

Principles of Management

Block

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Expert Committee

Dr. J. Mahender Reddy
Vice Chancellor
IFHE (Deemed to be University)
Hyderabad

Prof. Y. K. Bhushan
Vice Chancellor
IU, Meghalaya

Prof. Loveraj Takru
Director, IBS Dehradun
IU, Dehradun

Prof. S S George
Director, ICMR
IFHE (Deemed to be University)
Hyderabad

Dr. O. P. Gupta
Vice Chancellor
IU, Nagaland

Prof. D. S. Rao
Director, IBS, Hyderabad
IFHE (Deemed to be University)
Hyderabad

Course Preparation Team

Prof. Ramalingam Meenakshisundaram
IFHE (Deemed to be University)
Hyderabad

Ms. Pushpanjali Mikkilineni
IFHE (Deemed to be University)
Hyderabad

Ms. Smita Singh
IU, Sikkim

Ms. Ch Syamala Devi
IU, Meghalaya

Ms. Hadiya Faheem
IFHE (Deemed to be University)
Hyderabad

Mr. Mrinmoy Bhattacharjee
IU, Mizoram
Aizawal

Prof. Tarak Nath Shah
IU, Dehradun

Mr. Manoj Kumar De
IU, Tripura
Agartala

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Block VI

Controlling

The sixth block to the course on Introduction to Management deals with the managerial function of controlling. The block contains four units. The first unit explains the significance of controlling in organizations and various degrees of control at each level of management. The second unit focuses on variety of control methods and systems used by managers to deal with various problems in the organizations. The third unit discusses the significance of productivity and the importance of operations management in improving productivity. The fourth unit discusses the significance of information systems and the types of information systems managers can implement in an organization.

The first unit, *The Control Function*, discusses the importance of controlling in organizations and the basic control process. The unit also discusses the requirements for effective control since managers need adequate and effective control systems to help them make sure that events conform to plans. The unit also explains certified management audit and enterprise self-audit.

The second unit, *Control Techniques*, explains how managers use variety of tools and techniques to exercise control in organizations. The unit gives an overview of major control systems – financial control system, budgetary control system, quality control system, and inventory control.

The third unit, *Productivity and Operations Management*, discusses the concepts of production and productivity. The unit gives an overview of operations research, production, and operations management. The unit also explains operations research techniques and limitations of operations research.

The fourth unit, *Management Information Systems (MIS)*, discusses the concept of information systems and its components. The unit discusses major types of information systems, namely, transaction processing systems, office automation systems, decision support systems (DSS), and executive support systems. The unit also explains evolution of MIS and its advantages to the organization.

Unit 19

The Control Function

Structure

1. Introduction
2. Objectives
3. Planning and Controlling
4. Importance of Controlling
5. Levels of Control
6. Basic Control Process
7. Direct vs Preventive Control
8. Types of Control
9. Requirements for Effective Controls
10. Certified Management Audit and Enterprise Self-Audit
11. Summary
12. Glossary
13. Self-Assessment Test
14. Suggested Readings/ Reference Material
15. Model Answers

1. Introduction

In the previous unit, the managerial function of leading was discussed. In this unit, the controlling function will be discussed. Control is an essential function of management in every organization. The management process is incomplete and sometimes useless without the control function.

The control function is concerned with ensuring that the planning, organizing, staffing, and leading functions result in the attainment of organizational objectives. In other words, control is a tool that helps organizations to measure and compare their actual progress with their established plan.

In this unit, significance of controlling and control process is discussed. The unit also explains direct versus preventive control, requirements of effective control, and certified management audit and enterprise self-audit.

2. Objectives

By the end of this unit, students should be able to:

- Determine the relationship between planning and controlling
- Explain the significance of controlling

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- Classify the levels of control
- Explain the basic control process
- Compare and contrast direct and preventive controls
- Explain certified management audit and enterprise self-audit

3. Planning and Controlling

Planning and controlling are two managerial functions that are interrelated. Planning is a process of setting goals and objectives and developing action plans to achieve these objectives. Controlling is a process of regulating the activities toward a pre-determined goal. It ensures that the strategies are implemented according to the plans and that the desired results are obtained.

