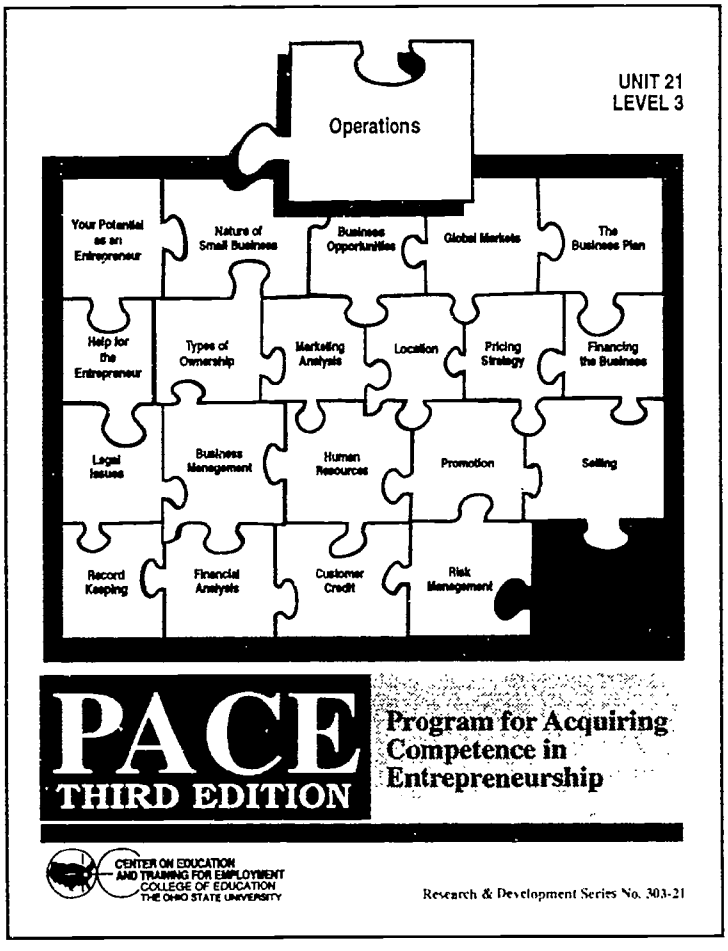
DOCUMENT RESUME

ED 373 258 CE 067 092

TITLE	Operations. Unit 21. Level 3. Instructor Guide. PACE. Program for Acquiring Competence in Entrepreneurship. Third Edition. Research & Development Series No. 303-21.
INSTITUTION	Ohio State Univ., Columbus. Center on Education and Training for Employment.
PUB DATE	94
NOTE	35p.; For the complete set, i.e., 21 units, each done at three levels, see CE 067 029-092. Supported by the International Consortium for Entrepreneurship Education, the Coleman Foundation, and the Center for Entrepreneurial Leadership Inc.
AVAILABLE FROM	Center on Education and Training for Employment, 1900 Kenny Road, Columbus, OH 43210-1090 (order no. RD303-21 IG, instructor guide $4.50; RD303-21 M, student module, $3; student module sets, level 1--RD301M, level 2--RD302M, level 3--RD303M, $45 each; instructor guide sets, level 1--RD301G, level 2--RD302G, level 3--RD303G, $75 each; 3 levels and resource guide, RD300G, $175).
PUB TYPE	Guides - Classroom Use - Teaching Guides (For Teacher) (052) -- Guides - Classroom Use - Instructional Materials (For Learner) (051)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	Behavioral Objectives; Business Administration; *Business Education; *Competency Based Education; Entrepreneurship; Learning Activities; *Management Information Systems; *Planning; Postsecondary Education; Secondary Education; *Small Businesses; Teaching Guides
IDENTIFIERS	*Inventory Control; *Program for Acquiring Competence Entrepreneurship

ABSTRACT

This instructor guide for a unit on operations in the PACE (Program for Acquiring Competence in Entrepreneurship) curriculum includes the full text of the student module and lesson plans, instructional suggestions, and other teacher resources. The competencies that are incorporated into this module are at Level 3 of learning--starting and managing one's own business. Included in the instructor's guide are the following: unit objectives, guidelines for using PACE, lists of teaching suggestions for each unit objective/subobjective, model assessment responses, and overview of the three levels of the PACE program. The following materials are contained in the student's guide: activities to be completed in preparation for the unit, unit objectives, student reading materials, individual and group learning activities, case study, discussion questions, assessment questions, and references. Among the topics discussed in the unit are the following: plan of operations, purchasing procedures, inventory control systems, computerized information management systems, and production plan. (KC)



Objectives:

- Design a plan for the operations of your business.
- Select purchasing procedures.
- Develop inventory control systems for your business.
- Analyze the use of computerized information management systems.
- Generate a production plan.

INSTRUCTOR GUIDE

Unit 21

Operations

Level 3

HOW TO USE PACE

- Use the objectives as a pretest. If a student is able to meet the objectives, ask him or her to read and respond to the assessment questions in the back of the module.
- Duplicate the glossary from the *Resource Guide* to use as a handout.
- Use the teaching outlines provided in the *Instructor Guide* for assistance in focusing your teaching delivery. The left side of each outline page lists objectives with the corresponding headings (margin questions) from the unit. Space is provided for you to add your own suggestions. Try to increase student involvement in as many ways as possible to foster an interactive learning process.
- When your students are ready to do the *Activities*, assist them in selecting those that you feel would be the most beneficial to their growth in entrepreneurship.
- Assess your students on the unit content when they indicate they are ready. You may choose written or verbal assessments according to the situation. Model responses are provided for each module of each unit. While these are suggested responses, others may be equally valid.

Objectives	Teaching Suggestions
1. DESIGN A PLAN FOR THE OPERATIONS OF YOUR BUSINESS	
Why should an entrepreneur plan operations carefully?	Lead a discussion on the importance of planning for business operations.
What is a design plan for the operations of your business?	Define the concepts of design (or layout) plan and economic activity center. Use the four questions outlined in the unit to highlight important features of a design plan.
How do you choose a layout type?	Explain the concepts of process layout and product layout and give examples. Ask students to offer their own examples to check their understanding of these concepts. Complete the discussion by defining the concepts of hybrid and fixed-position layout.
What are performance criteria?	Develop a chart to express the relationship between capital, materials handling, flexibility, work environment, equipment maintenance, productivity, and other criteria and operations performance.
2. SELECT PURCHASING PROCEDURES	
What are purchasing procedures?	Invite a local entrepreneur to speak about management activities related to purchasing. Ask the speaker to address JIT systems, supplier selection criteria, supplier relationships, contracting, placing, tracking, and receiving orders, centralized buying, and value analysis.
What is distribution?	Ask students to define distribution. Lead a discussion on distribution related activities (warehousing, carrier selection, scheduling, product delivery, etc.). Ask for examples from local industry.
3. DEVELOP INVENTORY CONTROL SYSTEMS FOR YOUR BUSINESS	
What is inventory control?	Ask the guest entrepreneur to discuss events that affect inventory control.
What is stock turnover?	Define stock turnover and use numerical examples to apply the definition. Ensure that students understand what type of information this accounting measure conveys to entrepreneurs.
What are different inventory control systems?	Ask the guest entrepreneur to discuss inventory control systems that he/she uses in their own business.
Who controls the inventory?	Introduce the concepts of Just-in-Time and Gantt charts. Suggest students do research on pivotal systems people like Deming, Juran, and Crosby.

Objectives	Teaching Suggestions
4. ANALYZE THE USE OF COMPUTERIZED INFORMATION MANAGEMENT SYSTEMS	
What are the operational uses of computer systems in inventory analysis?	Organize a field trip to a local manufacturing business to demonstrate to students the operational uses of computerized systems.
What is an electronic inventory system?	Use a supermarket as an example of the use of scanners and electronic eyes.
How do computers lend support in the inventory process?	Develop a chart to show how the different types of software assist entrepreneurs in updating records, providing management reports, automatic reordering, generating exception reports, etc.
5. GENERATE A PRODUCTION PLAN	
What is a production plan?	Ask students to give examples of activities outlined in a production plan.
Can you generate a production plan?	Assist students in understanding how production plans are generated. Define the concepts of *trial and error* and *tableau method.*
What is implementation?	Use Figure 1 to emphasize the implementation step of production planning.

