

Module 4

Inventory, supply chain, projects and measurements



Outcomes

Upon completion of this module students will be able to:

- *Explain* the reason for having inventory.
- *Explain* various inventory models including sales and operations planning, material requirements planning (MRP) and manufacturing resource planning (MRP II).
- *Discuss* the theory of constraints.
- *Define* supply chain management from a strategic view.
- *Discuss* the bullwhip effect or demand amplification.
- *Define* collaborative supply chains.
- *Describe* the nature of project management and the strategic nature of projects.
- *Describe* project organisation structures.
- *Discuss* the critical chain method.
- *Describe* measurements for business excellence.
- *Describe* the Hoshin process for setting goals and using measurement systems.
- *Describe* the balanced scorecard approach to performance measurement.



Unit 9

Inventory planning and management



Outcomes

Upon completion of this unit students will be able to:

- *Explain* the reason for having inventory.
- *Explain* why the economic order quantity is not appropriate for modern business.
- *Describe* a fixed-order quantity model and a periodic review model.
- *Describe* how lead times and safety stock affect inventory management.
- *Describe* the process for sales and operations planning.
- *Describe* material requirements planning (MRP).
- *Describe* manufacturing resource planning (MRP II).
- *Explain* a bottleneck process.
- *Discuss* the theory of constraints.
- *Explain* the theory of constraints logical thinking process.
- *Discuss* the drum-buffer-rope.
- *Describe* the operations scheduling process.
- *Differentiate* between backward and forward scheduling.

Activity 4.1



Activity

Now that we have introduced the subject, reflect on what inventory does for an organisation. Think of an organisation with which you are familiar and try answering these questions:

1. How much inventory should the organisation have?
2. When should you pay for it?
3. How much should you pay for it?
4. What happens if you have too much inventory?
5. What happens if you have too little inventory?
6. Where is inventory stored?
7. How much storage space is required?
8. How is inventory transported?
9. How much inventory is transported at one time?
10. How is inventory stored?
11. What happens if the inventory is a hazardous substance (or dangerous to handle)?
12. How do you keep track of what inventory you have?
13. What is the value of the inventory you have?
14. What can you do with the inventory you do have?
15. We could consider many more questions at this stage but the above give some idea of where we are heading.

Activity 4.1 feedback

Inventory costs money so when an organisation obtains more inventory it costs it more money. If it obtains a lot more inventory it costs it a lot more money. That money is now tied up with the inventory investment and cannot be used for any other purpose. While inventory is being held it may appreciate in value but, more than likely, it will depreciate. Appreciation arises in times of rising prices and currency fluctuations. Depreciation is more common as customers are not prepared to pay full price for something that is not brand new or fresh.

Inventory hides problems and compensates for poor delivery performance, high levels of scrap and rework, poorly maintained equipment, incorrect quantities used and supplied, and poor buying



decisions. Inventory, in this sense, encourages ineffective behaviour and poor performance.

Inventory requires storage places. Warehouses, storage sheds, retail shelves, containers and transport systems are built to hold and manage inventory. This is a real concern when the items held are large, bulky and carry little value. Foam used in packaging and upholstery is an example of a product made almost entirely of air that is relatively cheap to make but expensive to store.

Inventory slows production as batches of product move through production systems. When more inventories are used, transport systems are bigger, slower, clumsier and less able to cope with changing customer demands.

Inventory encourages obsolescence or may even become obsolete. The use-by date on supermarket items encourages households to buy in smaller quantities and hold smaller quantities in their homes to prevent the goods expiring.

Inventory requires special handling conditions and may be hazardous to store. Dangerous chemicals and flammable liquids need specially constructed storage areas and staff need specialist training when handling and using these items.

Inventory is counted, administered, managed and may also be insured against loss. These actions take time and money for the people involved.

Activity 4.2



Activity

Now that we have introduced the subject of material requirements planning, try answering this question:

What data is required to develop a very basic MRP?

Activity 4.2 feedback

Material requirements planning (MRP) is a set of techniques that uses the master production schedule, bills of material and inventory data to calculate the requirements of component materials.

MRP uses the master production schedule which is the list of products, quantities and dates for the next few months. It starts with each specific item and quantity listed and calculates the quantities of all components and materials required to make those items and the date those items must be available for use.

To calculate the quantities of all components and materials required it uses the bill of materials indicating the quantities of components to be used to make each product. Bills of materials are also called formulas, recipes, formulations or ingredient lists.

MRP explodes the bill of material, adjusts for inventory quantities on hand or already on order, and calculates net requirements that are offset by the lead time.

