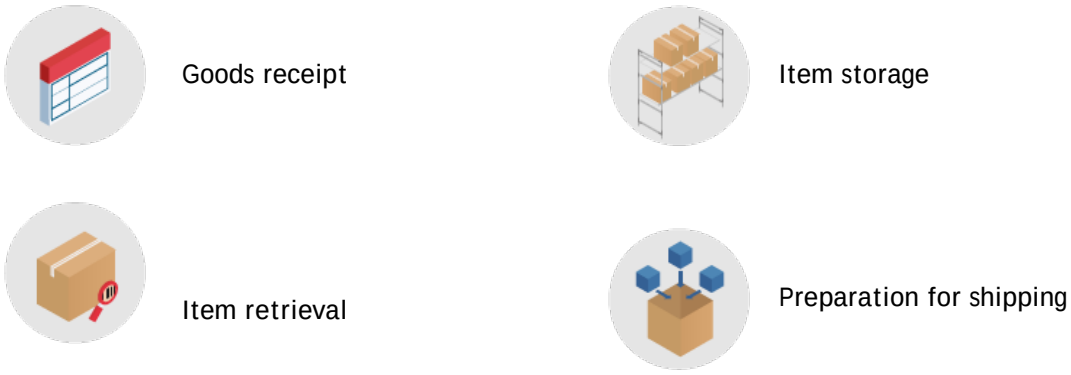

Figure 18. Basic warehousing operations. Developed by LINCS in Supply Chain Management Consortium.

Warehouses can efficiently store products for varying periods of time; however, occasionally, individuals call warehouses DCs or vice versa. The actual distinction is detailed next.

Warehouses

Conventional warehouses are used by all types of businesses to store and manage products. Manufacturers use warehouses to store their products, and they may be located next to their manufacturing facility. Importers direct products purchased abroad to seaport warehouses. Warehouses can be found in a variety of locations, from large cities to small towns. In the past, warehouses were large brick and mortar buildings, often concentrated in a central location; many major cities had an entire warehouse district.

Many of today's warehouses are sophisticated operations using **barcodes** for each **pallet**, automated storage and retrieving systems, and efficient **inventory management** computer systems. However, some warehouses manage with a simple pallet jack and a single bay for loading and unloading. Many warehouses operate on a **just-in-time** (**JIT**) management system in which products move in and out

very rapidly. Warehouses may store equipment, raw materials, excess or obsolete inventory, and inventory that is a **work in process**.

If warehouses are automated, there are a variety of technology-enhanced methods of moving products, such as automated **conveyor** belts and programmable robot devices that move products around with little or no human contact.

Distribution Centers (DCs)

DCs are stocked with a set of products that are redistributed to wholesalers, retailers, or directly to consumers. A DC is the principal part, or **order processing** element, of the entire order fulfillment process. The terminology used to differentiate facility types is as follows: A retail DC normally distributes goods to retail stores, an order fulfillment center commonly distributes goods directly to consumers, and a cross-dock facility stores few or no products, at least for significant lengths of time.

Warehouse Management Systems (WMS)

In today's modern warehouse and DC operations, **warehouse management systems (WMS)** are the brain that manages warehouses and DCs. WMSs are sophisticated computer software systems designed to control the receiving, movement, storage, and retrieval of products (see *Figure 19*). WMSs are designed to direct related warehouse transactions like acceptance of product into the warehouse, proper storing of products, direction of product selection, and management of outbound shipping. They also generate the paperwork necessary for managing warehouses, including reports and shipping documents.

A WMS guides and optimizes product storage and is based on real-time information about the status of warehouse space utilization and product turnover. For example, if a product is a slow-moving item, the WMS will automatically direct workers to store the product in a location that is comparatively remote (in both height off floor and distance from dock) to minimize any disruption to faster-moving items. The WMS monitors the movement of products throughout warehouses if items need to be moved, incorporates entire physical warehouse layouts, uses information-technology tracking systems, and manages communication among areas like receiving, storing, and shipping.

The WMS utilizes advanced technology to improve warehouse efficiency, including barcode scanners, wireless handheld systems, pick-to-voice, **pick-by-light**, mobile computers, and radio frequency identification (RFID) tags to manage the flow of inbound products, storage, and final outbound movement of products from warehouses. A WMS is a large database of information that also generates status reports such as product locations, number of units available, and number of units received and shipped in a given time period.

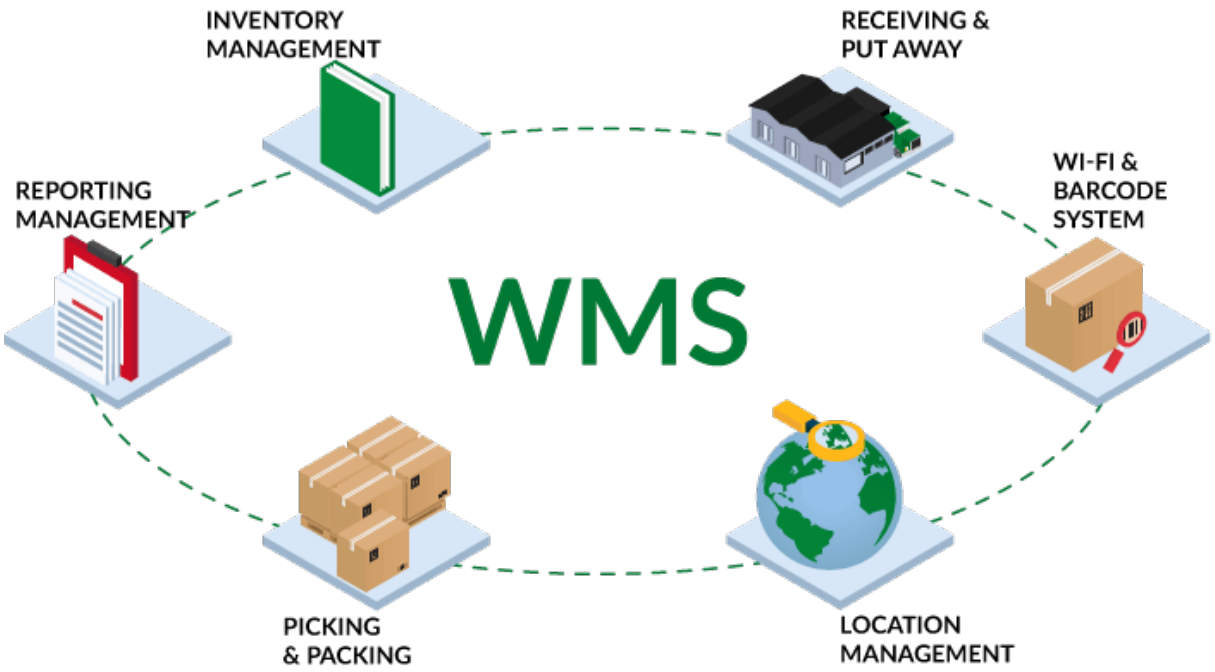

Figure 19. WMS functions. Developed by LINCS in Supply Chain Management Consortium.

Unit 2: Receiving

The Receiving Process

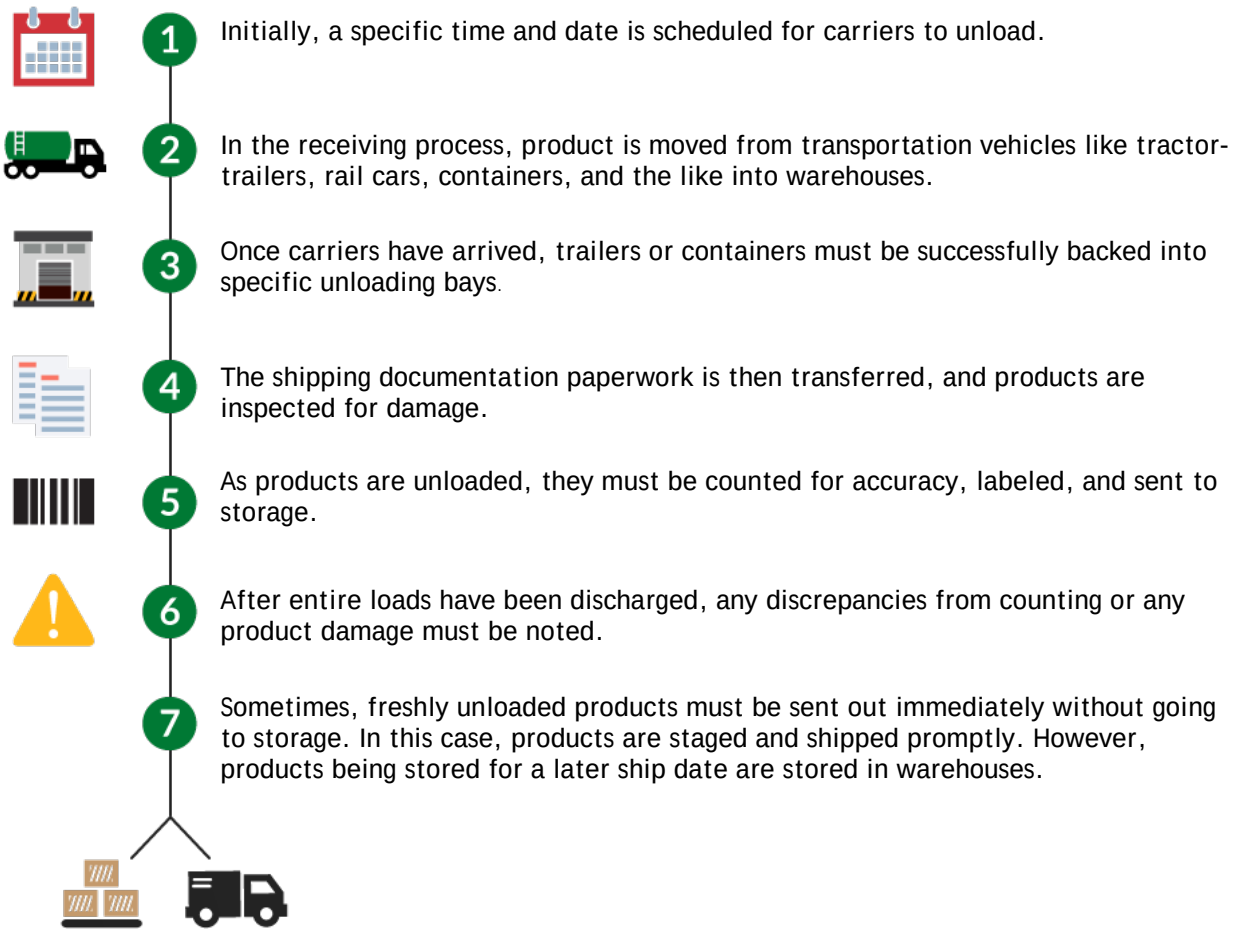

Figure 20. The receiving process. Developed by LINCS in Supply Chain Management Consortium.

Common Equipment and Technology

Common equipment at receiving bays includes dock plates, **dock levelers**, dock seals, and wheel chocks. These tools help secure trailers in place and provide bridges that allow forklifts and other heavy equipment to unload a trailer. Pallet jacks and forklifts are used to unload palletized product (see *Figures 21* and *22*).

Figure 21. Pallet jack. By EastEliteLiftingEquipment (Own work) [CC BY-SA 4.0], via Wikimedia Commons.

Figure 22. Forklift. By Marketing Team (Sa'ad Jafar) [Public domain], via Wikimedia Commons.

Individuals use pallets to stack product and allow operators to move large amounts of products at one time. Pallets can be made of either wood or plastic; while plastic pallets are preferable because they are durable and clean, they are also expensive. Wood is most common in warehouse pallets because it is has a comparatively low cost and is essentially disposable. Wooden pallets, however, break easily, can create messes and safety hazards with splinters, and can harbor insects and rodents.

As discussed previously, WMSs are software programs that manage the inbound storage and outbound shipping of products. Mobile handheld devices enable stockers and pickers to communicate with the WMS. **License plate** barcode labels are commonly found on pallets. When pallets are received at warehouses, WMSs generate barcode labels that are placed on pallets and act as a license plate for pallets full of product. Pallets can be instantly identified using a barcode scanner (see *Figure 23*).

The latest technology includes RFID. These RFID tags are small and can be placed anywhere on pallets. While they are expensive today, RFID tags will likely become the method of choice in the future.

Figure 23. By IAEA 3 (Flickr) [CC BY-SA 2.0], via Wikimedia Commons.