MODEL ASSESSMENT RESPONSES

1. A complete answer to this question should include the needs and capabilities of the business, cost and time considerations, productivity, market conditions, etc.

2. An appropriate design plan should consider centers to be included in the layout, space and capacity needed by each center, each center's space configuration, and the location of each center.

3. The four types of layouts are: product layout, process layout, hybrid layout, and fixed-position layout. (1) Product layout arranges work stations or departments in a geometrical path (e.g., linear, O, S, U, L-shaped, etc.). Product layout is used when the facility's positioning strategy calls for repetitive or continuous production. (2) Process layout groups work stations or departments according to a specific function needed in the production process. It is used when positioning strategy calls for low-volume, high-variety production, such as a job shop. (3) Hybrid layout combines both product and process layout. It is used for islands of automation, retail stores, etc. (4) Fixed-position layout is used when the product is fixed in place and workers, along with their tools and equipment come to the product to work on it. It is used for extremely large or difficult to move products.

4. The three performance criteria (capital, materials handling and flexibility) should be employed according to the needs and capabilities of the business.

5. After considering the basic criteria mentioned above, entrepreneurs should account for work environment conditions, equipment maintenance, productivity, employee's attitudes and needs, etc.

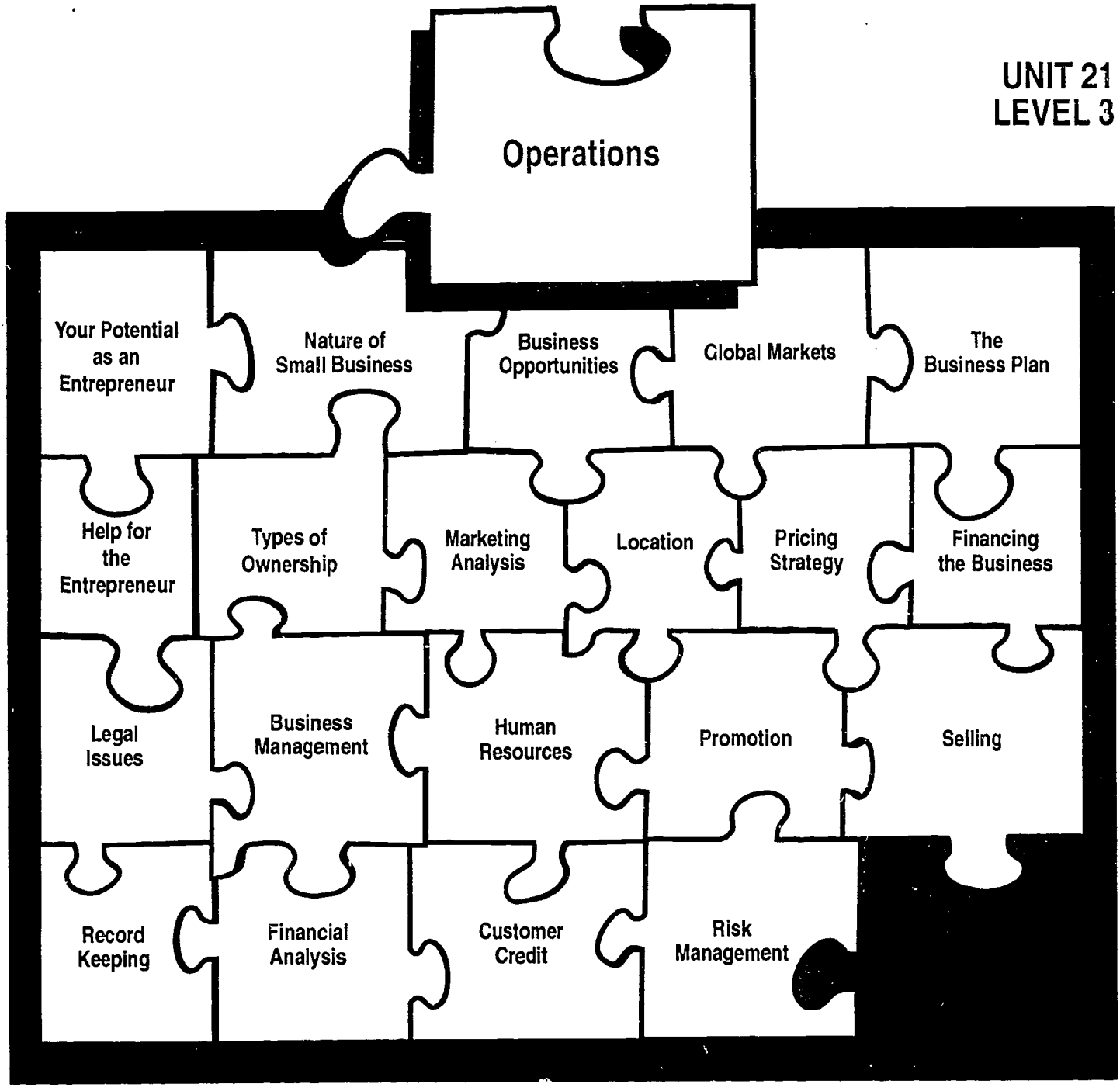
6. The acquisition process involves receiving a request to place an order through a purchase requisition, selecting a supplier (i.e., identifying suppliers, asking for bids, etc.), placing the order, tracking the order through follow-up by telephone, letter, telex, fax, etc., and receiving the order.

7. The purchasing procedures involve acquisition (see response to question 6), selecting suppliers based on price, quality, time, flexibility, and tradeoffs as they relate to the needs of the business, maintaining supplier relationships, contracting (i.e., bids, sole-source contracts, supplier catalogs), centralized buying and value analysis.

8. Distribution is the management of the flow of materials from manufacturers to consumers. Distribution involves storage and transportation and affects operations through the choice of warehousing, carriers, and product delivery.

9. There are two basic types of inventory control—perpetual and physical. Perpetual inventory systems involves keeping continuous records on inventory receipt and withdrawal (e.g., cards, pages, tags, electronic systems). Physical inventory systems involves the actual inventory count of items in the stock (can be done weekly, monthly, annually, etc.).

UNIT 21
LEVEL 3



PACE
THIRD EDITION

Program for Acquiring Competence in Entrepreneurship

CENTER ON EDUCATION AND TRAINING FOR EMPLOYMENT
COLLEGE OF EDUCATION
THE OHIO STATE UNIVERSITY

Research & Development Series No. 303-21

OPERATIONS

BEFORE YOU BEGIN . . .

1. Consult the *Resource Guide* for instructions if this is your first PACE unit.

2. Read What are the Objectives for this Unit on the following page. If you think you can meet these objectives now, consult your instructor.

3. These objectives were met at Level 1 and Level 2:

   Level 1

   - Define operations for a small business.
   - Identify the factors that affect purchasing.
   - Explain the importance of inventory control.
   - Identify the procedures to be followed in shipping and receiving.
   - Identify the considerations in production and packaging.

   Level 2

   - Identify the operational responsibilities for a small business.
   - Explain the purchasing procedures for a small business.
   - Analyze the options for inventory control.
   - Identify the operational use of computer systems.
   - Describe the basic productive elements in operating a business.

4. Look for these business terms as you read this unit. If you need help with the meanings, ask your instructor for a copy of the PACE Glossary contained in the *Resource Guide.*

   Acquisition process
   Bidder
   Centralized buying
   Common carrier
   Contract carrier
   Design plan
   Economic activity center
   Fixed position layout
   Hybrid layout
   Job shop
   Private carrier
   Process layout
   Product layout
   Production plan
   Profit centers
   Quality
   Statistical process control (SPC)
   Stock turnover

OPERATIONS

WHAT ARE THE OBJECTIVES FOR THIS UNIT?

Upon completion of this unit you will be able to—

- design a plan for the operations of your business,
- select purchasing procedures,
- develop inventory control systems for your business,
- analyze the use of computerized information management systems, and
- generate a production plan.