The inventory data needed for a basic MRP system includes lead time required to obtain or manufacture all products and materials, the quantity to order or the batch size and the quantity on-hand or the current inventory balance.

The master production schedule entries are translated into gross requirements for all materials by time period.

The gross requirement is the total requirement of an item generated from the master production schedule and subsequent levels in the bill of material. The gross requirement is balanced with inventory on hand, scheduled receipts and safety stock to calculate net requirements.

The net requirement is the result of applying a gross requirement against inventory on hand, allocations, scheduled receipts and safety stock. The net requirement is then lot-sized and offset for lead time and becomes a planned order.



MRP calculates the net requirements by subtracting current stocks and current on order quantities from the overall gross requirement. The explosion process is controlled by the bills of material. If net requirements are greater than zero, order receipts must be planned. The order release is offset from the required order receipt date by the lead time.

MRP outputs include planned orders, order release notices, changes in open orders due to rescheduling, and inventory status data. The resulting planned order releases which become the detailed production schedules are examined for availability of resources for each time period. If the capacity is inadequate to meet the schedule, the MPS is modified and the MRP programme is run again. The procedure is repeated until the MPS and available capacity have a reasonable match.

Activity 4.3



Activity

Work through the following questions. You may need to go back and re-read the unit to help you.

1. Explain why the economic order quantity model is not appropriate for modern business.
2. Explain the difference between MRP and MRP II.
3. Explain the sales and operations planning process.
4. Explain why sales and operations planning is performed at the aggregate level.
5. Explain the theory of constraints.
6. Explain how the drum-buffer-rope works.
7. Explain the difference between a capacity-constrained resource and a bottleneck.
8. Explain why an organisation might carry safety stock.

Activity 4.3 feedback

All answers are in the learning material.

Unit 10

Supply chain management



Outcomes

Upon completion of this unit students will be able to:

- *Define* supply chain management from a strategic view
- *Discuss* the bullwhip effect or demand amplification
- *Define* collaborative supply chains
- *Explain* the triple-A approach to supply chains
- *Discuss* the strategic role of inventory in supply chains
- *Discuss* the criteria for supplier selection.

Activity 4.4



Activity

Work through the following questions. You may need to go back and reread the unit to help you.

1. Explain the bullwhip effect. In particular, explain how it happens and what can be done to minimise adverse effects.
2. Describe the Triple-A supply chain approach.
3. Explain vertical integration as a means to secure more linkages in the supply chain.
4. Evaluate the criteria for selecting a supplier.

Activity 4.4 feedback

All answers are in the learning material.



Unit 11

Project management



Outcomes

Upon completion of this unit students will be able to:

- *Define* a project.
- *Describe* the nature of project management.
- *Discuss* the strategic nature of projects.
- *Describe* project organisation structures.
- *Discuss* the role of the project manager.
- *Discuss* project management processes.
- *Define* a critical path.
- *Discuss* project risk and uncertainty.
- *Discuss* the critical chain method.
- *Outline* what makes a project successful.

Activity 4.5



Activity

Work through the following questions. You may need to go back and reread the unit to help you.

1. What is a project?
2. What makes a project different from other business activities?
3. What is project “creep” and what should be done to prevent it?
4. Explain the critical chain method.
5. What makes a project successful?
6. As a project manager, how would you ensure that your project is successful?

Activity 4.5 feedback

All answers are in the learning material.

Unit 12

Performance measurement



Outcomes

Upon completion of this unit students will be able to:

- *Describe* measurements for business excellence.
- *Describe* the Hoshin process for setting goals and using measurement systems.
- *Describe* the balanced scorecard approach to performance measurement.
- *Describe* how the closed-loop management system links strategy and operations.
- *Describe* benchmarking.

Activity 4.6



Activity

Work through the following questions. You may need to go back and reread the unit to help you.

1. Describe the balanced scorecard approach.
2. Evaluate Hoshin planning as a strategic planning system.
3. Evaluate Hoshin planning as a performance measuring system.
4. What are some financial measurements for an organisation?
5. What are some operational measurements for an organisation?
6. How can innovation and learning be measured?
7. What is an appropriate measurement for internal processes?
8. What performance measurements are suitable for a call centre?
9. How does benchmarking benefit an organisation?

Activity 4.6 feedback

All answers are in the learning material.



Operations Management Exam Questions

Guidelines

The allocated exam time is three hours.

The student should answer **six questions** from a choice of **eight**.

Each question should take about 30 minutes to answer.