Paperwork and Inspection in Receiving

The packing list is the shipping document required for every commercial shipment. The packing list details the information about the contents of containers:

- Items included
- Item codes or **Stock Keeping Units** (**SKUs**)
- Description of the items
- Quantity
- Any additional important information about the items

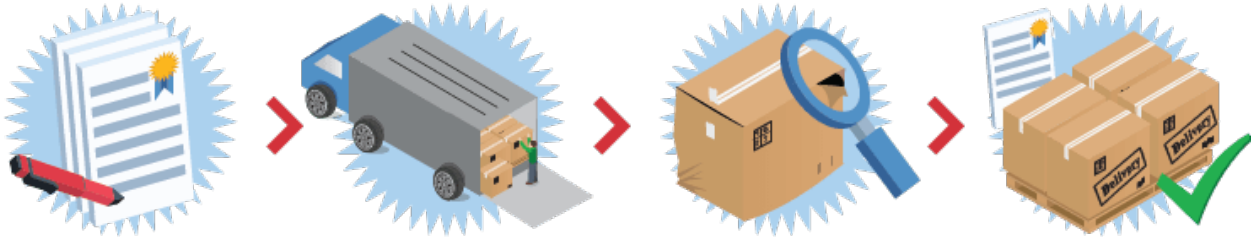

Figure 24. Paperwork and inspection. Developed by LINCS in Supply Chain Management Consortium.

The **bill of lading** is a contract document from shippers that acknowledges that specific goods have been delivered to the appropriate locations and received by the correct recipients. It is used to record and track the dispatch and delivery of goods, as well as the weights of each load.

Inspecting and verifying a delivery is the final step in receiving. Once paperwork has been reviewed and products have been unloaded, the next step is to inspect the goods for visible signs of damage like crushed, torn, or broken cartons or containers. It is also important to confirm the quantity of products against packing lists, bills of lading, and original purchase orders. Companies do not want to pay for damaged or missing goods, and any issues should be noted on the bills of lading, with a copy given to the carrier.

Unit 3: Storage

The Storage Process

Storage is the act of putting products away in specific, clean, and secure locations so they can be easily retrieved when they are needed. Storage is an essential and basic part of any warehouse and DC. Proper storage takes time and effort, but the benefit is worth the cost because time and money would be lost if workers ran around warehouses trying to find products to fill customers' orders. After products have been received, checked, and verified, they are ready to be put into storage from the warehouse receiving area *(*see *Figure 25*).

Figure 25. Warehouse storage. Acquired from pixabay.com.

Strategies for Storage

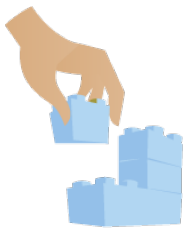

Figure 26. Minimal handling. Developed by LINCS in Supply Chain Management Consortium.

Minimal Handling: In warehouses, the most efficient management practice is minimizing the number of times that products are handled. Ideally, items are received, stored, and shipped out, but this process can be far more complex than it sounds. Additional handling costs money due to the extra time and labor involved; it also increases the opportunity for damage to the product and can lead to misplaced products, as when products are stored in one designated location and moved to another without appropriate documentation.

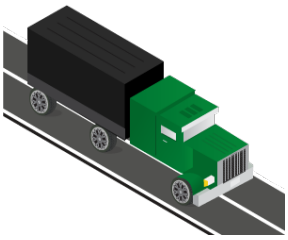

Figure 27. Transport truck. Developed by LINCS in Supply Chain Management Consortium.

Product Demand: A key element of proper storage is determining the demand for particular items. When items in high demand are received, these products may never go into actual storage, instead being taken directly to outbound shipping areas. By contrast, other items move slowly and would likely be stored in the most remote areas of the warehouse.

Figure 28. Storage racking. Developed by LINCS in Supply Chain Management Consortium.

Storage Racking: Using storage racks is one of the most common strategies employed by warehouses (see *Figure 28*). Each storage rack has a unique number, and within each rack is a row number. Rack numbering systems allow everyone to know exactly where products have been stored. Racking creates a safe, organized, and clean workspace and provides protection of products when they are in storage. Racks also make excellent use of overhead space; for instance, when combined with high lift forklifts, racks can go up to eight pallets high, depending on the height of warehouse buildings.

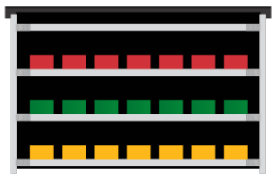

Figure 29. Bins and containers. Developed by LINCS in Supply Chain Management Consortium.

Bins and Containers: Racking is perfect for storing full pallets of products, but these pallets need to be broken down into smaller units. In some situations, items stored in configurations smaller than pallets are moved into bins or containers to facilitate fixed and flexible storage options. Packaging and wrapping used in the shipping and transportation process are not suitable to actually fill orders. The bins and containers are then put away into their own separate racking and storage area (see *Figure 29*).

Labeling and Storage Location

Another key to storage success is the effective use of storage labeling, also called location labeling. Often called license plates, storage labels are generated at receiving bays once products have been successfully received into warehouses (see *Figure 30*). This label is generated by the WMS, which determines where products are to be stored and where labels are attached to products. Products are then delivered to their designated storage locations. Once orders arrive for these products, the WMS informs pickers where to find products needed to fill orders. Effective labeling systems reduce errors in picking, save time in finding items, and facilitate more accurate inventory management.

Figure 30. Storage label. Developed by LINCS in Supply Chain Management Consortium.

Unit 4: Order Fulfillment

The Order Process

The order fulfillment process starts when orders are placed by customers; they may come from retail stores, other DCs, manufacturing organizations, or directly from end users. Orders from customers specify a unique part or item number, quantity, color, other unique attributes, and a delivery date. When orders are received at warehouses, pick lists are generated and the fulfillment process is initiated.

Figure 31. The order process. Developed by LINCS in Supply Chain Management Consortium.

Order Picking

When orders are received, they must go through the fulfillment process. Products must be located and brought out of storage locations to prepare for shipment, known as picking or **order picking**. These terms refer to selecting or picking items from their storage locations to complete orders. The goal of order picking is to be as efficient as possible by saving time, reducing wasted effort, and lowering costs.

In larger warehouses, the WMS includes integrated, handheld barcode scanners. Pickers use the handheld scanners by scanning the license plate, entering the quantity, and scanning locations at each point of the picking process. Orders are then processed on computers; inventory is also managed in this manner. As pickers scan orders for shipping, the inventory of specific SKUs is automatically reduced by the quantity picked.

Distinctive Picking Types

There are several distinctive types of picking:

Manual Picking	Order Picking
This is the most basic method of picking, in which order pickers physically pick one item from storage and bring it back to the shipping staging area.	In this method, items are picked individually for an entire order. Pickers have a cart, basket, or pallet container and work in the entire warehouse picking for one order until it is complete. Once finished, pickers will take orders to the shipping staging area.

Batch Picking	Zone Picking
In batch picking, pickers focus on picking a batch of items for several different orders, which improves picking efficiency and accuracy.	Warehouses are divided into zones; zone picking assigns different pickers to each zone or area, and they pick the items in their zone for any order.

Voice Picking

Voice-activated picking is a method for picking orders using any of the previously mentioned methods; employees listen to others on a headset to determine which items in which quantities are needed for orders (see *Figure 32*). Voice picking operates much like voice-guided GPS systems in cars, with pickers simply following the directions that they receive. The benefits of voice picking include faster picking times and reduced picking errors.

Figure 32. Voice-activated picking. Developed by LINCS in Supply Chain Management Consortium with images from pixabay.com.

Pick-by-Light

Pick-by-light systems can be beneficial if items need to be selected quickly and accurately. Shelves in warehouses have digital displays telling employees where and what to pick from the shelves (see *Figure 33*). Once items have been selected, operators flip a switch to turn off the indicator light that is located above racks or bins where employee are picking. This picking method is primarily used in environments where many orders must be processed in a speedy manner.

Figure 33. Pick-by-light. By KBS Industrieelektronik GmbH (Own work) [CC BY-SA 3.0], via Wikimedia Commons

Processing Orders

Once order picking has been completed, warehouse personnel ensure that the picked products and associated paperwork are moved to the next step of delivery preparation. Arrangements must also be made to ensure that products are packed and packaged adequately to safeguard them during transport.

Unit 5: Preparation for Shipment

Overview

The last step in the order fulfillment process is preparation for shipment. During this process, shipping and warehouse personnel have one last opportunity to correct any order issues, add or subtract any last-minute changes to orders, and verify that orders are absolutely correct. Additionally, personnel need to know if products are fragile and require extra packing and packaging and if carriers have special requirements for specific items.

Figure 34. Shipping via truck. By Joost J. Bakker (truck trailer loading dock) [CC BY 2.0], via Wikimedia Commons.

In preparing orders for shipment, personnel should keep in mind:

- The size of the order; for example, a book shipped by the United States Postal Service (USPS) from Amazon to a customer in Seattle has significantly different requirements than a truckload of 100-pound bags of sugar from a factory warehouse to a bakery.
- The modes and methods of transportation; the vast majority of goods are hauled by trucks first (see *Figure 34*), rail second, and air last.
- The carriers' shipping requirements; for example, shippers may require airbags from warehouses to secure certain loads.
- The need for refrigeration or safeguards for hazardous materials.

Safety and Cleanliness, Staging, Loading, and Transporting

The staging area of warehouses is where products come off the truck or go onto the truck. Safety is of utmost importance because this area is known to be the most dangerous area in warehouses or DCs. It is dangerous because everyone moves as rapidly as possible: order pickers quickly bundle orders and run back for more items, lighting may be poor or inconsistent due to sun blindness, forklifts rush back and forth, large trailers back in and pull out, trailers butt up against buildings, and the overall environment is hot, noisy, crowded, and busy. Consequently, it can be hazardous.

One way to make warehouses safe is by making sure they are clean. Warehouses are dynamic environments, with different types of equipment that have dirty engines like forklifts, hand jacks, and trucks. Additionally, pallets might be damaged and falling apart with sharp splinters in various places, pieces of shipping boxes and packages may be strewn about, mixed with discarded paperwork, strapping material, mud and dirt from footwear, and boxes from re-packing (see *Figure 35*). These issues can contribute to a decrease in warehouse efficiency and an increase in safety hazards. Therefore, it is everyone's job to keep warehouses neat and clean.

Figure 35. Discarded shipping boxes contributing to warehouse clutter. Acquired from pixabay.com.

Figure 36. Automated wrapping system. By MOVITEC WRAPPING SYSTEMS (MOVITEC WRAPPING SYSTEMS) [GFDL or CC BY 3.0], via Wikimedia Commons.

Keeping the inside of warehouses clean is important; however, tidying up truckloads is as important for many reasons. Large palletized orders will be shrink-wrapped or banded tightly to keep their contents from spilling inside trailers. Protective padding is placed around fragile items because trucks can face bumpy rides, especially over rough pavement that may jostle their contents. Many food products must be shipped in either refrigerated or frozen trailers. These trailers must be pre-cooled or pre-frozen before loading because heated trailers take too long to reach the appropriately cool temperature, which could easily destroy perishable food items.

Pallets and loads must be secured on trailers because products can be damaged in transit. Many warehouses wrap pallets with plastic wrap before loading, which keeps products tight and secure on their pallets during transport. The plastic wrap can either be applied by hand or by an automated wrapping system (see *Figure 36*).

Shipping Documentation

Shipping involves the following paperwork:

- **Bill of Lading**: The most important document to ship an item is the bill of lading, which is given to carriers before departure (see *Figure 37*). The bill of lading is a contract that specifies goods have been accepted by a specific carrier as cargo to be delivered to a specific location and a specific receiver.
- **Shipping/packing list, shipping manifest, and waybill**: These documents provide itemized details (usually without costs or pricing) to show the complete inventory of loads. They provide more detail about product specifics than a bill of lading for both shippers and customers.
- **Tracking**: Tracking is accomplished by entering data into a transportation system with a unique identifier, much like the systems used by the USPS, FedEx, and UPS. Along the transportation route, actions at each point are updated, enabling users to determine each load's exact status and location.

Figure 37. Bill of lading. Developed by LINCS in Supply Chain Management Consortium.

Learning Block 3 Summary

Figure 12. Supply Chain Management Principles. Developed by LINCS in Supply Chain Management Consortium.

Warehouses and DCs play an important role within the modern supply chain, serving as the key point between production and customers. Warehouses are involved in receiving, storing, and moving products and goods. Efficient management is thus critical in providing excellent customer service, minimizing cost, and contributing to an effective and efficient supply chain. This learning block outlined typical warehouse management and operations. It considered the standard aspects of warehouse management, including the role of warehouses, the WMS, equipment, storage processes, safety and cleanliness concerns, and the importance of proper documentation. Ultimately, in warehousing as in every part of the supply chain, the needs of customers must be met efficiently and at the lowest cost possible.

Learning Block 3 Optional Supplemental Resources

The optional supplemental resources listed below may be used to reinforce the content covered within this learning block.

Bowersox, D. J. (1996). *Logistical management: The integrated supply chain process*. Boston, MA: McGraw-Hill.

Chopra, S., & Meindl, P. (2012). *Supply chain management: Strategy, planning, and operation* (5th ed.). London: Pearson.

Richards, G. (2014).*Warehouse management: A complete guide to improving efficiency and minimizing costs in the modern warehouse* (2nd ed.). Philadelphia, PA: Kogan Page.