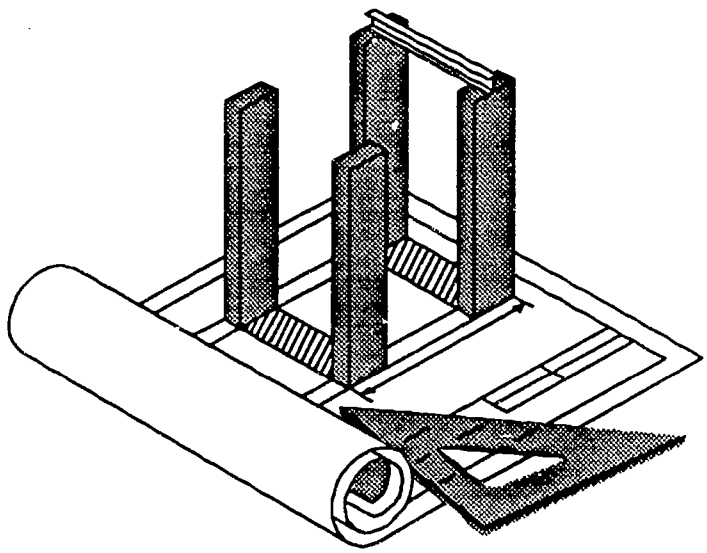
WHAT IS THIS UNIT ABOUT?

This unit will discuss the competitive operational or logistical strategy for your business. This includes design plans for the operations of the business and the evaluation of purchasing procedures and inventory control systems. Also, analysis of computerized information management systems will be discussed. Finally, the unit will present information to help generate a production plan.

WHY SHOULD AN ENTREPRENEUR PLAN OPERATIONS CAREFULLY?

In this unit, some of the important systems for which a business must make a plan will be discussed. Individual businesses will need special systems to handle the special needs of the business. It is important to think of these systems in advance because they will affect the costs of doing business and the productivity of your operation. Too many systems and too many tasks can be just as costly as no systems at all. The goal is to plan for needed operations in as simple a way as possible that will also control the flow of business effectively.

FACTORS FOR DESIGNING AN OPERATIONS PLAN



- Layout
- Needed space and capacity
- Space configuration
- Location

WHAT IS A DESIGN PLAN FOR THE OPERATIONS OF YOUR BUSINESS?

A *design plan*, or *layout plan*, for your business, involves decisions about the physical arrangement of economic activity centers within the plant. An *economic activity center* can be anything that consumes space: a person or group of people, a machine, a workbench or work station, a department, a stairway or an aisle, a timecard rack, a cafeteria or storage room, and so on. The goal of layout planning is to allow workers and equipment to operate at peak effectiveness and efficiency. The term *physical arrangement* raises four questions for the entrepreneur regardless of whether it is a manufacturing business or any other type.

1. **What Centers Should the Layout Include?**

   Centers should reflect the process design and maximize productivity. For example, a central storage area for tools is most efficient for certain processes but keeping tools at individual work stations makes more sense for others. Centers also should reflect the business size and strategy. For example, is it easier to have the factory in one location and the

headquarters in another, or to have everything in the same area?

2. **How Much Space and Capacity Does Each Center Need?**

   Inadequate space can reduce productivity, deprive employees of privacy, and even create health and safety hazards. However, excessive space is wasteful, can reduce productivity, and can isolate employees unnecessarily.

3. **How Should Each Center's Space Be Configured?**

   The amount of space, its shape, and the elements in a work center are all interrelated. For example, placement of a desk and chair relative to the other furniture is determined by the size and shape of the office, as well as the activities performed there. Providing a pleasing atmosphere should also be a part of the layout planning.

4. **Where Should Each Center Be Located?**

   Location, whether in the middle of the facility or in a back room, can significantly affect productivity. It is important to plan each area for its most positive impact.

HOW DO YOU CHOOSE A LAYOUT TYPE?

The choice of layout type depends largely on your organization's positioning strategy. There are four basic types of layout: process, product, hybrid, and fixed.

What is Process Layout?

When positioning strategy calls for low-volume, high-variety production, such as a job shop, the operations manager must organize resources, employees, and equipment around the process. A *process layout*, which groups work stations or departments according to function, accomplishes this purpose. For example, all drilling equipment is located in one area of a machine shop, or all budget apparel is displayed in one area of a department store.

The process layout is most common when the same operation must intermittently produce many different products or serve many different customers. Demand levels are too low or unpredictable for management to set aside human and capital resources exclusively for a particular product line or type of customer. Resources are relatively general purpose, flexible, and less capital intensive. Because the process layout is less vulnerable to changes in product mix or new marketing strategies, it is more flexible. Equipment utilization is high because the requirements for all products can be pooled. In addition, employee supervision can be more specialized, an important factor when job content requires a good deal of technical knowledge.

A process layout focus also has its disadvantages. Processing rates tend to be slower, and productive time is lost in changing from one product or service to another. Also, more space and capital are tied up in inventory, making problems for the smaller business with less capital immediately on hand.

What is Product Layout?

When a facility's positioning strategy calls for repetitive or continuous production, the operations manager dedicates resources to individual products or tasks. This strategy is achieved by a *product layout*, which arranges work stations or departments in a line or linear path. Output is balanced to move the product or customer along in a smooth, continuous flow. Operations arranges resources around the product's route rather than share them across many products. An automated car wash is a good example of this. Product layouts often follow a straight line but this arrangement is not always best. In such cases, managers may opt for different shaped assembly lines. These can include *O*, *S*, *U*, or *L*. A product layout is often called a *production* or *assembly line*. The difference is that an assembly line is limited to assembly processes.

One of the mysteries in process layouts—where to locate centers—is not as complicated as thought for product layouts. Obviously, if a product's routing is from *Point A* to *Point B* to *Point C*, then Point A should be placed next to B and B next to C in the layout. This arrangement, which simply follows the product's routing, ensures that all interacting pairs of centers are as close together as possible since they have a common boundary or link. The challenge of product layouts is to group activities into work stations and achieve the desired output rate with the least resources. The composition and number of work stations are crucial decisions that must be tackled early. Bear in mind that when product design changes are made to the product itself, often times the product layout must also be revised.

What is Hybrid Layout?

More often than not, a positioning strategy combines elements of both a product and process focus. This intermediate strategy calls for a *hybrid layout*, which arranges some portions of the facility as a process layout and others as a product layout. Operations managers often create a hybrid layout when introducing flexible manufacturing systems, designed to achieve repeatability, even when product volumes are too low to justify dedicating a single line to one product. They sometimes become *islands of automation*, representing miniature product layouts, as all resources needed to make the family of parts are brought together at one center. The rest of the facility represents a process layout. Hybrid layouts also occur in facilities having both fabrication and assembly operations. Fabrication operations, where components are made from raw materials, tend to have a process focus. Assembly operations, on the other hand, tend to have a product focus.

A retail store is an example of a hybrid layout in a nonmanufacturing setting. The manager may group similar merchandise, enabling customers to find their desired items easily (a process layout). At the same time the layout often leads customers along predetermined pathways, such as up and down aisles (a product layout). The intent is to maximize exposure to the full array of goods, thereby stimulating sales.

What is Fixed-Position Layout?

The fourth basic type of layout is the *fixed-position layout*. In this arrangement, the product is fixed in place; workers, along with their tools and equipment, come to the product to work on it. This type of layout

makes sense when the product is particularly massive or difficult to move, as in shipbuilding, assembling locomotives and ships, making huge pressure vessels, building dams, or repairing home furnaces. A fixed-position layout minimizes the number of times that the product must be moved and often is the only feasible solution.

WHAT ARE PERFORMANCE CRITERIA?

Other fundamental choices facing the entrepreneur when making the layout plan, concern *performance criteria.* As with decisions on product or service planning and location, the manager must decide early in the solution process which dimensions need emphasis in defining a good solution. Should the layout be developed to maximize sales or to minimize materials-handling costs? The answer depends on the situation. Generally, three criteria are involved.

Why is Capital Investment a Consideration for Layout?