Lecturer to choose **eight** questions from the 15 provided below.

Choose only one from each heading.

Strategy and competitiveness

Question 1

“The battle is won not in the boardroom but in the laboratories, on factory floors, at service counters and in computer rooms. Companies that fail to exploit fully the strategic power of operations will be both hampered in their own attacks and vulnerable to those of competitors that do exploit its power.”

Discuss.

Answer

The direct quotation in the following four paragraphs is sourced from Robert H. Hayes and David M. Upton (1998) ‘Operations-based strategy,’ *California Management Review*, 40(4): 8–25. This provides the context on which the question is based.

The battle is won not in the boardroom but in the laboratories, on factory floors, at service counters and in computer rooms. Operations’ role is larger than just that of implementer of strategy; it is the foundation for – indeed, the driver behind – successful strategic attacks and defences. The important implication for company leaders: companies that fail to exploit fully the strategic power of operations will be both hampered in their own attacks and vulnerable to those of competitors that do exploit this power.

Nowhere is this clearer than in cases where large companies that have established a powerful, well-entrenched competitive position (possibly by following a clear strategy) are attacked successfully by competitors that lack both position and strategy. Indeed, again and again we observe small companies that – although lacking the advantages of size, experience, established position and proprietary

technology – take on big companies and in a relatively short time push their way to industry dominance. Why were the former leaders so vulnerable? Why didn't they react more promptly and vigorously to such attacks – even after extended periods of time? And how are some companies, in contrast, able to defend themselves successfully?

Most studies of this phenomenon focus on cases where the key to the attacker's success was the development of a new technology and/or the identification of an emerging market. Strategy then becomes primarily a matter of finding the right 'position' in that market and then moving there. But there are many other examples where radical new technologies and markets play a minor role: the attackers exploit technologies that are available to all and compete for customers who already are being served by established competitors. In such cases, the key to success is often an operations-based advantage.

Superior operations effectiveness not only serves to buttress a company's existing competitive position, but, when based on capabilities that are embedded in the company's people and operating processes, is inherently difficult to imitate. For this reason it can provide the basis for a sustainable competitive advantage even when the company adopts the same competitive position as one or more of its competitors. Moreover, this sort of competitive advantage tends to be less visible to competitors than one that is based on staking out a differentiating competitive position. As a result, they are not prompted to respond as quickly. The sustainability of a competitive advantage that is based on superior operating skills is enhanced, therefore, both because it is difficult to duplicate and because competitors may not perceive its potential effectiveness, or even its existence, until too late.

Guide to markers: This is a very open question and you should be looking for an argument that suggests the operations function has a major role to play in designing products and delivering solutions to customers. Traditionally, the operations function has taken a back-seat approach but the modern view is to treat operations as a powerful weapon. Each of the quoted paragraphs above presents a powerful story but the essence of the answer is in the final paragraph, "Superior operations effectiveness..."



Nature and role of operations

Question 2

“The customer wants quality, flexibility and service to increase while variability, lead time and costs decrease.” Discuss the customer and the six basic requirements of the customer.

Answer

The customer is the next process or where the work goes next. This view can lead to internal and external customers, but the concept of satisfying the customer can only be fully implemented when considering the customer as the next process.

Most people will think of the customer as the person who buys the product or service. The payment for products and services may occur at any point in the supply chain or at the end. Essentially, the payment recognises a change of ownership for a product or the completion of the service. The person who pays for the product or service is called the end customer or final customer or consumer.

Guide to markers: The objectives of operations management should be viewed from the customer's point of view. The customer is defined as the next process or where the work goes next. Thus customers can be internal to the firm as well as external. Regardless of the type of business, internal and external customers generally have the following six basic requirements:

1. Higher level of quality.
2. Higher degree of flexibility.
3. Higher level of service.
4. Lower cost.
5. Less time or quicker response.
6. Less variability.

Customers determine the quality of the required output. So quality in this sense is to understand exactly what the customers want, when they want it, how they want it and why they want it, and then delivering that to them.

Customers do change their minds. This does not mean they are indecisive. Over a period of time they change their behaviours, preferences, styles, ideas, desires, wants, needs and relationships. Therefore, the supplier needs to understand these changes and have the capability to react to whatever volume or product is required.

The merging of products and services often makes it difficult to measure how well the customer is satisfied. Customers demand higher levels of service. Suppliers are required to truly understand the customer with objective and subjective measures.

Lower cost is always mentioned as a customer requirement. However, it is not just the price that needs to be lowered; it is the total cost to the customer. Some firms, especially in information and communications technology, refer to this as the cost of ownership.