Rushton, A., Croucher, P., & Baker, P. (2014). *The handbook of logistics and distribution management: Understanding the supply chain* (5th ed.). Philadelphia, PA: Kogan Page.

Learning Block 3 Practice Questions

1. Warehouse and DCs serve as a key connection between manufacturing and _____ for finished products.

a. Employees
b. Customers
c. Storage facilities
d. Warehouses

2. Many warehouses utilize a _____ to receive, store, and retrieve products.

a. Serial Process
b. Warehouse management system (WMS)
c. Storage system
d. Bill of lading

3. Stocking finished products in a warehouse enables a company to immediately:

a. Use equipment efficiently
b. Keep employees busy
c. Utilize all of the rack space
d. Satisfy a customer's order

4. In today's modern warehouses and DCs, a WMS is the central _____ of managing a warehouse and DC.

a. Place
b. Center
c. Brain
d. Operations

5. Which of the following are not examples of advanced technologies supported by WMS to improve warehouse efficiency?

a. Barcode scanners
b. Mobile computers
c. Pick-to-voice
d. Forklifts

6. The process that moves products from transportation vehicles into the warehouse is called:

a. Packaging
b. Picking
c. Receiving
d. Staging

7. What document is used by receiving personnel to obtain information about the contents of a delivery being received?

a. Quality report
b. Packing list
c. Driver's log
d. Claim report

8. Order tracking capability enables users to:

a. Combine shipments
b. Determine shipments' exact status and location
c. Maintain warranty information
d. Review customer preferences

9. When shipping products, the most important document is the:

a. Waybill
b. Shipping list
c. Bill of lading
d. Shipping manifest

10. The last step in the order fulfillment process is:

a. Receiving
b. Storing
c. Preparing for shipment
d. Kitting

Learning Block 4: Inventory Management Overview

Learning Block 4 Description

This learning block provides a basic overview of inventory, followed by a review of inventory management and its role in supply chain management. The types of inventory are included, as are inventory costs and factors affecting inventory management: the definition of inventory, the definition of inventory management, and the benefits of good inventory management practices. It is not unusual to find inventory management personnel situated close to where inventory is located or even in a section of the warehouse itself.

Learning Block 4 Learning Objectives

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

- Differentiate between fixed and **variable costs** and direct and **indirect costs**
- Describe the four types of inventory
- List several key performance indicators for successful inventory management
- Understand **inventory turns**
- Differentiate between inventory and inventory management

Unit 1: Inventory Basics

What is Inventory?

Inventory is generally defined as physical assets that are held or stored for use, at some point, in manufacturing products, completing partially manufactured products, direct sales to customers, or for operating maintenance tasks. Inventory is an asset that represents a monetary expense and therefore needs to be turned to make a profit. Inventory comes in various types and has different exposures to risk:

- Fruits and vegetables sold at markets, for instance, have different expiration dates before they spoil and become unusable.
- Computers, phones, or other electronic items belong to an industry undergoing rapid

Figure 38. Inventory tracking. By Limicrofono Oggiono. [CC BY 2.0]. Acquired from flickr.com.

technological change. Soon after selling these products at full price, they will have little or no value in the market.

- Clothing ranges from basics such as socks and underwear to high-fashion items that change seasonally.

What is Inventory Management?

In industry, two terms are used quite often: inventory management and inventory control. These terms can mean two different things or can be used interchangeably. By combining these terms, inventory management is defined as the long-range, mid-range, and day-to-day processes, protection, and deployment, including the control**,** of assets in inventory (see *Figure 38*).

Inventory management strives to balance risk between stockouts, in which no inventory is available to sell, and excess, in which there is leftover inventory. Companies need to have raw material inventory to satisfy their manufacturing needs and finished goods to meet customer needs. At the same time, companies cannot afford to have more inventory than they need because it commits capital dollars and increases the costs of managing inventory (see *Figure 39*).

Figure 39. Managing excess inventory. Acquired from pixabay.com.

Unit 2: Cost Considerations

Inventory Costs

The cost of an item specified on a purchase order is the baseline cost or purchased item cost. When considering total inventory costs, defined as **acquisition costs**, add the cost elements below to the purchased item cost to calculate the total acquisition costs, or **carrying costs**:

1. Warehousing costs (receiving, picking, etc.)
2. Labor
3. Risk of expiration or obsolescence that requires disposal
4. Damage

When merchandise arrives, companies pay to store it, move it, insure it, and process it, at a minimum. The value of the merchandise grows with each activity. These activity costs are divided into direct and indirect costs and are also broken down into whether expenses are fixed or variable. These terms are addressed in more detail in the next section.

Inventory Types

The four basic types of inventory are:

Raw materials

Work in process

Finished goods

Maintenance, repair, and operating (MRO)

Figure 40. Inventory types. Developed by LINCS in Supply Chain Management Consortium.

Raw materials are used in manufacturing and can sometimes be true raw materials (i.e., basic materials derived from nature). Other raw materials may be broken down into sub-categories that include:

- Parts
- Components
- Semi-processed goods
- Catalysts
- Commodities
- Critical components
- Packaging

These raw materials are consumed to make finished goods, which are products that have completed the manufacturing cycle and are ready for final sale or distribution. Inventory that has been moved and staged for manufacturing is called work in process. Work in process is reduced as it is consumed to make finished goods in the manufacturing process or categorized as scrap. Any loss that cannot be converted into value is referred to as fabrication waste.

Finished goods are usually considered to be a completed product or a service repair part that can be sold to an end user or consumer. Finished goods may also be unsellable for multiple reasons:

- **Obsolete**: No longer of value in the market or past expiration date
- **Reworks**: Manufactured with some form of defect that must be re-manufactured to make it sellable
- **Returns, or reverse logistics**: Merchandise brought back from customers that requires inspection or rework
- **Quarantine**: Merchandise requiring a holding period to determine if quality has been maintained

Lastly, MRO products are not directly consumed in the manufacturing and operations, unlike the inventory types listed previously. MRO is product consumed to support operations to manufacture and manage inventory like gears to repair a conveyor or grease used to lubricate machines.

Unit 3: Inventory Management Practices

Effect of Lead Time on Inventory Management

The time from placing an order with a supplier to receiving those goods is referred to as lead time. This includes supplier administrative order processing time and manufacturing time. Lead time also includes the time it takes for transportation from a supplier's facility to the destination. Therefore, the reorder point must be accurately defined to ensure there is sufficient stock to continue operations until the new order is received.

Long lead times usually demand higher inventory levels to ensure manufacturing operations and customer orders are not adversely impacted by stockouts.

Inventory Turns

The metric that tracks how often product is used and replaced in a given time period—usually one year—is called inventory turns. If the inventory turn ratio is high, this means products are moving or turning quickly; a low inventory turn ratio can indicate low sales and even overstocking of unneeded items.

There are numerous quality assurance management and operational efficiency methodologies that enable an organization to document processes and implement efficiencies to reduce costs and work more productively. **Lean**, Six Sigma and 5-S processes are some examples. For example, taking a lean approach to inventory management focuses on minimizing investment and carrying costs (see *Figure 41*). This will maximize the profit return on the lowest possible inventory investment. In turn, taking a lean approach increases the ability to invest capital in other areas or obtain loans at a lower interest rate.

Figure 41. Lean inventory management. By Cortes003 (Own work) [CC BY-SA 3.0], via Wikimedia Commons.

Lean and Just-in-Time (JIT)

The terms lean and JIT are used regularly in inventory management. Lean refers to operational and procedural practices that create efficient flow. Tasks that do not contribute to value are reduced and eliminated. Using JIT, the company can receive raw materials as they are needed for manufacturing, which can eliminate or dramatically reduce raw material warehousing and holding costs. It eliminates the task of moving the materials to storage and the later retrieval of the same merchandise. If companies extend JIT to manufacturing, then finished goods can be produced and immediately loaded for shipping, thus eliminating even more stocking and retrieval operations.

Supplier-Managed Inventory (SMI) and Third-Party Systems

Supplier-managed inventory (SMI) occurs when the supplier is responsible for the monitoring and **replenishment** of inventory as needed. Retail stores may adopt SMI, in which case representatives come in and count an area such as socks and re-order based on a stock level that has been agreed upon by the customer. Similar activities occur in local supermarkets in managing inventories for bread, chips, and soda. Similar inventory management can be maintained via third-party warehousing. Inventory levels are monitored and controlled by contract service providers.

Learning Block 4 Summary

Inventory management is a complex interplay of processes and controls. Successful execution helps companies succeed while also strengthening the customers and suppliers on which they depend. By balancing inventory levels, companies provide maximum service at the lowest total costs. By reviewing the topics in this learning block, business plans can be understood so as to utilize inventory and resources, successfully to improve customer satisfaction.

Figure 12. Supply Chain Management Principles. Developed by LINCS in Supply Chain Management Consortium.

Learning Block 4 Optional Supplemental Resources

The optional supplemental resources listed below may be used to reinforce the content covered within this learning block.

Cohen, S., & Roussel, J. (2013). *Strategic supply chain management: The five core disciplines for top performance* (2nd ed.). Boston, MA: McGraw-Hill.

Dittmann, J. P. (2013). *Supply chain transformation: Building and executing an integrated supply chain strategy*. Boston, MA: McGraw-Hill.

Simchi-Levi, D., Kaminsky, P., & Simchi-Levi, E. (2008). *Designing and managing the supply chain: Concepts, strategies, and case studies* (3rd ed.). Boston, MA: McGraw-Hill/Irwin.

Waller, M. A., & Esper, T. L. (2014). *The definitive guide to inventory management: Principles and strategies for the efficient flow of inventory across the supply chain*. Upper Saddle River, NJ: Pearson Education.

Learning Block 4 Practice Questions

1. _____ is defined as products that are held and that will be used, at some point, for manufacturing products, completing products, selling to customers, or performing daily operations.

a. Storage
b. Inventory
c. Warehouse
d. Distribution center

2. Inventory management achieves to balance the of risk between:

a. Products and services
b. Stockouts and excess inventory
c. Inbound and outbound
d. Production and warehouse

3. Once a product is completely assembled, the cost of the parts used plus the costs to manufacture the products are defined as the:

a. Total costs
b. Inventory costs
c. Raw materials costs
d. Acquisition costs

4. The process for suppliers to monitor and replenish inventory on an as-needed basis is called:

a. Supplier advanced shipments (SAS)
b. Supplier safety stock (SSS)
c. Supplier holdback replenishment (SHR)
d. Supplier-managed inventory (SMI)

5. All of the following are one of the four basic types of inventory, except:

a. Raw materials
b. Work in process
c. Customer service
d. MRO

6. An obsolete part can be defined as:

a. No longer having value
b. Containing defects
c. The wrong color
d. The wrong size

7. Longer lead times may contribute directly to _____ inventory levels.

a. Inaccurate
b. Lower
c. Higher
d. Accurate

8. The time from purchase order placement to product receipt is defined as:

a. Lead time
b. Queue time
c. Storage time
d. Retrieval Time

9. All of the following can be defined as raw materials, except:

a. Maintenance equipment
b. Parts
c. Components
d. Commodities

10. What best describes how often products are used and replaced in a given time period?

a. Just-in-time
b. Lean management
c. Inventory turns
d. Reverse logistics

Learning Block 5: Manufacturing and Service Operations Overview

Learning Block 5 Description

The supply chain element of manufacturing and service operations (M&SO) is accountable for the management, resources, and processes that provide saleable products and services. Manufacturing operations apply labor, materials, and equipment to produce a tangible item that can be placed in inventory; by contrast, **service operations** apply labor, tools and equipment, often including repair parts, to provide a service that is not tangible and cannot be placed in inventory.

M&SO is a critical link in the supply chain and its success is dependent on demand planning, procurement, inventory management, and warehouse operations. Their outputs enable M&SO to plan the desired outputs in an efficient manner.

Learning Block 5 Learning Objectives

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

- Understand the significance of M&SO in the supply chain process
- Explain the difference between manufacturing and service operations
- Discuss **product life cycles**
- Identify three different types of operational decisions
- Recognize the role of quality

Unit 1: What is a Process?

A process is a set of individual activities that are combined to produce a product, service or a combination of products and services. In a manufacturing environment, the overall process plan to make an item is often referred to as a manufacturing routing, based on a collection of several individual processes.

Most manufacturing routings consist of four elements: inputs, outputs, controls, and resources.

For instance…

If a routing were developed to produce cookies in a bakery, the inputs would be the ingredients to make the raw cookie dough and the controls on the routing would be the actual recipe, the oven temperature, and the baking duration. The resources in this example would be the oven and labor required to make the cookies. Finally, the output is the baked cookies that would be packed, packaged, and transported to retail stores.

There are several types of process structures, as shown in *Figure 42*. A **product-process matrix** is used to plan product outputs; the matrix has five process structures that can be plotted based on volume and product variety:

- **Project Process**: High variety and low volume, with few products made, such as custom homes.
- **Job Shop Process**: Medium-to-low volume and medium-to-high variety, such as auto repair shops.
- **Batch Process**: Medium volume and medium variety, such as bakeries.
- **Repetitive Process**: High volume and medium-to-low variety, such as automotive assembly.
- **Continuous Process**: High volume and low variety, such as bottling factories.