A cyclical relationship exists between planning and controlling. The planning/control cycle begins with the identification of the mission of the organization, the establishment of goals and objectives, and the formulation of plans to accomplish them. When these plans are implemented, the control function monitors the actual performance and compares it with the predetermined standards. If any deviations are discovered, corrective action is taken. If there are no deviations, the operations process continues. Feedback during the planning/control cycle results in a dynamic process in which the means for accomplishing organizational objectives continuously evolve in response to changes in the external environment.

4. Importance of Controlling

The control function is gaining importance in today's organizations due to a number of factors. These factors include the need for accountability in organizations, the need to detect environmental changes that significantly affect organizations, the growing complexity of present day organizations and the need to identify operational errors in organizations to avoid incurring excessive costs.

Controlling plays an important role in helping managers detect irregularities, identify opportunities, handle complex situations, decentralize authority, minimize costs, and cope with uncertainty.

Coping with Uncertainty

In today's turbulent business environment, all organizations must cope with change. When organization goals are established, they are based on the knowledge available at that point of time. However, by the time the goals are accomplished, many changes may have occurred in the organization or its environment. The pace at which environmental and other factors change creates a lot of uncertainty. A constant evaluation and revaluation of the organization's strategic and tactical plans is necessary to keep up with changes and cope with uncertainty.

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Detecting Irregularities

Control systems help managers detect undesirable irregularities, such as product defects, cost overruns, or rising personnel turnover. Early detection of irregularities can prevent minor problems from mushrooming into major ones and often save a great deal of time and money for the organization. Problems such as missing important deadlines or selling faulty merchandise to customers are sometimes difficult to rectify. Identifying aberrations in the early stages helps organizations avoid such problems.

Identifying Opportunities

Control also helps managers identify areas in which things are going better than expected, thereby alerting management to possible future opportunities.

Handling Complex Situations

Another important factor contributing to the need for a control mechanism is the growing complexity of today's organizations. When a company requires only one kind of raw material, produces only one kind of product, has a simple organization design, and enjoys constant demand for its products, it can afford to have a very basic and simple system of control. But, as organizations grow or engage in producing many products from a number of different raw materials, and operate in a large market area with many competitors, efficient and effective coordination becomes necessary. In such cases, managers have to keep track of various activities to make sure that they are well synchronized. Thus, sophisticated control systems become necessary to maintain adequate control in large and complex organizations.

Decentralizing Authority

Controls also help managers decentralize authority. With the help of controls, managers can allow their subordinates to take decisions while ensuring that the ultimate authority remains in their hands.

Minimizing Costs

When implemented or practiced effectively, effective control systems could improve output per unit of input, eliminate waste and lower labor costs.

5. Levels of Control

The different managerial levels like strategic, tactical, and operational levels exercise different degrees of control. These are described in detail below:

Strategic Control

Strategic control involves monitoring critical environmental factors to ensure that strategic plans are implemented as intended, assessing the impact of strategic plans, and adjusting such plans when necessary. Strategic control is exercised by the top-level managers. It involves effective implementation of strategic plans and scanning the external environment to adjust the plans according to the environmental changes.

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Tactical Control

Tactical control focuses on assessing the implementation of tactical plans at department levels, monitoring associated periodic results, and taking corrective action when necessary. Tactical control is exercised by the middle-level managers who deal with functional objectives, programs, and budgets. It involves evaluation of tactical plans at the implementation stage and taking corrective action in case of variations in the actual performance.

Operational Control

Lower level managers deal with operational control, which involves assessing the implementation of the operational plans, examining the results, and adjusting the process to the standards.

Activity: The director of the Mighty Educational Institutions wants to offer management programs through his group of institutions. As the planning of the project is complete, arrangements have been made to put the plan into action. Can you apply the three levels of controls in appropriate situations to ensure that the project conforms to the objectives of the company?