Customers want products produced and delivered in less time. This requires a shorter cycle time, shorter delivery times and faster service response. However, the real measure is consistency of performance. This requires less variability. The output from one session is the same as the output from the next.

Demand management and forecasting

Question 3

Discuss the purpose of the demand forecasting process and the advantages for an organisation that develops an effective demand forecasting system.

Answer

The forecasting process is the business process that attempts to predict demand for products and services so that sufficient capacity, resources and materials are available in time to meet the need.

Guide to markers: the following paragraph relates to the purpose of demand forecasting. These points should be covered by the student.

The real measure, or purpose, of these forecasts in the long term, medium term and short term is to determine the level of expenditure. It will cost money to buy capacity; it will cost money to occupy a facility; it will cost money to buy raw materials and components; it will cost money to train and educate employees to perform production and service activities; and it will cost money to deliver products and services to customers.

Guide to markers: the following paragraph relates to the advantages for the organisation that develops an effective demand forecasting system. These points should be covered by the student.

How much a firm or an organisation spends is a decision entirely up to them. Depending on how much they spend and when will determine how well, or how poorly, they are able to satisfy customer demand. If they spend the right amount of money they will satisfy customer demand at the minimum cost. If they spend too much they may find they have under-utilised resources.



Capacity planning and management

Question 4

Yield management can be very effective when balancing supply with demand especially for service organisations. Discuss the business environment for yield management and how it could be used by an airline company.

Answer

Yield management is the application of discriminatory pricing to various market segments so that relatively fixed capacity can be used to satisfy customer requirements and simultaneously maximise revenue.

The objective of yield management (also known as revenue management) is to increase revenues for organisations that operate with relatively fixed capacity. The subject comes under a variety of terms including revenue management, pricing and revenue optimisation, and demand chain management.

The concept of yield management was first applied in the airline industry during the late 1970s.

The application of yield management is well practised in the airline industry with airlines offering flights for as low as one dollar but for flights at least six months later. Closer to the day of the flight, airlines may offer discounted fares on lightly loaded sectors and these bookings usually have to be paid in full, are non-transferrable to another person, and non-refundable. In some cases they are changeable, but with the payment of a change penalty fee and by paying any applicable fare adjustment. Peak-hour flights are unlikely to have many fares at lower rates since the airlines have little trouble selling these at higher rates.

Guide to markers: The student should have discussed four or five of the following bullet points and then used examples from the airline industry to illustrate the points being made.

The business environment for yield management is most effective when the following exist:

- Relatively fixed capacity and the same unit of capacity can be used in a variety of ways.
- Demand can be segmented by market and each segment has varying needs, behaviour, and willingness to pay.
- Demand is highly variable (seasonal fluctuations) and uncertain.
- Inventory is perishable (hotel room by night, airline seat by flight).
- Product can be sold in advance.
- Product can be forecast with relatively high accuracy.

- Fixed costs are high.
- Marginal costs of selling one extra unit are low.
- Price is not an indicator of quality.
- Producers are profit-oriented and have freedom of action.

Designing processes

Question 5

Womack describes the perfect process as “a process in which every step is valuable, capable, available, adequate and flexible”.

Discuss.

Answer

James Womack described the perfect process as one that creates exactly the right value for the customer. He acknowledged that value is hard to define for external processes and even harder to define for internal (support) processes. Each step in the process must be valuable, capable, available, adequate and flexible.

1. To be valuable it has to add value to the customer and to be recognised by the customer as adding value and not adding cost. Consider removing this step from the process and check if it is absolutely necessary.
2. The capable qualifier comes from process capability and six sigma capability. A capable process can be executed the same way with the same satisfactory result every time it is run.
3. The concept of being available is a derivative of total productive maintenance and suggests it is able to be executed every time it is necessary without waiting. This implies that production machines are available for use and not waiting for parts or maintenance.
4. The theory of constraints defines processes that are adequate. An adequate process has enough capacity to perform this step when it needs to be performed without waiting.
5. Flexible processes are lean and are based on the Toyota Production System. Each step in a flexible process occurs only at the command of the next downstream step within the time available.

Guide to markers: The student should state that the perfect process creates exactly the right value for the customer. Then they should discuss each of the five key points (valuable, capable, available, adequate and flexible).



Improving processes – lean thinking

Question 6

One of the aims of lean thinking is the elimination of waste. Discuss the seven categories of waste.

Answer

Waste is any activity that does not add value to the product or service as valued by the customer.