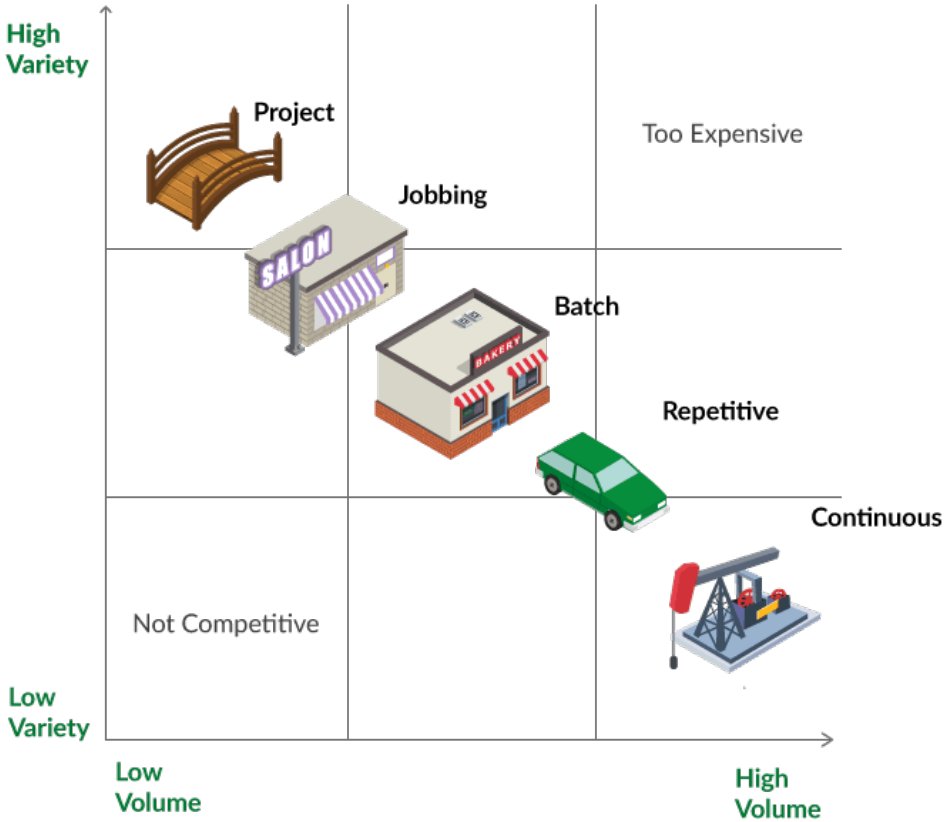

Figure 42. Product-process matrix. Developed by LINCS in Supply Chain Management Consortium.

Unit 2: Product Life Cycles

The product life cycle shows the typical progression of manufactured goods (see *Figure 43*). This is an important concept because businesses need to change and adapt their operational capabilities based on product life cycles. The product life cycle has four major segments or phases:

- **Introduction**: Introducing new products is the result of many months or even years of market evaluation, product designs, testing, and packaging. The introduction of a product also requires designing and setting up a supply chain.
- **Growth**: In this stage, product sales expand. Changes to product design, manufacturing processes, and quality evolve to maximize this revenue stream. The supply chain is also monitored and evaluated on a regular basis to ensure production capacity can be maintained or even expanded.
- **Maturity**: The demand for products is relatively stable when they reach maturity, so product changes and production changes are minimal. Now, the focus is on reducing costs and increasing production rates and supply chain efficiency. New, low-cost competitors entering the marketplace are a major threat in this stage.
- **Decline**: As demand continues to drop, companies will try to adopt product innovations to keep customers interested, but at some point the product will no longer appeal to customers.

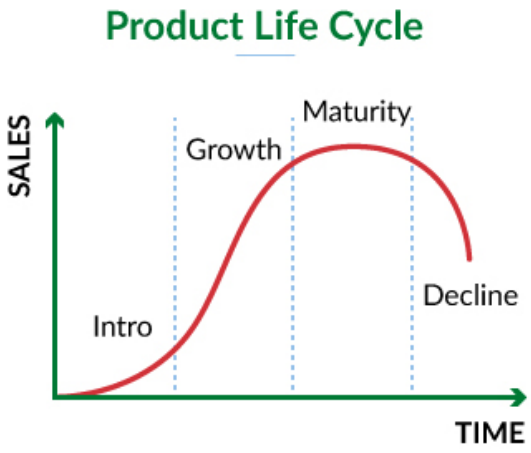

Figure 43. Product life cycle. Developed by LINCS in Supply Chain Management Consortium.

The time of each phase can vary dramatically. For instance, products can go from introduction to decline in months, like new smartphone models. The reverse can also happen when a product reaches the maturity stage and demand stabilizes, as in breakfast cereals. Knowing products' life cycles is important for operations managers, who use this information to plan and adapt supply chain processes to support their products.

Unit 3: Manufacturing & Services Operations (M&SO) Expanded

M&SO is the management of the transformation process by which inputs are converted to provide a product or service. In the U.S., more people work for service-providing companies than for product manufacturing companies. The difference between manufacturing and service operations is the output of manufacturing operations is a tangible item that can be placed in inventory; by contrast, the output of service operations is not tangible and cannot be placed in inventory.

For example…

Cars produced in a factory by manufacturing operations (see *Figure 44*) require dedicated operations management organizations. The factory output creates an inventory of autos that are made available for consumer sales. Service operations include automotive technicians, repair personnel, and repair parts to service the autos after they are sold. The service operations provide extremely valuable services but their output cannot be placed in inventory.

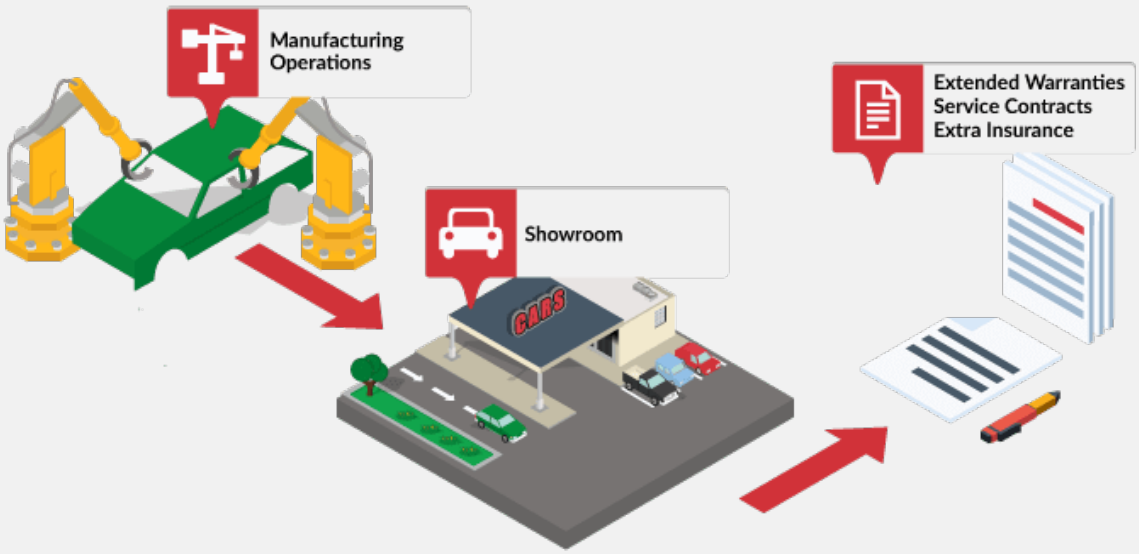

Figure 44. Manufacturing operations. Developed by LINCS in Supply Chain Management Consortium.

Manufacturing and service operations are not always separate; they can be used together to provide the end users with products and services combined. For example, a heat pump company utilizes an operations management organization to assemble heat pumps for residential and commercial applications; the same company employs a service management organization to train and deploy personnel to install and service the heat pumps.

Independent and Dependent Demand

The output of a manufacturing process can be inventoried, whether they are finished products ready for final consumers or parts that will go into a finished product. The finished goods that are sold are called independent demand. This demand is created outside the company (independently) by consumers. Independent demand in turn creates new demand for additional finished goods to be manufactured, which creates a dependent demand to manufacture additional raw materials.

For instance, at a bicycle manufacturer the independent demand is the demand created by consumers for completed bicycles. The dependent demands are the tires, seats, and other components that are used to assemble the bicycle.

A document referred to as the bill of materials (BOM) is the comprehensive listing of the dependent demand parts and components required to manufacture and assemble the final products (in this

example, the bicycles). The BOM is often also used by repair technicians in the service industry to troubleshoot and pinpoint defective parts and to order replacement (repair) parts.

Defining How Products Are Sold

Production approaches are defined by a company and used to align production capabilities with customer expectations. These approaches must be synchronized between marketing and manufacturing operations to ensure manufacturing capabilities exist to support the marketing strategy.

Engineer-to-order (ETO)	The **engineer-to-order (ETO)** process usually has long lead times and involves highly customized and expensive products. Usually, customer orders are required before any work begins. Once orders are received, the ETO process and new designs begin. These types of businesses are usually project or shop processes because of the high customization and low volume: examples include custom-built homes, individually designed yachts, and custom vehicles.
Make-to-order (MTO)	The **make-to-order (MTO)** process is geared towards a larger class of customers and allows for customization. Typically, orders are required before beginning the production process; however, unlike ETO, most of the design work is complete and parts may be in inventory. This preparation reduces the amount of time and expense required to process the order. One example is purchasing a builders spec home in which the customer defines finishing features like flooring, fixtures and paint colors.
Assemble-to-order (ATO)	The **assemble-to-order (ATO)** process includes products that are assembled from standardized parts and modules, with the flexibility arising from how the parts are finally assembled; usually, several options are available to allow buyers to customize the assembled products. The process structures used in ATO are repetitive processes, so organizations use mass customization processes, as when paint stores mix paints from a single base white to produce hundreds of customized colors.
Make-to-stock (MTS)	In the **make-to-stock (MTS)** process, companies mass produce goods to be kept in inventories, so when customers order, products are ready to ship. Companies use demand forecast to estimate production requirements. Products that are in the mature stage are usually the best ones for this type of process because demand can be estimated with confidence. The process structures used in MTS are repetitive assembly lines and continual processes, as with books, patio furniture, and clothing.

Defining How Services Are Offered

Service operations typically involve companies providing intangible products or services directly to consumers, as with car washes and repair shops. Service operations require some amount of interaction with consumers, whether face-to-face, online, telephone, or smartphone. The basic service types are:

- **Service factory**: This sector typically involves low labor costs, low customization, and low customer interaction, with examples including hotels, trucking companies, and airlines. A key customer trait in this area is price-shopping; customers look for the best deal based primarily on the price of the service. Many customers choose hotels based strictly on which hotel offers the lowest cost per night (see *Figure 45*). Operations managers will focus their efforts on facilities and equipment utilization by maximizing output and keeping costs low.
- **Service shop**: This sector requires high customization and customer interaction but relatively low labor costs, as with auto repair shops. Two of the biggest issues for operation managers in this sector include staying current with technology updates and scheduling.
- **Mass service**: This sector requires lower customization and customer interaction, but labor costs are relatively high, as in retail banks. Operations managers are usually concerned with improving service times and strive to employ automated technologies.
- **Professional service**: This sector is characterized by high customization and customer interaction and high labor costs, as with accountants, consultants, doctors, and lawyers. These types of service providers are highly educated, and the services they perform are time-consuming and deeply customized.

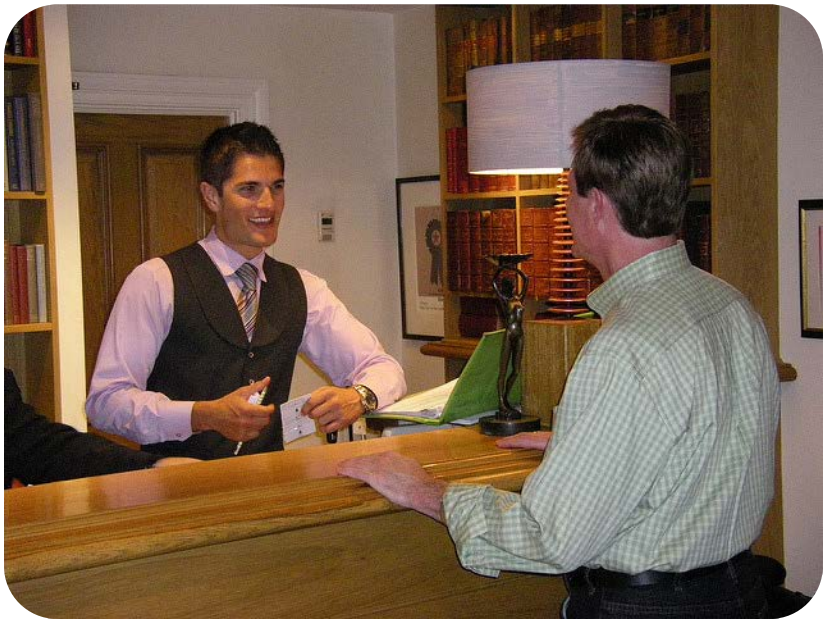

Figure 45. Service operations - a hotel clerk checking a woman into a hotel. By Alan light [CC-BY 2.0]. Acquired from flickr.com.