Floor space, equipment needs, and inventory levels depend in part on whether management selects a process or a product layout. When volumes are low, higher resource utilization is possible with a process focus. This focus reduces equipment and space needs, although management must consider the possible disadvantage of added space and investment in inventory. Capital investment is an important criterion in all settings. If the objective is to increase privacy by adding partitions, the amount of investment required rises. If an existing layout is to be revised, renovation costs can be significant. Major renovations occur regularly at major department stores in order to find a better way to attract customers and allow them to find what they need.

How does Materials Handling Affect Layout?

Relative locations of centers should allow large flows to go short distances. Frequent trips or interactions between work centers should be recognized by locating these centers close to one another. In a manufacturing plant, this approach minimizes materials-handling costs. In a warehouse, stock-picking costs are reduced by storing items typically needed for the same order next to one another. In a retail store, customer convenience improves if items are grouped predictably to minimize customer search and travel time. Most department stores place shirts and ties in the same general area in order to give convenience to customers. In an office, communication and cooperation often improve when people or departments that must interact frequently are located near one another. Telephone calls and memos can be poor substitutes for face-to-face communication.

Why is Flexibility Important?

A flexible layout is best for most situations. *Layout flexibility* means either that the facility remains desirable after significant changes occur or that it can be easily adapted in response to them. The changes can be in the mix of customers served by a store, goods made at a plant, space requirements in a warehouse, or organizational structure in an office.

Layout flexibility in the first sense depends in part on management's ability to forecast

well. Layout flexibility in the second sense means designing the layout to minimize the cost of revisions to it. Using modular furniture and partitions, rather than permanent load-bearing walls, is one way to minimize the cost of office layout changes. So can having wide loading bays, heavy-duty floors, and extra electrical outlets in a plant.

What are Other Criteria to Consider?

Work environment, maintenance, employee attitudes, and labor productivity are just a few other criteria that can be important. Labor productivity can be affected if certain work stations can be operated by common personnel in some layouts but not in others. Downtime spent waiting for materials can be caused by materials-handling difficulties resulting from poor layout. Equipment maintenance can be made difficult by inadequate space or poor access. The work environment, including temperature, noise level, and safety, can be layout related. Finally, employee attitudes may depend on whether the layout allows workers to socialize, reflects equitably the employee's level of responsibility, or puts the worker under the watchful eyes of the supervisor.

WHAT ARE PURCHASING PROCEDURES?

Purchasing is the management of the acquisition process, which includes deciding which suppliers to use, negotiating contracts, and deciding whether to buy locally or centrally. As the starting point of the materials management procedure or *cycle*—acquisition, storage, conversion, storage, and distribution—purchasing is of strategic importance. It must satisfy the firm's long-term supply needs and support the firm's production capabilities. This task is crucial for any organization, whether retailer, service provider, or manufacturer. The basic steps of acquisition will be examined and then decision areas that are particularly important, including supplier selection and relations, contracting, and centralized buying.

What Is the Acquisition Process?

There are five usual steps in the acquisition or procurement process. They are receiving a request to place an order, selecting a supplier, placing the order, tracking the order, and receiving the order.

1. **Receive a request to place an order.**

   The request, usually called a *purchase requisition*, includes the item description, quantity and quality desired, and desired delivery date. In the small business, this step may not be necessary since the owner usually does this. For example, John wants to order 100 pounds of flour for his bakery. He still uses a purchase requisition so that he can keep a record of what he is ordering.

2. **Select a supplier.**

   This step involves identifying suppliers capable of providing the items, grouping items that can be supplied from the same supplier, asking for bids on the needed items, evaluating the bids in terms of multiple criteria, and selecting a supplier. This step is important to the small business entrepreneur since price varies for the same product from one supplier to another. Using the same example, John looks at three flour suppliers and finds a

difference of 20 cents per pound in flour, but the highest supplier also delivers free of charge, a savings of 24 cents over the other two suppliers. Also, this third supplier will allow John to pay off his bill within 60 days versus payment on delivery with the first two. John decides to go with the third supplier because he can get better service for his bakery.

3. **Place the order.**

   The ordering procedure can be complex and time consuming, as with expensive one-time purchases, or as simple as a phone call for a standard item routinely ordered from the same supplier. This depends on the time frame in which the supplies are needed. John needs the flour every Monday morning and must place the order by the preceding Friday in order to get it by Monday morning. If he fails to order from the supplier, he will have to wait until the next scheduled delivery date for his area to have the flour delivered.

4. **Track the order.**

   Tracking includes routine follow-up of orders, so as to anticipate late deliveries or probable deviations from requested order quantities. Suppliers are contracted by letter, telex, fax, or telephone. Follow-up is particularly important for large purchases, when a delay is disruptive to production plans or when a delay could mean loss of customer goodwill and future sales. Tracking the order was important to John when he ordered his bakery ovens. In order to open his bakery on time, he needed the ovens on the date promised by the manufacturer. John did follow-up the order in order to make sure his order was on schedule. If there had been a delay, this would have thrown off other parts of his plans.

5. **Receive the order.**

   Incoming shipments must be checked for quantity and quality. If the shipment is not satisfactory, the small business entrepreneur must decide whether to return it to the supplier for replacement or a credit. The entrepreneur should also keep records on punctuality, quality, quantity deviations, and price as a part of supplier evaluation. But the small business owner must also make sure that suppliers are paid accurately and on time in order to keep a solid business relationship.

How Should You Deal with Supplier Selection?

Purchasing is the eyes and ears of the organization in the supplier marketplace, this is, continuously seeking better buys. This process begins with the supplier selection decision. Purchasing agents for some companies establish formal rating procedures to help them select new suppliers or periodically review the performance of current suppliers. The various competitive priorities such as price (low cost), quality (high-performance design and consistent quality), time (fast delivery time and on-time delivery, and research and development speed), flexibility (customization and volume flexibility), and tradeoffs which the business is willing to make regarding any of these.

Three criteria considered in a selection decision almost always are price, quality, and delivery. As important as it is, price should not be the only consideration. Much

of the business sales income is reinvested or spent on purchased items. Finding suppliers who charge lower prices is a key to healthy profit margins, and perhaps even keeping the company in the black.

Next, the quality of a supplier's materials can be very important. The hidden costs of poor quality can be high, particularly if defects are not detected until after considerable value has been added by subsequent manufacturing operations. The hidden costs of poor quality are not limited to manufacturers. For a retailer, poor quality can mean loss of goodwill and future sales. The third is delivery. Shorter lead times and on-time delivery help the buying company maintain acceptable customer service with less inventory. This is called *Just-In-Time* production which means that deliveries from the suppliers are helping minimize inventory levels. JIT systems are intended to minimize inventory buildups by coordinating the flow of materials between production processes. This constraint means that suppliers must have nearby plants or warehouses in order to receive the goods *just in time* to be used.

What Supplier Relationships Are Needed?

A second purchasing issue of strategic importance is the type of relations maintained with suppliers. A business firm can relate to a supplier either competitively or cooperatively. The competitive orientation is particularly prevalent in North America where negotiations between buyer and seller are viewed as game: whatever is lost by one side is gained by the other. Short-term advantages are prized over long-term commitments. The buyer may try to beat the supplier's price down to the lowest survival level or to push demand to high levels during boom times and order almost nothing during recessions.

The supplier, on the other hand, presses for higher prices for specific levels of quality, customer service, and volume flexibility. Which party wins depends largely on who has the most clout. The buyer has more clout, and thus the upper hand, when—

- the buyer represents a significant share of supplier's sales;
- the purchased item is standardized, with substitutes offered by other suppliers;
- the buyers could produce the materials themselves;
- the supplier cannot supply the new materials when needed by the buyer;
- switching to a new supplier is not costly; and/or
- conversely, the supplier is more powerful if these situations are reversed.

When Is Contracting Used?

The entrepreneur or purchasing agent must decide how to contract for each of the items that most businesses buy. The procedure selected depends a great deal on volume and usage rates. When demand is low, as with customized items not held in inventory, a buyer has three options:

- Competitive bidding means that several suppliers are asked to submit formal quotations. The lowest and best (most

capable) bidder receives the contract. This method is not mandatory in the private sector but is prudent when the expenditure to be made is great, as with heavy equipment or a computer system.