There are seven categories of waste:

1. overproduction — excess quantity or too early
2. waiting — queues or delays
3. transportation — unnecessary movement
4. processing — poor process design
5. motion — activities that do not add value
6. inventory — items that are adding cost and not value
7. defects — scrap or rework.

Overproduction is producing a quantity greater than required. Overproduction occurs for a number of reasons. The worst reason is that management believes that the cost of set-up can be amortised over a longer production run and that this lowers the unit cost of production.

The waste of waiting occurs whenever the flow of production is interrupted. Job shop processes are referred to as intermittent because they stop-start-stop-start. Lean thinking endeavours to eliminate the stop and make sure that materials and production flow all the way from initial process to final process.

The waste of transport is any unnecessary movement of materials or products. Inwards goods delivered to the wrong part of the building that have to be transported to the correct place is waste. Products sent in bulk to a remote location then called back to the main centre to meet customer needs represents waste of transport.

The waste of processing is the inclusion of any processing step that does not add value. It usually arises from poor process design. Examples include heating ingredients to a temperature and allowing them to cool and then having to heat them again when the rest of the process is ready. This is poor co-ordination of processing steps.

Waste of motion is the use of activities that do not add value, such as placing heavy items on the floor rather than at waist height. Assuming an operator can lift the items it is better to place them on a table rather than bending to place them on the floor and then subsequently bending to pick them up.

Inventory waste is the storage of items that are not needed. This requires storage in a warehouse and that requires additional cost which would not occur if the inventory did not exist.

Producing defects, scrap and rework is waste. Scrap is an output that is dumped at the end of processing because it does not meet customer specification. Why is that product made in the first place? It may be quicker to just throw money away or flush it down the toilet. Rework occurs when a product is made and it is determined that a defect can be corrected if it passes through the processing step again. Painting and repainting is an example. When this waste occurs the item is made twice but the customer only pays once. That is waste.

Guide to markers: Students should have clearly described each of the seven categories of waste and included the key points noted above.

Question 7

“A big breakthrough in the development of lean thinking systems was to realise the difference between process and operations; process is the total flow of production from the customer’s order to the finished product while operations is a set of machines.” Discuss how a focus on the process teaches us to smooth out our operations and make us more effective. (Note: Lean thinking systems are synonymous with lean production systems and just-in-time production systems.)

Guide to markers: Students should focus discussion on elimination of waste to make production flow. They should highlight inefficiencies in particular areas and how these can be improved. If companies just concentrate on individual machines it becomes too disjointed and unconnected. They need connection and flow.

Product design

Question 8

What is quality function deployment?

Answer

Quality function deployment is a methodology that identifies customer needs (the voice of the customer) and ensures these needs are met or exceeded with the technical (design) requirements throughout the product development and production process. Quality function deployment can be viewed as a set of communication and translation tools. It tries to eliminate the gap between what the customer wants in a new product and what the product is capable of delivering.



Quality function deployment is a methodology to:

- Prioritise spoken and unspoken customer excitement, performance wants and basic needs.
- Translate these needs into actions and designs such as technical characteristics and specifications.
- Build and deliver quality products and services by focusing business functions on a common goal of achieving customer satisfaction.

Quality function deployment picks up the spoken and unspoken customer requirements and maximises positive excitement such as ease of use, fun and luxurious feel. This creates value in the customers' eyes.

Traditional design aims at minimising negative aspects such as defects and poor service. The aim of traditional design in this sense is to obtain zero defects. What is the point of difference when all organisations have zero defects?

Quality function deployment is a system that implements elements of systems thinking and psychology. The systems view looks at the whole system and the psychology part looks at the customer needs, how they evaluate value and what makes a customer choose one product or service over another.

The performance wants and excitement characteristics provide an excellent opportunity for an organisation to gain competitive advantage. Knowledge about each market segment and changing customer requirements helps to hit the customer targets. Quality function deployment is epistemic and allows the invisible customer requirements to become visible.

Guide to markers: This is a fairly high-level question and the answer above is rather strategic in nature. Students could quite easily answer by discussing the house of quality which takes customer requirements and translates them into technical requirements. They may also discuss the four levels of the house of quality which eventually derives process control characteristics. When marking you should be looking for the three bullet points above.

Concept of quality

Question 9

Six sigma quality has developed from a simple way of measuring quality to an overall strategy for an organisation. Describe the six sigma approach to quality.