Understanding the type of service provider in different organizations helps companies to manage operations better and hence minimize costs and maximize customization efficiency.

Unit 4: Manufacturing and Service Quality

Quality is a critical aspect in manufacturing and service organizations. In fact, companies can lose market share very quickly if their products and services are viewed poorly by their customers. Therefore, organizations spend considerable amounts of resources to ensure their products and services meet or exceed customer expectations. To recognize companies' adherence to quality excellence, a national award—called the Malcolm Baldrige Quality Award—is presented by the U.S. National Institute for Standards and Technology in recognition of superior quality and performance excellence.

Total quality management (**TQM**) is about designing processes that produce consistent quality. This emphasis on quality goes on constantly throughout entire organizations. Additionally, there is a continuous quest to achieve improvements in product, service, equipment, people, procedures, material, and virtually any activity conducted by organizations.

For example…

Figure 46. Six Sigma Symbol. Developed by LINCS in Supply Chain Management Consortium.

Six Sigma is a program that strives to enhance the quality of process outputs by identifying the reasons poor-quality products are made, removing the root causes of defects, and reducing variability. Six Sigma quality ensures there are less than 3.4 defects per each one million units made.

Learning Block 5 Summary

Operations management directs and controls the transformation processes in which inputs are made into products and services. This learning block detailed the essential element of understanding operations, which is process thinking in terms of activities that transform inputs into outputs. It also presented the difference between manufacturing and service operations, the elements in the product-process matrix, and the importance of quality to operations.

Figure 12. Supply Chain Management Principles. Developed by LINCS in Supply Chain Management Consortium.

Learning Block 5 Practice Questions

1. The marketing approach that usually has long lead times for highly customized products is known as:

a. Make-to-stock
b. Make-to-order
c. Engineer-to-order
d. Assemble-to-order

2. The service factory sector typically requires low labor costs, low customization ability, and minimal customer interaction. The following are examples of service factory organizations, except:

a. Trucking companies
b. Hotels
c. Automobile repair shops
d. Airlines

3. The Malcolm Baldrige Quality Award is a national award recognizing organizations who have demonstrated superior excellence in:

a. Engineering and design
b. Production and service
c. Shipping and receiving
d. Quality and performance

4. The service sector characterized by high customization, high customer interaction, and high costs is:

a. Professional service
b. Mass service
c. Service shop
d. Service factory

5. An auto repair shop most likely falls into which of the following service sectors?

a. Customer service
b. Mass service
c. Quick-turn service
d. Service shop

6. Which marketing approach would a company use to mass produce products?

a. Make-to-order
b. Make-to-stock
c. Engineer-to-order
d. Make-for-stockouts

7. Manufacturing operations outputs differ from service operations in that:

a. Manufacturing outputs have to be repetitive
b. Service outputs are a result of long-term planning
c. Manufacturing outputs are tangible
d. Service outputs are highly customized

8. Total Quality Management (TQM) is defined as:

a. Designing processes to produce consistent quality
b. Inspectors hired to check quality
c. A process to repair poor-quality products
d. An element not necessary for providing services

9. Manufacturing process activities to produce a given product are often summarized on a:

a. Product matrix
b. Inventory plan
c. Manufacturing routing
d. Quality improvement plan

10. A bill of material (BOM) is a document used to:

a. Obtain a Malcolm Baldrige Quality Award
b. Provide a comprehensive listing of parts and components required to manufacture a given product
c. Advertise a product to consumers
d. Promote sales

Learning Block 6: Transportation Operations Overview

Learning Block 6 Description

Transporting goods often requires multiple modes of transportation; the combination of modes can vary depending on cost, values, dimensions, weights, time-definite delivery requirements, and other special considerations. This learning block is intended to provide a high-level overview of the significance of transportation as one element in the overall supply chain.

Learning Block 6 Learning Objectives

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

- Understand how different areas of product transportation affect the overall success of companies
- Recognize supply chain technology tools used in transportation systems
- Identify the challenges in establishing efficient and effective transportation processes within industries
- Determine which modes of transportation are more cost-effective in given situations and why
- Demonstrate metrics used to measure transportation service quality and efficiency

Unit 1: Role of Transportation in Supply Chain Principles

Availability of Service

In the supply chain, transportation involves how goods move among suppliers, manufacturers, and customers. The availability of transportation systems is essential to fulfilling the demand in the supply chain. Companies spend a significant amount of money on transporting goods; in some industries, it is the main element that impacts the ability of companies to compete in certain markets. Modes are defined as truck, train, plane, ship, or **pipeline**; sometimes a combination of modes, known as intermodal, enable the movement of people and goods from one point in the supply chain to another point and ultimately to their final destinations.

Efficiency of Service

Demand for transportation services is derived from customer demand. Transportation must be cost effective and efficient to ensure customer satisfaction in order to help customers gain access to higher-quality, lower-priced materials. However, low-cost transportation has little value if products do not arrive on time to the correct location or if they are damaged in transit. Therefore, managing transportation processes can prove to be complex and include numerous obstacles.

Providing effective transportation systems has a direct impact on organizations' abilities to thrive in their markets. The key is transporting

- ☑ the right products
- ☑ to the right customers
- ☑ in the right quantities
- ☑ under the right conditions
- ☑ at the right places and
- ☑ the right times and
- ☑ for the right costs.

Challenges

Many challenges must be addressed to ensure transportation operations effectively support the overall supply chain:

Complexity of supply chains	Competitive markets and increases in customer requirements influence companies to increase the number of products and means of distribution. The growth in complexity creates a less cost-efficient supply chain that is often overlooked when making these expansion decisions.
Growth of offshore manufacturing	Relying on global supply chains that extend from China and India requires more expensive and complicated transportation processes to connect buyers and sellers who are thousands of miles apart from each other.
Customer demands for more tailored services	Organizations that do not want to manage their transportation processes may outsource them to **third-party logistics providers** (**3PL**). Not only are 3PLs integrated providers of warehousing and transportation services, but they also utilize state-of-the-art **logistics** software and inventory management technologies. The benefits of using 3PLs include enhanced customer service capabilities, greater flexibility affecting variable costs, improved operational efficiency, and reduced capital expenditures.
Capacity constraints from other types of infrastructure	Transportation capacity constraints can create roadblocks. For example, a surge in containers entering a port or congestion on highways in a major city can cause shipment delays or promote increases in shipping rates.

Rising transportation rates	Transportation rates pose another major concern for organizations. Carriers are sensitive to the resources required and often need to increase rates rapidly to cover the rising costs of fuel, labor, and equipment.
Government regulations	The Department of Transportation contains 13 bureaus that are responsible for the policies and regulations about the safety and efficiency of various transportation systems. These bureaus directly oversee the five transportation modes: Federal Motor Carrier Service Administration, Federal Highway Administration, Federal Aviation Administration, Federal Railroad Administration, Maritime Administration, Federal Transit Authority, National Highway Traffic Safety Administration, and Pipeline and Hazardous Material Safety Administration are examples of these regulatory bureaus.

Unit 2: Modes of Transportation

There are five major modes of freight transportation: motor, railroads, air, water, and pipeline. Each mode has distinct attributes organizations should consider in order to create an overall cost-efficient system.

Road Transport

Road transport, also known as **motor carriers** and common carriers, are the most widely used domestic mode of transportation because most freight is routed regionally (see *Figure 47*). Following are other characteristics of road transport:

Figure 47. Motor carrier. Acquired from pixabay.com.

- They are the mode of choice for high-value, time-sensitive goods
- Motor carriers are in a highly competitive industry due to low barriers to entry; the only requirements are a truck and a driver
- The two main categories of trucking operations are for-hire and private fleet
- Challenges with motor carriers include rising costs, driver shortages, and competition

Rail Transport

Railroads are the transportation mode of choice for large volumes and when shipment distance exceeds 900 miles (see *Figure 48*). Following are other characteristics of railroad transportation:

- They are the highest-cost per ton-mile (one ton of freight carried one mile) mode of transportation
- Railroads are primarily used for long-distance movement of low-value raw materials and manufactured products
- The cost of entry is high for purchasing locomotives, rail cars, and building and maintaining railroad tracks, so only a few large railroad companies exist in the U.S.
- Rail equipment is organized in loads and transported by manifest trains, unit trains, or intermodal trains
- Challenges facing railroads include large investment in terminals, equipment to begin operations, capacity as volume surges, and a virtually unchangeable track infrastructure

Figure 48. Railroad. Acquired from pixabay.com.

Air Transport

This mode of transportation is often viewed as too expensive and used only in emergencies. However, the importance for companies of maintaining lower inventory levels has added new impetus to the use of airfreight as a faster option with JIT operations (see *Figure 49*). Following are other characteristics of airfreight transportation:

- **Ecommerce** and the growth of supply chain initiatives have contributed to an increase in demand for this mode of transportation
- International air transportation is projected to continue growing
- Airfreight is the mode of choice for shipping small quantities of high-value and low-weight semi-finished and finished goods
- Challenges for air carriers include cost issues for profitable growth, competition, and security

Figure 49. Air carrier. By Martin_vmorris [CC-BY-SA 2.0]. Acquired from flickr.com.

Water Transport

Water transportation over oceans is the major mode for international trade and dominates other modes in international freight revenue (see *Figure 50*). Following are other characteristics of ocean transportation:

- Ships are slow but offer tremendous capacities for volume freight, efficient fuel consumption, and low cost
- They handle a wide variety of goods from low-value commodities to imported automobiles
- Two types of water carriers dominate for-hire carriers: liner services and charter services

- Ocean transportation of goods use specialized ships like container ships, bulk carriers, and tankers
- Challenges with water transportation include capacity, trade imbalances, rising costs, piracy, and careful planning when transporting perishable cargo

Figure 50. Container Ship. Acquired from pixabay.com.

Pipeline Transport

Pipelines have been called the hidden giant of transportation and are used for handling inter-city ton-mileage of freight (see *Figure 51*). Following are other characteristics of pipeline transportation:

Figure 51. Pipeline. Acquired from pixabay.com.1

- Equipment is fixed in place, providing a warehousing function while protecting product from contamination
- Pipelines are the most economical form of transportation with the lowest cost per ton-mile
- The U.S. has the largest network of energy pipelines of any nation
- Pipelines are comprised of for-hire and private carriers
- Challenges with pipelines include issues of safety and security.

Intermodal Transportation

Intermodal transportation is defined as two or more independent modes used to transport and deliver the same cargo. Intermodal transportation has seen significant growth in the last twenty years and involves railways, ships, and trucks, without handling cargo when changing modes (see *Figure 52*).

For example...

Goods produced in Asia can be loaded into a container that is placed on a container ship; then, the ship unloads the container at a port on the West Coast of the U.S., after which it is placed on a truck and taken to the railroad station, where it is placed on a train and hauled to the Midwest; finally, it is taken by truck to a warehouse to be unloaded. The cargo inside the container is not handled until it reaches its warehouse destination.

Benefits of intermodal transportation include:

- Greater accessibility by linking individual modes of transportation
- Overall cost efficiency is achieved without sacrificing quality of service
- Ease of global trade
- Growth is attributed to better information systems for tracking freight, development of intermodal terminals, and creation of a standard-size container that can be used on a train, truck, or ship
- Challenges of intermodal transportation include congestion in transfer points, capacity, and labor issues

Figure 52. Intermodal transportation containers. Acquired from pixabay.com.

Unit 3: Transportation Processes

Shipment Preparation

When goods need to be moved throughout the supply chain, decisions must be made involving size, route, delivery method, and freight documentation. Additionally, products must be packed and packaged to prevent shipping and transportation damage and ensure safe delivery. When products are shipped, in-transit problems must be resolved, and quality of service must be monitored.

Figure 53. Transportation processes. Developed by LINCS in Supply Chain Management Consortium.

To ensure maximum effectiveness in the shipment-carrier process, many companies maintain a corporate transportation routing guide. These routing guides contain instructions for packing and packaging, carton and shipment labeling, insurance and billing requirements, and advanced shipping notification. The strategy behind using these guides is organizational efficiency, but they also promote centralized control over the number of carriers being used and ensure contractual agreements with carriers are being fulfilled.

The delivery process begins with customer orders. As orders and delivery requests are received, efforts should be made to consolidate freight, coordinate deliveries, and maximize container capacity.