- Sole-source contracting means a company negotiates a contract with a single supplier. This approach reduces purchasing lead time but does not guarantee the best buy, particularly if the buyer is unaware of comparative prices.

- Supplier catalogs are used to allow the buyer to simply look through several catalogs and make a selection from one of them. The cost of any further search outweighs the benefits.

When Is Centralized Buying Necessary?

When an organization has several facilities or plants, management must decide whether to buy locally or centrally. In deciding the best strategy for a particular item, management must weigh the advantages and disadvantages of each.

Large orders in centralized buying can increase purchasing clout. Savings can be significant, often on the order of 10 percent or even more. Increased buying power can mean getting better service, ensuring long-term supply availability, or developing new supplier capability. Since your product may be made from parts from all over the globe, centralization is becoming more and more favored by entrepreneurs.

When Is Value Analysis Used?

Value analysis is a systematic effort to reduce the cost or improve the performance of items either purchased or produced. It concentrates on the *function* of the item and asks questions such as the following:

- What is the function of the item?

- Is the function necessary?

- Can a lower-cost standard part that serves the purpose be identified?

- Can the item be simplified, or its specifications relaxed to achieve a lower price?

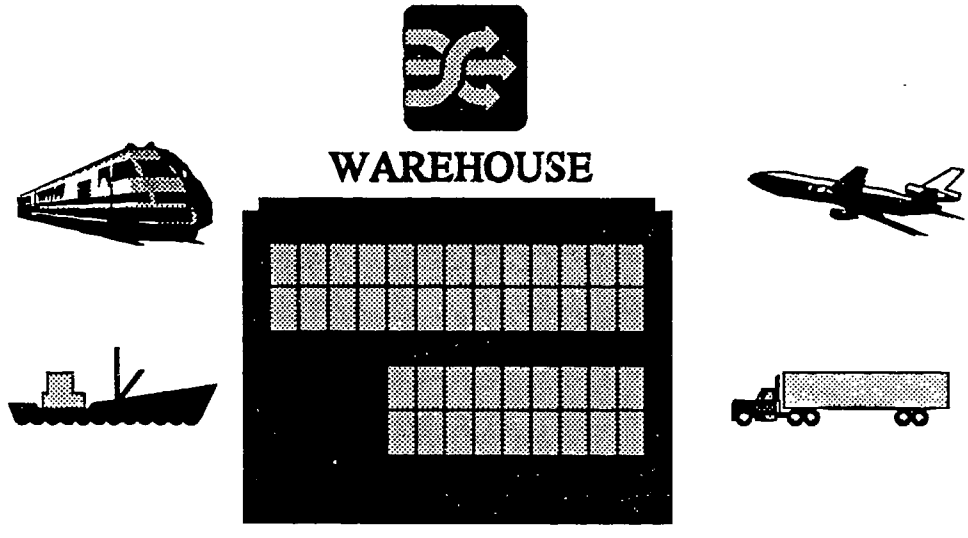
Value analysis should be performed periodically on the large dollar-volume items. for which potential savings are greatest. It is usually done on a team basis, involving purchasing, production, and engineering. Each type of management specialist brings different perspectives to this analysis, giving different results with different group mixtures. The entrepreneur, of course, must have all of these perspectives.

WHAT IS DISTRIBUTION?

While purchasing deals with inbound materials, distribution deals with outbound products. *Distribution* is the management of the flow of materials from manufacturers to customers, involving the storage and transportation of products. Distribution broadens the marketplace for a business, adding time and place value to its products. There are three issues distribution managers face: where to stock finished goods, what transportation mode to use, and scheduling, routing, and carrier selection.

Distribution Considerations

Transportation Modes Scheduling/Routing Carrier Selection



Why Is Placement of Finished Goods Inventory Considered?

A fundamental choice is where to stock inventory of finished goods. Forward placement means locating stock closer to customers at a warehouse or distribution center (*DC*), or with a wholesaler or retailer. Backward placement means holding the inventory at the manufacturing plant or maintaining no inventory.

Forward placement can have two advantages: fast delivery times and reduced transportation costs. However, forward placement is not always possible or advisable. If competitive priorities call for customized products, it doesn't make sense to have finished goods inventory. The risk of creating unwanted products is too great.

A second argument against forward placement is the *pooling effect.* The demand in a region may be unpredictably high one month and low the next. If demand in several such regions were pooled, as would be the case if inventories were placed in a central warehouse, the highs in some regions would tend to cancel the low in others. Demand is less erratic and more predictable when inventory is centralized rather than regionalized. Inventories for the whole system can be lower and costly reshipments from one distribution center to another can be minimized.

A good example of the pooling effect is furniture dealers. Most dealers have many retailers of their products in a metropolitan area so it is wise to maintain an inventory distribution center in the general area in order to service the retailers. The retailers

no longer need to carry separate inventories, except for display purposes. Filling a customer's order quickly and efficiently can increase.

What Should You Consider about Transportation Modes?

There are five basic modes of transportation. These are highway, rail, water, pipeline, and air. Each has its own advantages and limitations.

Highway transportation provides the flexibility of shipping to almost any location in the United States. No rehandling is needed for pickup and delivery. Transit times are good and rates are usually less than rail rates for small quantities and short hauls.

Rail transportation can move large quantities very cheaply but transit times are long and variable. This mode is usually best for shipping raw materials, rather than finished goods. Rail shipments often require pickup and delivery rehandling.

Water transportation provides high capacity at low unit cost, but again, transit times are slow and large areas are inaccessible to waterborne carriers.

Pipeline transportation is highly specialized, with limited geographical flexibility. It is limited to liquids, gases, or solids in slurry form. No packaging is needed and operating costs per mile are low.

Air transportation is the fastest and most expensive mode. Although volumes are increasing, most freight is not moved in this manner. Air transportation is limited by the availability of airport facilities and requires pickup and delivery rehandling.

Different forms of ownership and management are also possible. A business can integrate transportation into its process and become a *private carrier* by owning and operating its own trucks. It can instead leave the transportation to a contract carrier, by negotiating with the carrier for a specified amount, type, and frequency of shipments. A contract carrier does not provide service to the general public but instead serves specific customers. Or the business can select *a common carrier*, which by law must serve all customers without discrimination. This option gives the firm the least control over carrier availability but makes sense for low-volume producers with geographically dispersed markets or businesses whose budgets are a prime concern.

In addition to these primary and most-used modes, special service modes of transportation include air express, bus service, freight train forwarder, and parcel post.

Air express is becoming one of the most popular modes of transportation used in business today. It quickly ships merchandise around the world—sometimes even overnight to the recipient. It is offered by United Parcel Service (UPS) or Federal Express. Costs depend on size and weight but are mostly due to the quick turn-around time. If you have a customer who wants his order sent to him as quickly as possible, sometimes air express is the fastest way to get it there. Of course, there is a premium to pay for this service. Next is bus service and freight train forwarder. These allow your products to be sent throughout the country by bus or train. Depending on your customers' needs, these options can be used to save money on shipping but they do take an extended amount of time. If the customer is in no hurry for the shipment, these two are

much cheaper to use. However, the least expensive but the most time consuming is that of parcel post. Parcel post is a service offered by mail services such as the United States Postal Service. It differs from air express in delivery time and cost to the shipper.

How do You Control Product Delivery?

Several activities are involved in the day-to-day control of freight movement. The shipping schedule must mesh with purchasing and production control schedules. It also reflects the trade-off between transportation costs and customer response times. By delaying a shipment for another day or two, it may be possible to achieve *full carload cargo* rates for a rail shipment, or *full truckload cargo* rates for truck shipments. Routing choices must also be made. A manufacturer can select a route that combines shipments to multiple customers and gains lower freight rates. The business may even negotiate lower rates if it develops routes where large volumes can be shipped on a regular basis. This is of major importance to businesses whose reliance on shipping is a necessary part of the production process.

If deliveries are to be controlled by the small business owner, there must be a system of organization for the paperwork. If you are to take advantage of lower freight rates, you need to know when a full shipment is ready. By tracking this information, you will have access to it in order to schedule your shipments.

WHAT IS INVENTORY CONTROL?