Answer

Six sigma quality is a business improvement approach that seeks to find and eliminate causes of defects and errors in manufacturing and service processes by focusing on outputs that are critical to customers and a clear financial return for the organisation. It is a business process that allows organisations to improve bottom-line performance, creating and monitoring business activities to reduce waste and resource requirements while increasing customer satisfaction.

Six sigma quality is a proven methodology for driving and achieving transformational change within an organisation. It is a business improvement process that focuses on customer requirements, process alignment, analytical rigour and timely execution.

In its original form it concentrated on manufacturing variables, both controlled and uncontrolled, such as temperature, pressure, flow rate and time. It also improved the process output variables such as yield, waste, capacity, downtime and production rate.

This has now been extended to include non-manufacturing variables, both controlled and uncontrolled, such as communication methods, completeness, accuracy, training, inventory levels, shipping methods, promise dates, days of the week, seasons of the year and customer required date. It improves output variables such as order correctness, delivery time and package quality.

Six sigma quality aims to align executives to the right objectives and targets, to mobilise improvement teams, to accelerate results and to govern sustained improvement.

It has been practised by Motorola for more than 30 years and other large organisations have since unravelled the mysteries and applied the gains to their operations. It has been rather slow to be implemented within smaller companies. However, now the basic concepts are more widespread within small to medium enterprises despite the start-up costs and commitment required. In fact, some of the real benefits are being achieved with service companies.

It has its foundations in statistics — well, that is where the name comes from. Originally it was termed \pm six sigma capability and it measured the variation of each process. The process had to be designed such that it was capable of producing \pm six standard deviations (sigma) of the process within the customer-defined process limits.

Six sigma quality allows organisations to identify customer requirements and to design, and subsequently modify, business processes to consistently achieve nothing less than the minimum of customer requirements. Keep the customer happy, supply them



with exactly what they want, when they want it and they will come back for more.

A concentration on increased reliability by making processes more repeatable helps improve production, yield and efficiency.

Resources are focused on the right products and the right projects.

Guide to markers: Look for at least five of the paragraphs above. If a student described any five paragraphs then that would constitute an excellent answer.

Inventory planning and management

Question 10

Discuss the theory of constraints and how it can be applied to operations.

Answer

Goldratt explains that the goal of the firm is to make money by:

- Increasing throughput, which is the rate at which money is generated by sales.
- Reducing inventory, which is the money spent on buying items for subsequent sale.
- Reducing operating expense, which is the money spent to convert inventory into throughput.

Traditionally, management emphasises reducing operating expense and reducing inventory. Organisations take pride in proclaiming that they are on a “cost-cutting drive”. They target opportunities to cut expenses and reduce inventory. Expenses are easy to cut when the organisation stops spending money. Likewise inventory is easy to reduce when the organisation stops replenishing supplies.

Looking at both operating expenses and inventory, what happens when the organisation reaches zero? Managers argue that they will not actually reach zero and they will stop before they reach that limit. But they do not tell anyone where to stop, when to stop or how to stop. They just say, “Reduce operating expenses and inventory!” The finite limit is zero.

What kind of organisation have you built when operating expense is zero and inventory is zero?

There is no finite limit to increasing throughput, which is defined as the rate at which money is generated by sales. Having raw materials sitting in the yard waiting to be processed does not make the manufacturer successful. Having products sitting in a warehouse does not make an organisation profitable. Having products sitting on the shelf in a retail store does not make the retailer wealthy.

The only way to get rich, according to Goldratt, is to make the products, sell them and get paid for them and make sure that the amount you receive exceeds the amount spent on inventory and operating expenses.

The theory of constraints requires the entire production process working together to achieve the goals of the firm. Measurement systems should encourage the increase in net profits, return on investment and cash flow. Organisations can achieve this when, at the operations level, it recognises and rewards performance based on the amount of throughput, inventory and operating expenses created.

Guide to markers: Students should have highlighted four of the key points noted above.

Supply chain management

Question 11

Discuss how the bullwhip effect (or demand amplification) occur in supply chain management.

Answer

The bullwhip effect creates large oscillations of inventory in the supply chain network. Large changes in the supply position upstream are caused by small changes in downstream demand. The effect, also known as demand amplification, can be eliminated (or minimised) by synchronising the supply chain.

The consumer sales pattern that occurs at the final retail points gets distorted and amplified as the demand is transmitted up the supply chain, especially when each link in the supply does not fully understand the dynamics of the consumer sales pattern.

The effect can occur with any range of products and at any level in the supply chain but is most noticeable with consumer commodity products. If demand for an item is relatively constant at final retail points, then the available inventory in the retail store gradually diminishes until it is time for the retailer to place a replenishment order with the wholesaler.