Freight Documentation

Shipments are accompanied by documentation that details what the shipment contains, where it is, where it is going, and to whom it is being sent. The most common types of documentation are the bill of lading, the freight invoice, and the freight claim. Additionally, shippers' instruction letters are helpful in ensuring freight is handled and shipped according to their requirements.

The bill of lading is an official document—a contract—that can be used in a court of law. The document is proof of an agreement between companies responsible for shipping goods and companies actually transporting goods. The document contains an explanation of the goods, the quantity being transported, and the destination of the goods. Bills of lading are generated by shippers or 3PL companies. This document functions as the receipt upon the delivery of goods, must accompany the shipped goods, and must include authorized signatures from shippers, carriers, and receivers (see *Figure 54*).

Date **BILL OF LADING – SHORT FORM – NOT NEGOTIABLE** Page 1 of 1

SHIP FROM	**Bill of Lading Number:**
[Name] [Street Address] [City, ST ZIP Code] SID No.:	BAR CODE SPACE
SHIP TO	**Carrier Name:**
[Name] [Street Address] [City, ST ZIP Code] CID No.:	Trailer number: Serial number(s):
THIRD PARTY FREIGHT CHARGES BILL TO	**SPAC:**
[Name] [Street Address] [City, ST ZIP Code]	Pro Number: BAR CODE SPACE
Special Instructions:	**Freight Charge Terms** (Freight charges are prepaid unless marked otherwise): Prepaid ❑ Collect ❑ 3rd Party ❑
	❑ Master bill of lading with attached underlying bills of lading.

CUSTOMER ORDER INFORMATION

Customer Order No.	# of Packages	Weigh t	Pallet/Slip (circle one)		Additional Shipper Information
			Y	N	
			Y	N	
			Y	N	
			Y	N	
Grand Total					

CARRIER INFORMATION

Handling Unit		Package					LTL Only	
Qty	Type	Qty	Type	Weigh t	HM (X)	Commodity Description Commodities requiring special or additional care or attention in handling or stowing must be so marked and packaged as to ensure safe transportation with ordinary care. See Section 2(e) of NMFC item 360	NMFC No.	Class

Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property as follows: "The agreed or declared value of the property is specifically stated by the shipper to be not exceeding _____ per _____."

COD Amount: $ _____
Fee terms: Collect ❑ Prepaid ❑ Customer check acceptable ❑

Note: Liability limitation for loss or damage in this shipment may be applicable. See 49 USC § 14706(c)(1)(A) and (B).

Received, subject to individually determined rates or contracts that have been agreed upon in writing between the carrier and shipper, if applicable, otherwise to the rates, classifications, and rules that have been established by the carrier and are available to the shipper, on request, and to all applicable state and federal regulations.

The carrier shall not make delivery of this shipment without payment of charges and all other lawful fees.
Shipper Signature _____

Shipper Signature/Date	**Trailer Loaded:**	**Freight Counted:**	**Carrier Signature/Pickup Date**
This is to certify that the above named materials are properly classified, packaged, marked, and labeled, and are in proper condition for transportation according to the applicable regulations of the DOT.	❑ By shipper ❑ By driver	❑ By shipper ❑ By driver/pallets said to contain ❑ By driver/pieces	Carrier acknowledges receipt of packages and required placards. Carrier certifies emergency response information was made available and/or carrier has the DOT emergency response guidebook or equivalent documentation in the vehicle. Property described above is received in good order, except as noted.

Figure 54. Bill of lading. Developed by LINCS in Supply Chain Management Consortium.

Freight bills, or freight invoices, are distinct from bills of lading in that they do not serve as a key piece of evidence in any potential dispute. Freight bills differ from bills of lading because they include additional specific information, including transaction-related information and charges that describe the information on the bill of lading (see *Figure 55*).

Figure 55. Freight bill. Developed by LINCS in Supply Chain Management Consortium.

A freight claim is considered to be a legal claim by shippers or consignees against carriers for financial compensation for loss or damage of shipments *(see Figure 56*). Freight claims are also known as shipping claims, cargo claims, transportation claims, or loss and damage claims. The three types of freight claims include shortage or loss, damage, and delay. Damage can be labeled apparent or concealed: concealed damage is discovered after shipments have been received and signed for, when no visible damage to cartons or products was noted on the delivery receipt.

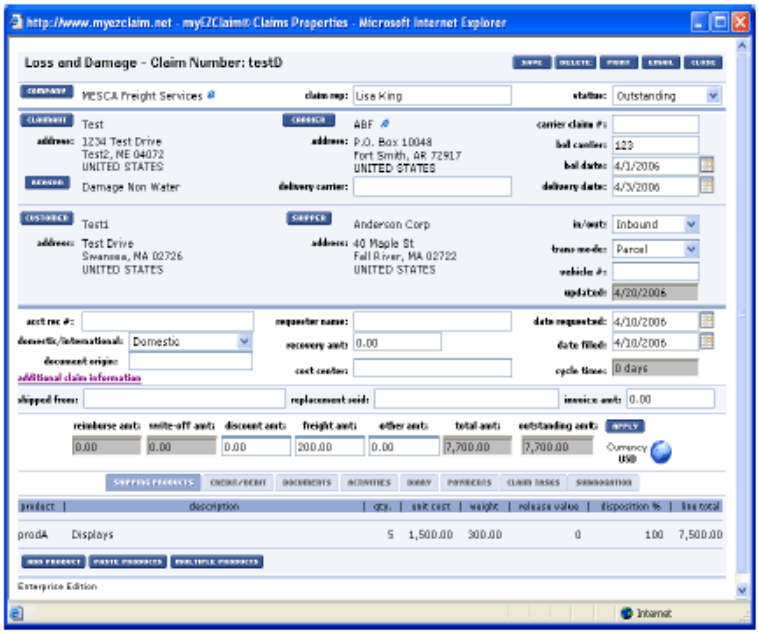

Figure 56. Freight claims form. Developed by LINCS in Supply Chain Management Consortium.

Safety and Security

Governmental deregulation has provided carriers with more freedom to operate in competitive environments, but governmental regulation is increasing in other areas related to quality of life. Legislation has been passed to improve the safety of the transportation industry, reduce its impact on the environment, and protect the country against terrorism. The U.S. Department of Transportation's Federal Motor Carrier Safety Administration recently introduced a new set of regulations regarding hours of service rules, effective July 2013:

- Allows truck drivers 11 hours of driving time within a consecutive 14-hour period, after which drivers must be off duty for 10 hours
- Limits the maximum average work week for truck drivers to 70 hours, a decrease from the current maximum of 82 hours

- Allows truck drivers who reach the maximum 70 hours of driving within a week to resume driving if they rest for 34 consecutive hours, including at least two nights when their body clock demands sleep the most, from 1:00 am to 5:00 a.m.
- Requires truck drivers to take a 30-minute break during the first eight hours of a shift (U.S. Department of Transportation, 2014)

Other issues have also been addressed by new regulations, including environmental protection issues relating to noise pollution, air pollution, hazardous waste material, known shippers, and vehicle emissions. Ensuring the safety and security of people and the environment can cost companies money; industry experts claim vehicle emissions regulation have led to higher fuel prices, more expensive truck engines, and lower fuel efficiency than previously; meanwhile, hours of service regulations have led to rate increases at driving organizations after reviewing and revising their policies.

Quality of Service

Control of freight in transit assists buyers in meeting customers' needs. Service quality monitoring of carrier performance includes information about:

- Customer service demands
- Service level of carriers
- Shipment date, arrival date, and shipment damage information
- Use of standardized scorecards

Key performance indicators are objective measures of carrier performance that are critical to companies' success. They are used for internal performance reviews and as benchmarks for comparing companies' performances against the competition. The types of performance that can be measured include:

- Transportation spending efficiency
- Freight protection
- Delivery service quality
- Customer satisfaction

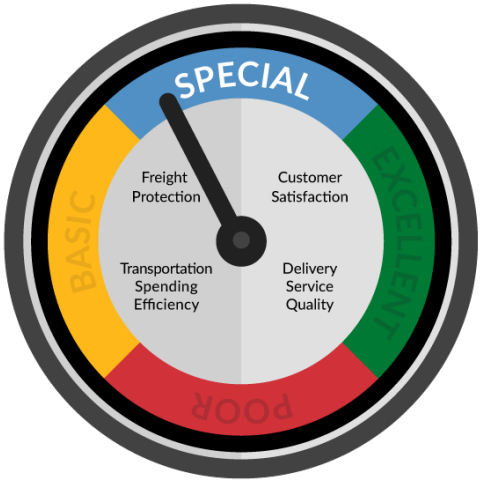

Figure 57. Quality of service. Developed by LINCS in Supply Chain Management Consortium.

Transportation Management Systems

Technology has played a major role in expanding visibility in the supply chain. Today, even the occasional online shopper can track or monitor where their orders are in the process and when they are likely to be delivered. Transportation management systems (TMS) include software tools related to moving goods throughout the supply chain. These tools are used to assist buyers and managers in making pre-shipment decisions. A TMS works in conjunction with an **order management** system, a WMS, and supply chain planning tools. TMS software applications include:

- ☑ Routing and scheduling
- ☑ Planning how to load containers or vessels
- ☑ Tracking orders
- ☑ Performance reporting and scorecarding
- ☑ Auditing freight bills

Inbound, Outbound, and Reverse Logistics

Figure 58. Inbound logistics. Developed by LINCS in Supply Chain Management Consortium.

Figure 59. Outbound logistics. Developed by LINCS in Supply Chain Management Consortium.

Inbound logistics refers to the transport, storage, and delivery of goods coming into a business. It covers anything a company orders from suppliers, including tools, raw materials, office equipment, and inventory. Inbound logistics is concerned with the relationship between companies and their suppliers.

Outbound logistics refers to the transport, storage, and delivery of goods that are leaving a business. It deals almost exclusively with end products, so outbound logistics concerns itself primarily with how companies deliver products to their customers. Inbound and outbound logistics decisions should maximize the reliability and efficiency of distribution networks while also minimizing costs.

Reverse logistics, however, refers to the transportation of goods that must be returned from a customer to the manufacturer. This typically occurs because of product defects or in-warranty repairs.

Decision to Outsource

Companies must choose between transporting goods using their own private fleets or using external service providers. Private fleets can be cost-effective, provide flexibility in scheduling, and offer low-cost promotional benefits. External service providers include for-hire carriers and 3PLs; they eliminate the need for large capital investment in private fleets and transfer risks like insurance liability, labor safety, and government regulations. They can also offer a wider array of transportation services.

Learning Block 6 Summary

Figure 12. Supply Chain Management Principles. Developed by LINCS in Supply Chain Management Consortium.

Transportation plays a major role in businesses. It is the link between customers and suppliers, warehouses and retail outlets, and virtually any two entities separated in the supply chain. Managing the transportation process requires substantial knowledge of transportation options, planning, decision-making, analytical skills, and information-sharing abilities. Transportation is the largest cost component in most supply chains and directly impacts other areas of the supply chain such as fulfillment and service quality. Numerous obstacles must be dealt with to coordinate transportation with other supply chain processes; otherwise, undesirable results could dramatically affect overall supply chain productivity and cost efficiency.

Learning Block 6 Optional Supplemental Resources

The optional supplemental resources listed below may be used to reinforce the content covered within this learning block.

BCCBusinessClips's Channel (Producer). (2012, January 26). *Fedex and UPS Documentary*. Available from http://www.youtube.com/watch?v=JZu_gxi3sbs

Load Delivered Logistics (Producer). (2012, October 1). *What is Logistics*? Available from http://www.youtube.com/watch?v=Vu3o2-3uSKE

Starbucks Coffee (Producer). (2012, November 30). *A behind the scenes look at Starbucks Global Supply Chain*. Available from http://www.youtube.com/watch?v=ElYNhGbOTOQ

The following link contains further details on various freight documentation:

Export.gov. (2013). *Common export documents*. Retrieved from http://www.export.gov/logistics/eg_main_018121.asp

Learning Block 6 Practice Questions

1. Identify which of the following is not a transportation challenge.

a. Decline in ocean container ships
b. Growth of offshore manufacturing
c. Rising rates
d. Government regulations

2. A company uses the term outbound logistics to describe:

a. Transportation and delivery of goods that are leaving a supplier
b. Transportation and delivery of goods that are leaving a business
c. Return of defective products
d. The forms necessary to transport products

3. The transportation and delivery of goods being shipped from a supplier to a company is defined as:

a. Outbound logistics
b. Reverse logistics
c. Inbound logistics
d. Third-party logistics

4. The major mode used for international trade, which dominates international freight revenue, is;

a. Ocean
b. Air carrier
c. Intermodal freight
d. Pipeline

5. _____ is the most widely used domestic mode of transportation because most freight is regional in nature.

a. Motor carrier/Common carrier
b. Pipeline
c. Railroads
d. Air carrier

6. Which mode of transportation is the highest-cost ton-mile mode of transportation?

a. Railroads
b. Motor carriers
c. Air carriers
d. Ocean

7. Which freight document is considered to be a contract that can be used in a court of law?

a. Bill of material
b. Bill of lading
c. Delivery invoice
d. Engineering drawing

8. Benefits of intermodal transportation include all the following, except;

a. Greater accessibility by linking the individual modes
b. Being the best choice in terms of cost and speed for companies
c. Overall cost efficiency to be achieved without surrendering quality of service
d. Easy global trade

9. Which of the following is not a function of a transportation management system?

a. Routing and scheduling
b. Planning how to load a container or vessel
c. Tracking orders
d. Ordering materials

10. Identify the mode of transportation that is the most efficient for large volumes and distances exceeding 900 miles.

a. Air
b. Pipeline
c. Railroads
d. Ocean containers

Learning Block 7: Customer Service Operations Overview

Learning Block 7 Description

This learning block provides an overview of the importance of customer satisfaction which should be the top priority of every company. Customer service excellence is used to achieve customer satisfaction and applies to both internal and **external customers**. **Internal customers** are people who work within a company, while external customers are people who purchase goods or services from the company.