Every type of business must be concerned with some type of inventory control. This may be for merchandise, supplies, raw materials, or parts. If these items are to be available when needed, you must have a system to keep them protected and in proper balance. The aim of inventory control is to keep the costs at a minimum while ensuring customers' satisfaction and continuous production.

Some facts that affect a proper balance include the following:

- Need to reduce costs
- Products that spoil
- Storage and handling costs
- Space limitations
- Reduced interest costs on inventory loans
- Increased product varieties
- Customers' satisfaction
- Reduced transportation costs

Inventories are a major expense. Not only must you consider the cost of the product, but you must also include costs of maintaining the inventory, such as the following:

- Rent on property
- Personnel costs
- Utilities
- Insurance
- Property taxes
- Damage
- Paperwork

WHAT IS STOCK TURNOVER?

A business measures the effectiveness of the investment in inventory (goods in stock) by how many times the average inventory is sold per year (or turns over). To find out what your turnover is you will need to find the value of your inventory on the average throughout the year. You will compare it to your annual sales at cost.

Turnover =	$\frac{\text{Annual Cost of Sales}}{\text{Average Inventory}}$
X =	$\frac{\$200{,}000}{\$20{,}000}$
X =	10

Let's say you have a shirt shop and the average cost of sales during the year was $200,000. If your average inventory costs $20,000, your stock turns over 10 times during the year.

Another example, a business whose profit and loss statement shows a cost of goods sold of $100,000, and an average inventory of $25,000, would have a turnover of four.

This relationship can also be computed for each type of product you sell. Thus, you can compare the rate of turnover for various products in your product line.

However, a higher turnover rate does not always mean greater profits. The turnover does not reflect the profits on sales that were lost because no inventory was available for sale. Your business may have a very high turnover or inventory, but if customers are going away dissatisfied because of poor selection or lack of availability of certain items, then your profits are not being maximized.

Having the ideal investment in inventory is always desired, and usually turning away sales because of under stocking is more harmful than having markdowns on excessive inventory items. Obtaining the proper inventory balance requires an accurate anticipation of your customer needs, coupled with a realistic investment.

WHAT ARE THE DIFFERENT INVENTORY CONTROL SYSTEMS?

There are basically two types of inventory control systems used in business, *perpetual* and *physical*. Electronic inventory control systems are also important, and combinations of these inventory control systems are common.

What Is a Perpetual Inventory?

When continuing records are kept of receipt and withdrawal of inventory, the process is called perpetual inventory. With this system, the business owner has a running tally on the current stock of an item. For each item, a record is kept as it is brought into the business, stocked, and sold. Records are maintained on perpetual inventory cards, pages, tags, or via electronic means. In retail operations, sales tickets, or punched cards are often used to maintain perpetual inventory information.

There are several different types of records for keeping perpetual inventory, and a variety of information can be maintained with these records. You will find that typical records include the item, the stock number, the reorder point, and the supplier.

When additional inventory is received, the number is added to the balance. When items are issued for use or are sold, the withdrawal is subtracted from the balance. The amount of inventory on hand for a particular item can be easily determined by looking at the balance on the record.

The development of cash registers, computers, and computer service networks with local computer banks has made maintaining perpetual inventory systems very easy for small businesses. At the end of the year, perpetual inventory records are added up and compared with the periodic physical inventory. Major differences may be investigated and perpetual inventory records then corrected.

What Is a Physical Inventory?

A physical inventory is a count of the actual items that are in stock. Whether your business is manufacturing, wholesaling, or retailing, the product you have on hand at any given moment is your physical inventory.

Physical inventories can be hard to keep track of unless proper steps are followed and maintained in order to ensure accuracy.

WHO CONTROLS THE INVENTORY?

Inventory control is a problem in most businesses because there is usually no clear understanding of who is responsible for the control. Another problem is that one person may consider keeping low inventories so that storage problems do not occur and another may keep too much inventory on hand which can create both a space and a cash flow problem.

One method of inventory control is called *Just-In-Time* or *JIT* inventory control. Although discussed earlier, a more complete explanation will be given now. This is a management system that allows your business to keep smaller amounts of raw materials in inventory. Basically, the main idea in this system is to be able to operate with a smaller inventory amount of goods which will avoid the need for large storage facilities which in turn avoids any problems with cash flow. The concept is to get the materials needed to make a product to the area where the product is being produced *just in time* for production needs. Many say this is a way of thinking and not a system of man-

agement, but many companies follow this as a system of inventory control. Another method of inventory control is the Gantt Charts. Gantt Charts are used for sequencing work on machines and monitoring progress. This was first devised by Henry L. Gantt in 1917. There are two basic forms of the chart: the *job* or *activity progress chart* and the *machine chart.*

WHAT ARE THE OPERATIONAL USES OF COMPUTER SYSTEMS IN INVENTORY ANALYSIS?

Computers are very much a part of all phases of the business in today's technological age. As mentioned above the computer has made inventory control more effective and easier to monitor. Database software not only helps in inventory control, but is an extremely effective marketing tool in keeping track of customers or clients. Along with the use of the database software, the word processing software packages can merge sales letters with numerous preselected names and addresses to promote services or sale products.

Today, many companies can create their own sales catalogs, company manuals, and other printings required by individual businesses through the use of desktop publishing software. Engineering also has incorporated the use of computers in computerized drawings. Financial reports and cashflow schedules can be automatic, if daily or weekly data is keyed in to financial and spreadsheet software. Graphic representations in reports have upgraded the management decision process. With computer business planning available now in software, a complete indepth business plan can be generated with much less capital used by the company.

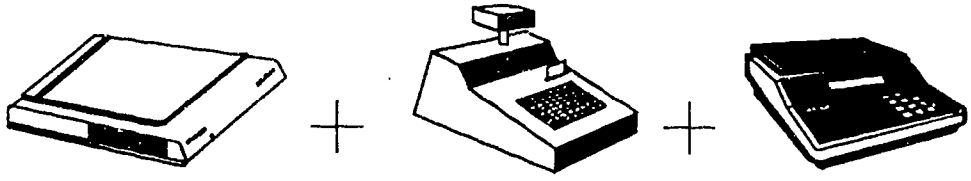
WHAT IS AN ELECTRONIC INVENTORY SYSTEM?

Recent improvement in the electronic inventory system, such as electronic cash registers and personal computers, have made computer-based data about a firm's operations available to many small retailers. Grocery store *scanners*, for example, are as helpful in inventory control as they are in checkout. At these scanner checkout lines, each item passes over an electric eye linked to a cash register and a scale. The *electronic eye* reads the UPC (Universal Product Code) symbol. The electronic eye also logs each outgoing item against inventory in the store or a centralized warehouse, warning the manager when a reorder is necessary.

Basically the electronic inventory control system consists of the following:

- Using a standardized system of classification
- In-store preparation of input information for computer use
- Central computer processing and report preparation
- In-store analysis of computer-prepared reports

ELECTRONIC INVENTORY SYSTEM



Scanner + Cash Register + Scale

Reads UPC

The costs involved in using electronic data processing are justified in terms of efficiency, information gained, and savings. Businesses that have adopted electronic inventory control have pointed to many advantages, such as timely reports, valuable style and vendor analysis, lower inventories because of better sales trend forecasting, better turnover of goods, and fewer clerical employees required for the reporting function. Current data regarding daily sales volume, inventory levels, sales ratio figures, and even profit and loss statements reviews are available within hours. With technological advances, more and more small businesses will have accurate and current information available in a short time period.

HOW DO COMPUTERS LEND SUPPORT IN THE INVENTORY PROCESS?

Managing inventories requires many calculations. Because computers excel at massive data manipulation, it is not surprising that many companies are computerizing at least part of their inventory systems.

Several inventory system software packages are available, in addition to the in-house systems developed by many individual companies. Five of the most common uses of such packages are for updating records, providing management reports, automating the reordering process, generating exception

reports, and recomputing decision parameters..

1. **Updating Records**. At the time of each transaction, the computer updates the inventory that is left. Other information, such as demand rates, price changes, and supplier performance can also be updated and displayed on request. Electronic record keeping can save the small business owner a great deal of time but the system often is too expensive to purchase and operate without ample personnel.