The wholesaler is expected to hold relatively large quantities of products so they can meet supply demands from multiple retailers. The wholesaler will usually be required to order from the manufacturer in large quantities if they want to secure favourable pricing arrangements. The wholesaler may even hold off ordering from the manufacturer until they have a very large order and thus secure even better payment and delivery terms.

At this stage the manufacturer is removed from the actual demand at retail and is confronted with a large order coming in from the



wholesaler. This may indicate that the demanded product is experiencing an increase in popularity and, to compensate for that popularity, the manufacturer schedules larger production runs. However, to be able to make the larger production runs the manufacturer must secure raw materials from their supplier. Original suppliers supply in bulk and often have large minimum and large multiple orders. Therefore, the manufacturer orders even larger quantities of raw materials from the supplier.

The bullwhip effect is a direct result of individuals making rational decisions within the supply chain infrastructure. If firms want to mitigate the effects they first have to examine the infrastructure of the supply chain rather than attempt to change the rational behaviour patterns.

Guide to markers: Students should describe many of the points above and their application to the supply chain.

Question 12

Discuss how to overcome the problems created in a supply chain when individual participants do not have communication with their suppliers beyond the first tier and do not have communication with their customers beyond the first tier.

Answer

The way to overcome these problems is to be part of a collaborative supply chain. Firms that form part of a supply chain that eventually supplies supermarkets or large retail chains should be fully aware of collaborative supply chains.

In its simplest form, collaborative supply chains eliminate internal barriers that result in costs and time that add little or no value to end consumers.

While possibly the best example of collaborative supply chains is practised by Wal-Mart Stores in the United States, most recent developments have occurred in Europe with a true focus on the consumer.

There are two distinct parts — the supply side and the demand side.

The supply side of collaborative supply chains addresses the need for rapid and efficient replenishment of products in the overall supply chain.

Traditionally, the retailer generates replenishment orders from the wholesaler or manufacturer. With collaborative supply chains, the suppliers determine the replenishment quantities based on information on stock and sales received from the retailer.

With a refined application of this process, all suppliers in the supply chain have access to current details of consumer demand at the retail level. This information may be sent electronically to

them, or they can access it themselves from the retailers' web sites. Thus, all suppliers know the true demand and they can initiate replenishment before the actual request filters through the supply chain. This allows all suppliers, not just the first tier suppliers, throughout the entire supply chain to prepare goods for despatch, confident that replenishment is required.

The delivery process speeds up and suppliers have a better understanding of true consumer demand.

Information about product movement (as recorded at the point of sale), outside factors that affect demand (such as seasonal changes), actual inventory levels, product receipts, and an acceptable agreed safety stock level are integrated electronically.

Guide to markers: Students should discuss the two distinct parts — the supply side and demand side and provide at least three strategies that could overcome the problem.

Project management

Question 13

Discuss how a project manager should manage a project to meet the various time, cost and quality constraints.

Answer

The role played by the project manager is critical to the success of every project and it is not easy to find really good project managers for every project. It certainly helps when the project manager has an understanding and an appreciation of the technical aspects associated with the project but the project manager does not have to be an expert in the field. A project manager for a project assembled to set up new information and communications technology, for example, should have an appreciation of the strategic role computers play in a business environment, but the manager does not have to be a computer technician. The technical knowledge, though, must be sufficient to be able to ask the right questions and make the right decisions.

The project manager should be able to ask penetrating questions, have credibility, sensitivity and the ability to handle stress.

Leadership and expertise in strategy are essential attributes for the project manager. The leadership is necessary to provide direction, motivation and help to all project team members and the strategy expertise is required to gain the overall perspective of the business need for the project.

A defining characteristic of the project manager is communication and people skills displayed at all times. The project manager may be dealing, at times, with a personal issue with one individual and,



at others, communicating project progress to the media and stakeholders. The project manager must be able to resolve interpersonal conflicts. This range of skills makes this role challenging and rewarding to the point that a good project manager should never complain about having a boring job.

The project basics of planning, executing and controlling resources such as people, equipment and material need to be managed to meet the quality, cost and time constraints of the project.

Monitoring and control activities include measuring the volume of work being completed, the quality of work, the costs compared to budget, the attitudes of those involved including team members and customers, the co-operation of the team and the status of the work being performed compared to plan.

Management resource is often applied to the cost and time constraints, and trying to keep the project within budget. Unless the project is quite similar to other projects, or contains quantifiable work packages, the original time and cost budget is a guess and wishful thinking. Instead of concentrating solely on cost and time elements, a good project manager is managing change and risk.