Employees portray important roles as ambassadors for their company, including giving first impressions, developing working relationships, and communicating personally and electronically. Elements of customer service in the supply chain include time, dependability, communication, and convenience.

Learning Block 7 Learning Objectives

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

- State the common elements of customer service definitions
- Discuss the difference between internal and external customers
- Recognize the importance of a positive first impression
- Explain the characteristics of successful ecommerce customer service
- State the four elements of supply chain customer service

Unit 1: Customer Service

Customer service is a key competitive advantage and is part of every interaction with a customer! Excellent customer service practices focus on using the fastest and most cost-efficient ways to support customers. Customer service starts with interactions before a sale and must continue during and after a purchase.

Customer service has evolved in today's hyper-connected world; it is more than the helpdesk agent that answers questions on a toll-free phone line. It has grown to encompass every interaction a customer has with a company or brand. It can take place in

Figure 60. Customer call-line representative. By Holidayextras [CC-BY 2.0]. Acquired from Flickr.com.

person or use media like phone, email, chat, web forums, and social media communications (see *Figure 60*).

To be effective, employees must act as ambassadors for their company. Customer service representatives must be trained and be proficient in the following processes:

- The order process and **customer relationship management** (**CRM**)
- Communications
- Returns and reverse logistics
- Challenging customers
- Legal and regulatory concerns

Unit 2: The Order Process and Customer Relationship Management

Overview

The order process describes the activities that explain processing orders, managing customer relationships, and fulfilling orders. This process requires teamwork and is often the first experience with a customer.

The Order Cycle

The customer **order cycle** occurs when customers interact with suppliers. Suppliers are wholesalers, retailers, or suppliers of material and the order cycle includes work directly involved in receiving and fulfilling customer orders. Normally, customers begin this cycle, which is then focused on fulfilling their demands (see *Figure 61*).

The order management process starts with a customer request and can be flowed by a request for follow-up information after the initial order is placed. When orders are placed, companies must ensure they are filled on time, completely, and without quality defects.

Companies need to perform exceptionally well when interfacing with customers. To ensure employees are being efficient and effective, performance metrics should be used to gauge and measure success or failure in meeting all defined objectives.

As customer issues arise, the customer experience regarding the resolution of issues will impact customers' decision to continue doing business in the future or switch to a competitor. To manage this, many companies use CRM software tools that help document all aspects of the interactions between customers and companies.

Finally, good practices should always be followed in all aspects of the order and interaction process, including clear and frequent communication, order consolidation, inventory management, and order automation.

Figure 61. The order cycle. Developed by LINCS in Supply Chain Management Consortium.

Relationship Management

CRM is a process that provides various pieces of information about customers, sales, marketing effectiveness, and market trends, with an eye to improving customer service. CRM also facilitates efficiency, cost reductions, increases in profitability, and streamlines sales and marketing processes.

Business relationships form the interaction between customers and suppliers over periods of time. As interactions develop over longer periods, closer relationships develop, which help improve confidence and trust. What can start as distant or remote relationships should evolve into more strategic partnerships built on confidence and trust. The customer life cycle is the term used to describe the steps used by a company to find, manage, retain, and develop interactions with customers.

Unit 3: Communications

Overview

Communication involves the transfer of information; to be effective, communicators need to understand to whom they communicate, the message they communicate, and the most appropriate form of each communication. There are various communication methods, each of which is called a communication channel (see *Figure 62*).

Figure 62. Communications in a global market. Developed by LINCS in Supply Chain Management Consortium.

Effective Communications

Verbal communication is using spoken words to communicate messages and information. Listening is an important form of communication because it requires an active effort to understand others. Nonverbal communications can help to improve how others may feel and how they interpret the company's message.

Writing skills are also an important communication tool; they are used widely today in emails, social media, and business letters. If a message is phrased inaccurately, it could be the source of confusion because written communications is effectively permanent and may reach wide audiences. On the other hand, visual communications use images to persuade, entertain, inform, and enlighten customers or potential customers about products and ideas. Finally, there may be barriers to communication such as language differences, cultural differences, lack of personal familiarity, and preconceived notions.

Unit 4: Returns and Reverse Logistics

Overview

Reverse logistics is the return of products in the supply chain. If products are not needed by customers or if they are defective, customers can return them in a reverse logistics flow. This process may include shipping, testing, repairing, returning, recycling, or discarding products.

Companies that sell and distribute products have generally dealt with returns resulting from damages or other reasons such as incorrect shipments. Today, most companies have policies in place that allow customers to return or exchange items if they are dissatisfied with their purchases for any reason.

Customer Service representatives must be skilled when dealing with customers wishing to return items. The customer has likely already reached a certain level of dissatisfaction, so special communication skills are necessary to help the customer achieve their goals while working to retain the customer for future sales.

Process

Customer returns and how they are handled can impact customer service levels either positively or negatively; it is essential that returns are handled in an efficient and effective manner. The general flow for returns begin with good customer service; the representative will usually issue the customer a return material authorization (RMA) number that approves the return and identifies it for processing when it is received by the company. The return can result in reinventory for resale, repair, or refurbishment for return to the customer, or in disposal if the product has no value.

Key metrics for returns can help a company improve the quality of products and improve how returns are handled. Examples include disposition cycle times, quantity and value of products reclaimed and resold, percentage of material recycled, waste, and handling costs per return.

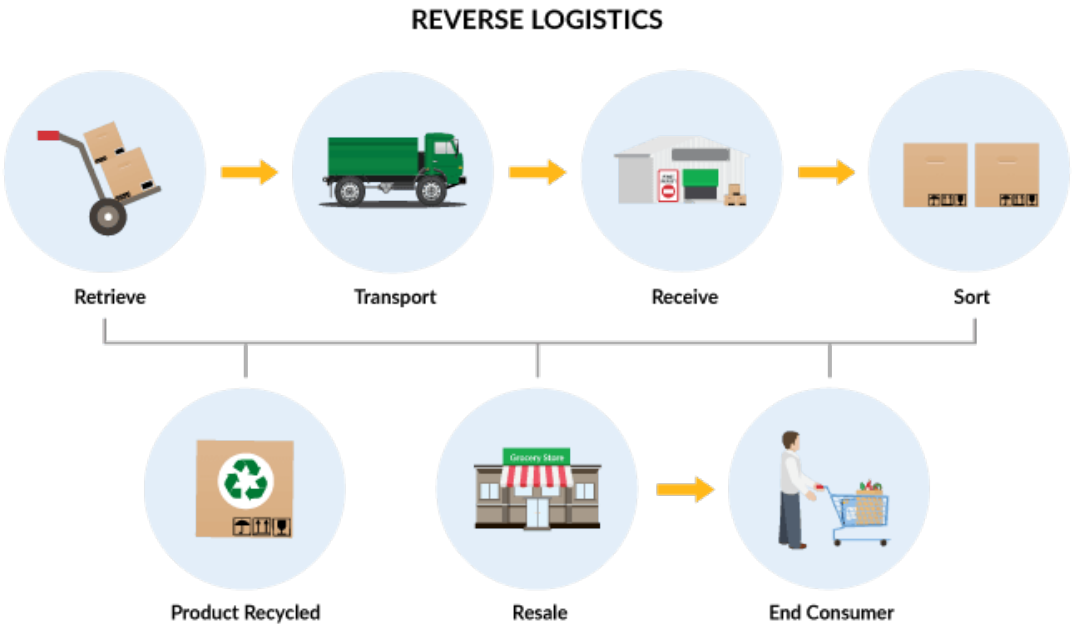

Figure 63. Reverse logistics process. Developed by LINCS in Supply Chain Management Consortium.

Unit 5: Challenging Customers

Overview

Customers can be a challenge for customer service representatives; patience, skill, and good communication skills can be effective ways to overcome these challenges. The world is full of different personalities, and some individuals may come across as defensive and negative.

Challenging or defensive individuals fall into these basic categories:

- Angry or openly antagonistic and aggressive
- Lacking good communication skills and the ability to express their thoughts
- Arrogant or supreme attitude
- Prone to making unwarranted personal attacks
- Overly talkative and lacking the will or ability to listen

Customer service representatives must use caution to defuse each situation and keep the focus on a win-win, positive outcome.

Figure 64. Challenging customer. Developed by LINCS in Supply Chain Management Consortium.

Summary

Good customer service is vital for virtually every company's success. Excellent customer service takes time and management leadership, along with positive employee energy. Customer service representatives must continually develop and refine skills to ensure timeliness of delivery, politeness, professionalism, and personalization.

Customer service representatives must also refine their skills to seek the root cause of problems, display an outward appearance of calmness and respect, and maintain the highest standard of ethics when dealing with customers, especially challenging customers.

Unit 6: Legal and Regulatory Concerns

Overview

Every organization and business is governed by rules, laws, and regulations determined by the community, the county, the state, and the federal government. In addition, companies write their own policies, which might be stricter than governmental requirements. Non-compliance with these rules, laws, and policies has consequences that can affect employees, employers, and customers, including fines and even imprisonment. Customer service representatives must be aware of all governing rules, laws, and policies, avoid violating them, and report customers that demand outcomes that could result in violations. Some examples are as follows:

- Human rights and human rights laws
- Food safety and food safety laws
- Hazardous products and material laws
- Environmental laws

Customer service representatives need training to become aware of the legal and regulatory concerns with order management and customer service to ensure employees conduct themselves professionally while ensuring customers' legitimate expectations are fulfilled.

Learning Block 7 Summary

Customer service is a critical element within the supply chain. Customer service includes attributes common to both internal and external customers, including the significance of communication and teamwork to achieve good customer satisfaction and retention.

Figure 12. Supply Chain Management Principles. Developed by LINCS in Supply Chain Management Consortium.

Learning Block 7 Practice Questions

1. When should customer service begin?

a. When there is a problem
b. Before a sale
c. After the sale
d. During a marketing campaign

2. Customer Service applies to;

a. Regulatory agencies
b. Auditors
c. Suppliers
d. Internal and external customers

3. Internal customers are individuals that work:

a. Remotely
b. Within the company
c. For suppliers
d. With consumers

4. The customer order cycle occurs when:

a. A web site is designed
b. New products are launched
c. Customers interact with suppliers
d. A marketing campaign is developed

5. Identify what can be used to gauge and measure performance and success.

a. Training
b. Marketing strategy
c. Quality plan
d. Performance metrics

6. Which of the following processes are used to provide various pieces of information about customer sales and trends?

a. Customer relationship management (CRM)
b. Flow-charting
c. Telephone solicitation
d. Magazine advertisements

7. Identify a type of challenging customer?

a. Quiet and polite
b. Antagonistic and aggressive
c. Repetitive caller
d. Good listener

8. Which of the following is not recognized as a method of communication?

a. Verbal
b. Written
c. Avoidance
d. Nonverbal

9. Identify the process used for the return of products.

a. Obsolesce
b. Reverse logistics
c. Scrap
d. Outbound logistics

10. Identify why customer service representatives need to understand policies, rules, regulations, and laws.

a. Increased call times
b. Non-compliance has consequences, including potential fines and imprisonment
c. To impress customers
d. To receive performance awards

Practice Questions Answer Key

Learning Block 1

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

Learning Block 2

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

Learning Block 3

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

Learning Block 4

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

Learning Block 5

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

Learning Block 6

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

Learning Block 7

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

Supply Chain Management Principles Certification Track Glossary

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

0-9

3PL*: See *Third-party Logistics provider.*

A

Acquisition Costs*: The net price plus other costs needed to purchase an item and move it to the point of use.

Assemble-to-order (ATO)*: In this type of process, products are assembled from standardized parts and modules. The flexibility in this process is in how the parts are assembled. Usually, there are several options available that allow the buyers to customize their products. The process structures used in this type of operation are repetitive, and some organizations use mass customization processes. Examples are Subway restaurants, which use an assembly line to make a customized sandwich from standardized ingredients or Home Depot paint departments, which customize colors for customers by mixing one of hundreds of standardized color choices to base white paint.