2. **Providing Management Reports**. Management can get reports on inventory investment that show measures such as dollar value of inventory, weeks of supply, and turnover. These data are often compared to measures from prior periods and can be broken down into various categories. For example, individual departments in a retail store usually act as autonomous profit centers, and periodic inventory reports for each one help top management assess performance. Other information important to management includes customer service measures and the costs of operating the inventory system itself. The entrepreneur also needs management reports. This tells the status of the business and where time needs to be spent to correct problems as quickly as they are spotted. For example, if there is a contract for a large number of lights to be made, the inventory report lists the amount of materials available and how much needs to be ordered. It is imperative to do this before the order is processed in the plant.

3. **Automatic Reordering**. Decision rules based on how often the company wishes to reorder items can be programmed into a computer. It can record inventory counts that are reviewed periodically, then take this information and generate an order or even place it with the right supplier. The computerized ordering system can save time because it can order only certain types of items or an array, depending upon the actions programmed into it. Usually an analyst will review all information from the computer. Even with this step, the analyst is saved many hours in finding out what current inventory levels are to see what needs to be ordered. After the analyst makes a decision of what to order, the computer can also be programmed to generate the paperwork for a purchase order or a shop order. The small business owner can set up a similar but simpler computer system.

4. **Generating Exception Reports**. An *exception report* is a computer-generated report pointing out some unusual situation needing management's *immediate* attention. These exception reports to normal conditions can be displayed on a computer screen or printed out as hard copy for the entrepreneur to assess. In small businesses, these reports can point to major problems if left alone, so it is in the interest of the owner to generate exception reports daily.

5. **Recomputing Decision Points**. A computer can be programmed to recompute periodically the points noted as key decision areas. Costs, lead times, or demands may have changed. Demand forecasts can be revised to recognize new trends. Lead times can be updated, based on recent experience. Current and proposed objectives can be simulated,

with projections of summary statistics on inventory and customer service levels displayed on a customer screen or printed out. These points are important. To remain competitive in the marketplace, the small business owner needs to keep abreast of all facets of operations which affect the business. For example, if the market changes and the entrepreneur's product stays constant, the losses will be extensive not only in lost sales but customer reliability on the entrepreneur's business.

WHAT IS A PRODUCTION PLAN?

A *production plan* is a managerial statement of time-phased production rates, workforce levels, and inventory investment that considers customer requirements and capacity limitations. The plan balances the typically conflicting objectives of maximizing inventory investment, maintaining a stable work force, minimizing production cost, and maximizing profit.

The production plan links the overall strategy of a business and its detailed operating plans. For manufacturing companies the production plan links strategic goals and objectives with the master production schedule. For service firms a production plan becomes a *staffing plan* and ties strategic goals to detailed workforce schedules.

CAN YOU GENERATE A PRODUCTION PLAN?

Developing a production plan is a repetitious process. First, a prospective or tentative plan is developed. A production plan with monthly periods, for example, must specify monthly production rates, inventory and backlog accumulations, subcontracted production, and monthly workforce levels—including hiring, layoffs, and overtime. The plan is prospective at this point because it has not yet been checked against constraints or evaluated in terms of strategic objectives. If the prospective plan is not acceptable for either of those reasons, a new prospective plan must be developed. It may include new alternatives or proposed changes in physical or policy constraints. When management judges the plan acceptable, implementation can begin.

What Is the Trial-and-Error Method?

The most common production plan used by entrepreneurs is the *trial-and-error* plan. The trial-and-error approach to planning first requires stating a strategy, then developing a plan, comparing the developed plan to other plans, and finally modifying the plan and/or strategy as necessary. This process can be continued until you are satisfied with the results.

The major advantage of this approach is its simplicity; however, the key to using it lies in the ingenuity of the planner. For production plans, the planner still must make many choices for each period of the plan. These decisions relate to the amount of anticipated inventory to produce, the amount of overtime to use, the number of units to subcon-

tract, and various other factors. This plan may also be quite costly, given the price of materials and labor, if the planner settles for this method to satisfy all production needs of the business.

What Is the Tableau Method?

The *tableau method* of production planning, almost always used with computers, is often called the transportation method. It is based on the assumptions that the planner has a capacity plan specifying the maximum capacity of regular time, overtime, and subcontractor production each period; a demand forecast for each period; and that all costs are linearly related to the amount of product produced. Given these assumptions, the tableau method yields the optimal mixed strategy production plan over the planning timeline. Large problems can be solved by computers helping make the plan a success, but small business owners may find that many of their problems can be easily solved as well. Since the plan looks to transportation, simple charts filled out with regular time, overtime, and subcontractor time and the production capabilities of each can be easily computed. Since many small businesses have computers, there are several software packages available to do this quickly and efficiently.

WHAT IS IMPLEMENTATION?

The final step is implementing and updating. Implementing a production plan requires commitment. This commitment begins with the creation of a plan from which there is a starting point. Later, the entrepreneur can make additional inputs, develop more completely, and update the plan as needed. Other business employees may even recommend changes to better balance conflicting objectives. Acceptance of the plan does not necessarily mean that everyone is in total agreement, but it does imply that everyone will work toward achieving it.

For example, if John's bakery wants to schedule certain pastries on Monday, Wednesday, and Friday, how does he go about doing it? The chart in Figure 1 can help.

JOHN'S BAKERY PRODUCTION SCHEDULE

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
100 dozen doughnuts	100 dozen doughnuts	100 dozen doughnuts	100 dozen doughnuts	100 dozen doughnuts	100 dozen doughnuts
100 dozen fruit rolls	100 dozen fruit rolls	100 dozen fruit rolls	100 dozen fruit rolls	100 dozen fruit rolls	100 dozen fruit rolls
100 dozen cinnamon rolls	100 dozen cinnamon rolls	100 dozen cinnamon rolls	100 dozen cinnamon rolls	100 dozen cinnamon rolls	100 dozen cinnamon rolls
15 dozen strawberry jelly filled doughnuts	15 dozen chocolate chip cookies	15 dozen cherry jelly filled doughnuts	15 dozen chocolate chip cookies	15 dozen blueberry jelly filled doughnuts	15 dozen chocolate chip cookies

Figure 1. Daily production schedule for a bakery

What is necessary after seeing Figure 1 is to make an order list for the ingredients to be ordered from the supplier. These will include flour, sugar, brown sugar, yeast, eggs, salt, cinnamon, assorted spices, strawberry jelly, cherry jelly, blueberry jelly, assorted fruit fillings, chocolate chips, and vegetable oil.

Based on demand, the bakery schedule may change from week to week, or even day to day. Depending on what items are to be baked, there are specific considerations to be

made. Each day an order for food items must be placed with the supplier for the appropriate amount. It is unwise to order an entire week's amount of flour when it can be delivered daily for immediate use. However, the entrepreneur must determine when it is best to order more than one day's amount of supplies. For example, cinnamon and other spices require little space in storage and can be ordered in quantities for a week at one time.

The next step to follow is to make sure there are ample sacks and bags available to package your product in when it is purchased by the customer. Sometimes boxes are necessary, when there is a large order and the customer wants the order placed in one container instead of several sacks.

Inventory costs is a major area. How much capital is required to be placed in daily inventory is of paramount importance. Also, when ordering inventory, storage space is a major consideration, as well as any special customer orders to be filled which may require seldom-ordered goods.

In order to be successful, the entrepreneur must think about the operations of the business and what steps are necessary to begin and maintain it. If there are changes made to production, adjustments need to be made. Maintaining flexibility for the marketplace customer will require more emphasis on operations by the entrepreneur.

ACTIVITIES

The following activities are designed to help you apply what you have learned in this unit.

INDIVIDUAL ACTIVITIES

A.

What are the types of choices that must be made in designing a layout? Which ones are the most strategic?

B.

How does a process layout differ from a product layout? Illustrate each with an example that you have encountered at work or where you live.

GROUP ACTIVITIES

A.