A change request seeks to expand or reduce the project scope, modify policies, processes, plans or procedures, modify costs or budgets, or revise schedules. Only formally documented change requests are processed and only approved change requests are implemented.

A change of scope is allowed but it has to be approved by the customer and the project plan has to be updated to reflect the change. Project danger arises from scope creep that allows changes to creep into the project without customer approval, without an allocation for additional resources and without adjusting the project duration. Most projects have creep of some form or other and a good project manager does not allow it to happen.

The best way to prevent project creep is to establish a clear project charter and an agreed project scope statement before detailed work commences.

As for risk, the project manager should be planning all risk elements, identifying risk, performing a qualitative risk analysis, performing a quantitative risk analysis and developing a risk response plan. The project manager should be able to spot unstated assumptions. These risk elements are strategic. They may be boring, but when identified risk occurs as an event the project is able to handle it within the scope of the project. It does not arrive out of the blue.

With project management, the objectives are often unclear, measurements of success are ambiguous and the process used to manage the project does not affect success or failure. Risk develops

as a result of uncertainty and the good project manager focuses on reducing uncertainty and therefore minimising risk. The successful project manager reduces risk by ensuring all communication channels are open and by allowing all team members to express opinions and concerns.

Guide to markers: Students should discuss the attributes of a good project manager as noted above as well as the use of processes to effectively manage projects.

Question 14

Projects often exceed budgeted cost and allocated time. The reasons for exceeding cost and time are usually unexpected. A project manager may attempt to compromise on quality in order to complete on time and/or within cost. Discuss three sources of unexpected problems that eventually cause the project to exceed cost estimates and three sources of unexpected problems that eventually cause the project to exceed time estimates.

Answer

For a variety of reasons projects have a habit of running behind schedule. Most of the reasons fall back on the shoulders of the project manager who should perform a better job. Initial time estimates may be too optimistic, resources may not be available when required, activity sequencing may be incorrect, technical problems may occur, scope creep may occur, or the customer may request changes.

Unexpected problems resulting in cost increases:

- difficulties require more resources
- scope of work increases
- initial bids or estimates were too low
- reporting was poor or untimely
- budgeting was inadequate
- there were price changes of inputs.

Unexpected problems resulting in time increases:

- delays owing to technical problems
- initial time estimates were optimistic
- task sequencing was incorrect
- required resources were not available as needed
- necessary preceding tasks were incomplete
- there were client-generated changes
- there were unforeseen government regulations.

Guide to markers: Students must competently discuss all six aspects relating to cost and time increases.



Performance measurement

Question 15

Discuss the four perspectives of the balanced scorecard approach and outline how the balanced scorecard approach could be used for performance measurement.

Answer

The balanced scorecard measures business performance from four perspectives:

1. Customer
2. Internal
3. Innovation and learning
4. Financial.

1. Customer perspective

The customer perspective asks, “How do customers see us?”. Organisations may have a strategic objective to add value to customers, to satisfy customer needs, to listen to customer wants, to allow customers to participate in process and product design and to act and think from a customer’s viewpoint. This needs measuring. This needs measuring from a customer perspective by asking customers for their views.

2. Internal perspective

The customer perspective looks at the organisation from the outside while the internal perspective looks at the organisation from the inside and asks, “At what aspects of business should we excel?”. Process design and improvement all occur internally and the results affect customers.

Processes measured as part of the balanced scorecard have the most impact on customer satisfaction. Clearly these affect lead time, throughput time, employee skills and attitudes, flexibility, availability, responsiveness and information systems.

3. Innovation and learning perspective

Innovation and learning perspective asks, “Can we continue to improve and create value?”. Competitive activities constantly challenge every organisation’s position. All other organisations challenge the organisation at the top of the league. Even organisations positioned somewhere in the middle have to face constant challenges for their position. Customer expectations constantly change and force organisations to be totally aware of the range and scope of those changes.

4. Financial perspective

The financial perspective asks, “How do shareholders see us?”. In the end it is the bottom line that counts. Firms can have any amount



of customer satisfaction, close to perfection with internal processes, unlimited innovation and learning and still fail on financial measures.

The trick is to capitalise on the other perspectives and translate gains made into financial achievements.

Guide to markers: Key aspects of each of the four perspectives must be discussed.



References



Reading

Gardiner, D. (2010). *Operations Management for Business Excellence* (2nd ed.). North Shore, New Zealand: Pearson Education.