ATO*: See *Assemble-to-order*.

B

Barcode*: A symbol consisting of a series of printed bars representing values. A system of optical character reading, scanning, and tracking of units by reading a series of printed bars for translation into a numeric or alphanumeric identification code. A popular example is the UPC code used on retail packaging.

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 environment being used. Best practices methodology may be applied with respect to resources, activities, cost object, or processes.

Bill of Lading*: A transportation contract document from shippers acknowledging specific goods have been delivered to specific locations and received by correct recipients.

Bill of Materials*: A comprehensive listing of the dependent demand parts and components required to manufacture and assemble final products.

BOM*: See *Bill of Materials.*

C

Capacity Requirements Planning (CRP): Software used to ensure sufficient labor, equipment, and supplies are in place to meet production demand.

Carrying Costs: Costs of holding inventory; is derived from carrying the inventory on the books.

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.

Consumer: Someone who purchases goods and/or services for personal use.

Conveyor*: Mechanism used to load and unload vehicles and/or to route items throughout the warehouse. Also can be used as an automated sorting system, of which there are four major categories: pop-up sorter, surface sorter, tilt slat sorter, and tilt tray sorter.

Core Competency*: Fundamental knowledge, ability, or experience in a specific area, or a skill set.

CPFR*: See *Collaborative Planning, Forecasting, and Replenishment*.

CRM*: See *Customer Relationship Management*.

CRP: See *Capacity Requirements Planning*.

Customer*: 1) In distribution, the trading partner or reseller. 2) In direct-to-consumer, the end customer or user.

Customer Relationship Management (CRM)*: Term given to developing different strategies to serve most effectively the full range of customers that interact with the company.

D

DC*: See *Distribution Center*.

Decline: As demand continues to drop, companies try to adopt product innovations to keep customers interested, but at some point, products do not appeal or meet customers' expectations. At this stage, cost is a critical factor.

Demand Patterns: A regular or repeating trend by which the desire for goods changes over specific time intervals. Demand patterns include stationary (even demand), trend (predictable growth or decline), seasonal (patterns that repeat cycle after cycle), cyclical (patterns that are influenced by external factors), trend with seasonality (predictable growth or decline based on cycles), and random (changes and variances that are not predictable).

Demand Shaping*: The practice of actively influencing demand to match supply.

Dependent Demand: A term in economics in which demand for one good or service occurs as a result of demand for another; this often occurs when the former is a component of production of the latter.

Direct Costs*: Costs incurred directly as expenses when items are being made.

Distribution Center (DC)*: The warehouse facility that processes inventory from suppliers and manufacturing for distribution in the supply chain.

Distribution Requirements Planning (DRP)*: Software used in the distribution system to plan how and when to have the finished items in the right place at the right time.

Dock Leveler: A device used to bridge the gap between the dock and the trailer bed of the vehicle. It may be mechanically, hydraulically, or manually operated.

DRP*: See *Distribution Requirements Planning*.

E

Ecommerce*: Electronically communicating with and handling customers, whether through email, smartphone, other online means, or any medium using electronic devices.

Engineer-to-Order (ETO): A process in which the manufacturing organization must first prepare (engineer) significant product or process documentation before manufacture may begin.

Enterprise Resource Planning (ERP)*: Software that combines MRP, DRP, and CRP into one system and merges the business planning systems.

ERP*: See *Enterprise Resource Planning*.

ETO: See *Engineer-to-order*.

External Customers: External customers are consumers of products and services a company sells.

G

Growth: In this stage, the sales of a product are expanding. Changes to product design, manufacturing processes, and quality are all evolving to maximize this revenue stream. The supply chain is also monitored and evaluated to make sure production capacity can be maintained or even expanded.

I

Inbound Logistics*: The transport, storage, and delivery of goods coming into businesses. Inbound logistics covers anything companies order from all suppliers, including tools, raw materials, office equipment, and inventory.

Independent Demand*: Finished goods that are sold to customers.

Indirect Costs: Costs incurred to facilitate the manufacturing process but not incurred directly in performing the manufacturing function.

Intermodal Transportation*: Intermodal freight transport involves using railroads, ships, and/or trucks without any handling of cargo when changing modes.

Internal Customers*: An individual or department which is a part of the supplying company

Introduction: The product of many months or even years of market evaluation and product design, testing, and packaging. Introduction also requires designing and setting up a supply chain.

Inventory*: The number of units and/or the value of the stock of goods held by a company.

Inventory Management*: The process of ensuring the availability of products through inventory administration.

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.

J

JIT*: See *Just-in-time*.

Just-in-time (JIT)*: An inventory control system that controls material flow into assembly and manufacturing plants by coordinating demand and supply to the point that desired materials arrive in time for use.

L

Lead Time*: Average time that elapses from placing orders with suppliers to receiving goods. It includes the time required for order transmittal, order processing, order preparation, and transit.

Lean*: Refers to operational and procedural practices that create efficient flow.

License Plate*: A barcode serial number assigned to items when they arrive at the warehouse if there is a need for intermediate storage. The license plate is used to track the movement of items within the warehouse.

Logistics*: The process of planning, implementing, and controlling the efficient and effective flow and storage of goods, services, and related information from point of origin to point of consumption for the purpose of conforming to customer requirements and minimizing costs.

Long-Term Planning: An aggregate plan used to ensure the major resources are adequate to meet demand.

M

Maintenance, Repair, and Operating (MRO): Product consumed to support the operations to manufacture and manage inventory.

Make-to-order (MTO)*: Geared towards a larger class of customers, but allows for some customization. Typically, orders are required to begin the production process. However, unlike ETO, most of the design work is complete, and parts may be in inventory. This reduces the amount of time required to finalize the order. The process structures used in MTO are batch, job shop, and cellular process.

Make-to-stock (MTS)*: Companies will mass produce goods to keep in inventory so that product is ready to ship when customers place orders. Companies will use demand forecasting to estimate production requirements. Products in the mature stage are usually the best ones for this type of process because demand is readily known. The process structures used in this setting are repetitive assembly lines and continuous processes.

Manufacturing Operations: Operations specifically used for making products, including dish soap to automobiles; they make tangible items that can be sold to consumers through stores, shops, and online.

Mass Service: Requires lower customization and customer interaction, but labor intensity cost is relatively high. Operations managers are concerned with improving service times and will try to employ automated technologies.

Master Production Schedule (MPS)*: Sometimes shortened to MPS, it is created from the demand forecast and alerts the factory as to how many end products are needed within a certain timeframe.

Materials Requirements Planning (MRP)*: A software system used in production to determine how many raw materials and parts will be needed for manufacturing and when they should be on hand.

Maturity: The demand for the product is relatively stable, so product changes and production changes are minimal. Now, the focus is on reducing costs and increasing production and supply chain efficiency. A major threat in this stage is low-cost competitors coming into the marketplace.

Mid-Term Planning: Outlining what will be produced by period, but not on a highly detailed schedule.

Motor Carriers*: Also referred to as common carriers, the most widely used domestic mode of transportation, as most freight is regional in nature.

MPS*: See *Master Production Schedule*.

MRO*: See *Maintenance, Repair, and Operating*.

MRP*: See *Materials Requirements Planning*.

MTO: See *Make-to-order*.

MTS*: See *Make-to-stock*.

N

Negotiation: Term used to describe discussions used to reach a formal agreement as to sale terms.

O

Operations Management: The management of the transformation process in which inputs are made into products and services.

Order Cycle*: The process that runs from placement of order to receipt of order, including order transmittal, processing, preparation, and shipping.

Order Management*: The process of fulfilling purchase demand (sales or orders) for companies' products and includes how firms receive orders (by phone, fax, or computer), how firms fill orders (order processing), and how orders are shipped to customers.

Order Picking*: Refers to the process of picking products off the shelves in warehouses (See *Picking*).

Order Processing*: 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.

Outbound Logistics*: The transport, storage, and delivery of goods that are leaving businesses. Outbound logistics deals almost exclusively with end products.

Outsource*: To utilize a third-party provider to perform services previously performed in-house. Examples include manufacturing of products and call center/customer support.

P

Pallet*: The platform that cartons are stacked on and then used for shipment or movement as a group. Pallets may be made of wood or composite materials. Some pallets have electronic tracking tags, and most are recycled in some manner.

Pick-by-light*: A system in which a computer automatically illuminates a light at the next picking location, with the quantity to be picked is displayed on a screen. The order picker follows the light to the location, makes the pick according to the quantity displayed, and pushes a button to confirm the pick has been made and to turn off the light.

Picking*: The process of collecting the appropriate items in the right quantities to fill a customer order. A combination of different methods can be used within a single warehouse.

Pipeline: Mode of transportation used for handling inter-city ton-mileage of freight.

Process: Set of activities that produce a product, service, and/or a combination of products and services.

Procurement: The area of supply chain management that controls the buying of materials, equipment, and services. In many corporations, it is also called supply management.

Product Life Cycle*: The cycle through which every product goes through, from introduction to withdrawal or eventual demise.

Product-Process Matrix: A way to link marketing decisions and a product's life cycle to an organization's operations capabilities.

Production Plan: Determines what type of machinery will need to be purchased and what type of inventory must be built up to meet future demand.

Professional Service: Characterized by high customization and customer interaction and high labor cost. Organizations that fit this model are accountants, consultants, doctors, and lawyers. These types of businesses have highly educated employees and the services they perform are time-consuming and customized.

Q

Qualitative Forecasting*: Using intuition or expert judgment because little to no historical data exists.

Quantitative Forecasting*: Forecasting based on numbers or historical data.

R

Raw materials*: Crude or processed material that can be converted by manufacturing, processing, or both, into new and useful products.

Replenishment: The process of moving or re-supplying inventory from a reserve (or upstream) storage location to a primary (or downstream) storage/picking location, or to another mode of storage in which picking is performed**.**

Reverse Logistics*: The transportation of goods that need to be returned through the supply chain because of defects or because products have reached the end of their usage; parts may be recycled or remanufactured.

S

S&OP*: See *Sales and Operations Planning*.

Sales and Operations Planning (S&OP)*: A collaborative approach between the sales and marketing team and the manufacturing team.

Service Factory: This sector typically requires low labor costs, low customization, and minimal customer interaction. Examples of service organizations are hotels, trucking companies, and airlines. A key customer trait in this area is low price. The customer is looking for the best deal, defined largely as the lowest price for the service. Operations managers will focus their efforts on facilities and equipment utilization, maximizing output and keeping costs low.

Service Operations: Involve companies that provide intangible products or services directly to consumers, such as having cars washed or providing Internet service.

Service Shop: Requires a high degree of customization and customer interaction but relatively low labor costs.

Short-Term Planning: Detailed scheduling and control processes to make sure that all resources, including raw materials, will be available when production is scheduled to start.

SKU*: See *Stock Keeping Unit*.

Stock Keeping Unit (SKU)*: A unique, individual item with a unique form, fit and function.

Strategic Sourcing*: Focuses on developing the most effective relationships with the right suppliers, to ensure that the right price is paid and that lifetime product costs are minimized. It also implies that the supply relationship will continue to improve and develop.

Strategic Supply Plan: Includes decisions about major capital expenditures and how to rationalize various assets.

Supply Chain*: Processes from end user through original suppliers that provide products, services, and information that add value for customers.

Supply Chain Management: The design and management of all functions involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers.

Supplier Relationship Management: Building, maintaining, and developing relationships with suppliers to aid the future of both companies.

T

Third-Party Logistics Provider (3PL)*: A firm that provides multiple logistics services for use by customers. Preferably, these services are integrated, or bundled, together by the provider. These firms facilitate the movement of parts and materials from suppliers to manufacturers, as well as finished products from manufacturers to distributors and retailers.

TQM*: See *Total Quality Management*.

Total Quality Management*: Sometimes shortened to TQM, designing processes to produce consistent quality.

V

Variable Costs: Costs that are incremental and vary based on the quantity ordered or manufactured.

W

Warehouse*: Storage place for products. Principal warehouse activities include receipt of product, storage, shipment, and order picking.

Warehouse Management System (WMS)*: The central brain that manages a warehouse or distribution center.

Weighted Scorecard: A method for evaluating criteria independently before arriving at an overall value by assigning each criterion, and thus each score, the appropriate weight.

WMS*: See *Warehouse Management System*.

Work in Process*: Partially finished inventory in a queue waiting for manufacturing completion or further processing for eventual sale.

Z

Zone Picking*: A system for order picking in which the warehouse is divided into sections or zones, with each picker responsible for filling all pending orders in a small section of the warehouse.

Notes Page

Addendum

The previous document version was V2.18 (file name LINCS.SCMP.v2.18.06072016).

Current version is v2.21 (file name LINCS.SCMP.v2.21.03242017) and contain the following updates:

- Replaced all CanStock images
- Replaced all unnecessary instances of “above” and “below”.
- Corrected the Abstract to match all other tracks
- All non-working links were replaced or deleted