Kathryn Shoemaker established "Grandma's Chicken Restaurant" in Middlesburg 5 years ago. It features a unique recipe for chicken—*just like grandma used to make.* The facility is homey, with relaxed and friendly service. Business has been very good during the last 2 years, for both lunch and dinner. Customers normally must wait about 15 minutes to be served, although complaints about service delays have increased. Kathryn is currently considering whether to expand the current facility or open a similar restaurant in neighboring Uniontown, which has been growing rapidly.

1. What types of strategic and tactical plans must Kathryn make?

2. What environmental forces could be at work at Middlesburg and Uniontown that Kathryn should consider?

3. What are the possible distinctive competencies of "Grandma's?"

B.

An office of 60 employees must be revised to accommodate 20 new employees. While changing the layout, it makes sense to review it to be sure that it is as effective as possible. You want to improve communication, find space for everyone, create a good work environment, and minimize adverse reactions to space reductions and relocations.

1. What information would you gather? How?

2. How would you analyze this information?

3. How much employee involvement would you recommend? Why?

CASE STUDY

"It's hard to believe," thought Glenn Moore as he walked into the employee lunch area, "that it has only been 2 years since I founded 'Hightec.'" He was not interested in lunch, since it was only 9:30 a.m. His purpose was to inspect the new microcomputer that was just purchased to better manage the company's inventory and accounting functions. The computer was housed at the rear of the employee lunch area, right next to the coffee, hot soup, and hot chocolate vending machines. There was absolutely no room for the computer elsewhere.

"Hightec" is a manufacturer of transducers. These devices convert gas or liquid pressure into an electrical signal. Another form of the device converts weight or force into an electrical signal. A typical customer order is for only three to ten units. The firm currently rents a 15,000 square-foot, L-shaped building housing four basic sections; the office area, an engineering area, a machine shop, and an assembly area. There are 45 employees, consisting of machinists, engineers, assemblers, secretaries, and salespersons.

Although Moore concentrated on finance and marketing during the first 2 years of "Hightec's" existence, his problems now lie more with production costs, inventory, and capacity. Sales have been increasing about 30 percent per year, and this growth is expected to continue. Specific symptoms of "Hightec's" problems include the following:

- Space limitations have delayed the purchase of a numerical control machine and a more efficient testing machine. Both promise greater capacity and higher productivity and are easily cost justified.

- The machine shop is so crowded that equipment not in constant use has been moved into the inventory storage area.

- More and more machines are being operated on a second and third shift basis that would otherwise be justified. Productivity is lower and quality is slipping.

- Approximately 10 percent of the work force's time is spent moving materials to and from the inventory storage area. Inventory at all stages of production is kept there. Since the supply room is so chaotic, it is difficult to find wanted parts. Considerable time is lost searching.

  Approximately 1,000 square feet of storage space must be rented outside the plant.

- Moore has been forced to forgo bidding on several attractive jobs due to lack of capacity. One salesperson is particularly disgruntled with this decision, as she lost her commission.

- Several office workers have complained about the cramped quarters and lack of privacy. The quality of employee space also leaves an unfavorable impression on prospective customers visiting the plant.

- Additional help was just hired for the office. To make room for their desks, Moore had to discard his favorite tropical plant, which started as a cutting when "Hightec's" was formed. It has sentimental value.

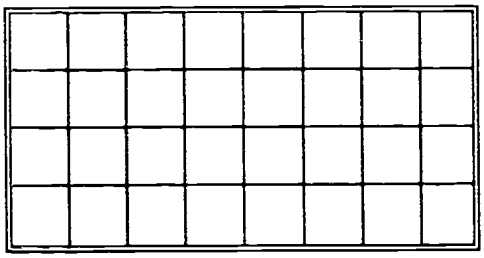
Department	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Area Needed (blocks)
1. Administrative office	I	A	E	U	A	E	O	O	O	O	I	E	O	U	3
2. Conference room		U	U	U	U	U	U	U	U	U	U	U	U	U	1
3. Engineering/mfg. mgt.			I	U	U	O	A	E	E	I	E	E	U	O	2
4. Production manager				U	A	A	A	A	A	I	I	E	O	A	1
5. Lunch room					U	U	U	U	U	U	U	U	U	U	2
6. Computer						A	X	U	U	U	O	I	U	U	1
7. Inventory storage							A	O	O	O	O	U	U	U	2
8. Machine shop								A	X	I	O	U	U	I	6
9. Assembly area									A	A	I	U	I	A	7
10. Cleaning										O	O	U	U	U	1
11. Welding											O	U	U	U	1
12. Electronic												E	U	U	1
13. Sales & accounting													O	U	2
14. Shipping and receiving														U	1
15. Load test															1
														Total	32

(a) Relationship Chart: Each block represents approximately 595 square feet.

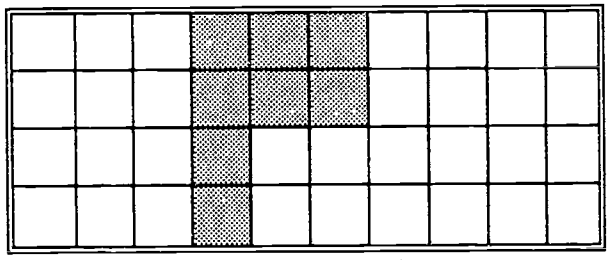
The Options

Moore has identified three options for increasing capacity at "Hightec." The first is to renew the rental contract on the current facility for another 5 years and rent portable units to ease the cramped conditions. He discarded this first alternative as being too piecemeal for a growing problem. The second alternative is to purchase land and build on it a new 19,000-square-foot facility. The most attractive site would cost $100,000 for land, and the construction cost is estimated at $40 per square foot. His cost of capital is around 15 percent.

The third alternative is to renew the rental contract on the current building for another 5 years and rent an adjacent 7,000-square-foot building only 50 feet from the current one. The rental cost of both buildings would be $2,800 per month. It would be necessary to build a $15,000 corridor connecting the buildings if this third option is chosen, although Moore estimates the relocation costs (such as for moving and installing the machines and the loss of regular-time capacity) to be $20,000 less than with the second alternative.



(b) Available space for new plan (Option 2)



(c) Available space for renting two buildings (Option 3)

The Layout

Regardless of which option Moore chooses, he must improve on the existing layout. It suffers in terms of materials handling costs and coordination between departments. When Moore initially designed it, he essentially placed the office first and then fit in the other departments as best as possible. The main consideration for the other departments was not to have the machine shop next to the clean room. Moore put together the information on the new layout, as shown in Exhibit 1. The projected area requirements should be sufficient for the next 5 years. Both layouts provide for 19,000 square feet. The REL chart gives particular emphasis to materials-handling and communication patterns.

Glenn Moore walked back to the office with a fresh cup of coffee in his hand. He hated hot chocolate and it was too early for soup. He wondered what should be done next. Whatever the choice, he wants a more attractive work environment for the engineering and materials management staffs, which are currently located in a cramped, open-office setting. It has been difficult attracting creative people in these areas. He made a mental note that the adjacent building currently is quite drab.

DISCUSSION QUESTIONS

1. What expansion alternative do you recommend to Glenn Moore? Justify your position.

2. Design an effective block plan. Compute its "score," as would be done by ALDEP.

3. Cite 7-10 quantitative and qualitative considerations that you believe make your design attractive.

ASSESSMENT QUESTIONS

Read the following questions to check your knowledge of the topics presented in this unit. When you feel prepared, ask your instructor to assess your competency on them.

1. Explain why the operations of a business should be planned carefully.
2. What elements should be included in the design plan of the business?
3. List and explain the four layout types and specify when each should be used.
4. How should the three performance criteria be determined?
5. What are other performance criteria which might be considered?
6. Explain the acquisition process steps.
7. Why should the purchasing procedures be followed? Explain the procedures in your answer.
8. Discuss distribution and its effect on operations.
9. Explain the inventory control system and describe each type while giving three examples of each.

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PACE

	Unit 1.	Your Potential as An Entrepreneur
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⇨	Unit 21.	Operations
	Resource Guide	
	Instructor's Guide	

Units on the above entrepreneurship topics are available at the following levels:

* Level 1 helps you understand the creation and operation of a business
* Level 2 prepares you to plan for a business in your future
* Level 3 guides you in starting and managing your own business