Answer:

Check Your Progress

1. Which of the following terms refers to the measurement of the performance of an organization?
 - a. Coordination
 - b. Organizational development
 - c. Appraisal
 - d. Control
2. What activities do managers perform under 'controlling'?
 - a. Influencing people in the organization to reach targets
 - b. Allocating and grouping resources
 - c. Regulating activities to reach goals
 - d. To design the mission of organization
3. The control function helps managers identify _____ and thus helps organizations avoid excessive costs.

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- a. Operational errors
 - b. Planning errors
 - c. Accounting errors d. Errors in objectives
4. The use of effective control systems does not lead to _____.
- a. Improved output per unit of input
 - b. Reduction in wastage
 - c. Increase in personnel turnover
 - d. Lower labor costs
5. Which of the following types of control focuses on assessing the implementation of tactical plans at the department level, monitoring the impact of the plans, and taking corrective action when necessary?
- a. Operational
 - b. Strategic
 - c. Tactical
 - d. Functional
6. _____ control involves monitoring critical environmental factors that could affect the viability of strategic plans, ensuring that strategic plans are implemented as intended and assessing the effects of organizational strategic plans.
- a. Tactical
 - b. Strategic
 - c. Operational
 - d. Organizational

6. Basic Control Process

The control process involves certain steps, which are described as follows:

Determining Areas to Control

Based on the objectives and goals of the organization, the manager should determine the significant areas where control is essential. The organizational goals and objectives defined during the planning process must form the basis on which managers decide upon the areas in which to exercise control.

Establishing Standards

Standards are the criteria against which actual performance is measured and indicates the acceptable level of performance. Control standards are of different kinds – quantitative standards, cost standards, time standards, and qualitative standards. Establishing standards helps employees understand what is expected of them and how their work will be evaluated. Second, it provides a basis for identifying job difficulties with reference to the personal limitations of

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employees, which may include lack of experience, ability or training or any other task-related deficiency. Finally, standards help reduce the potential negative effects of goal incongruence. Goal incongruence may occur due to various reasons, such as lack of support of the employees for organizational activities, lack of clarity in organizational goals, etc.

Unforeseen circumstances sometimes necessitate changes in established standards. In order to avoid making frequent changes in established standards, a 'cushion' is provided in the control process. This 'cushion' is known as tolerance and specifies the acceptable level of degree of variations in the established standards. It is the permissible deviation from the standard. In order to provide this type of 'cushion,' the standards in some industries may be set in terms of a range, such as 2 to 3 percent acceptable rejection rate, and so on.

Measuring Performance

After establishment of the control standards, the actual performance should be measured. The measurement of performance against standards should be done on a forward-looking basis. Measuring performance on such a basis helps managers detect deviations in their early stages. They can, then, be countered by appropriate action. Managers use different techniques to set standards. Most organizations use a combination of quantitative and qualitative performance measures. Qualitative performance measures may include qualitative judgment by peers. After selecting the means of measurement, a manager has to decide how frequently performance is to be measured. The manager should ensure that the measurement of the performance is accurate, reliable, simple, and objective.

Comparing Performance against Standards

The actual performance is compared with the control standards to ensure that the actual performance conforms to the standards. Managers often perform the task of comparison on the basis of information provided in reports. Management by exception, personal observation, and management by walking around the work areas are some of the techniques to measure performance.

Database programs allow supervisors to query, reduces the time spent on gathering facts, and reduces their dependency on other people. Such programs give supervisors quick and easy access to information.

Recognizing Good or Positive Performance

Managers should recognize the positive performance of subordinates and appreciate it with good remarks and rewards. This motivates employees towards efficient performance.

Taking Corrective Action when Necessary

Corrective actions should be taken if there are any serious deviations between the actual performance and the established standards. Managers must first determine the cause of the deviation from the standard, then take the required action to remove or minimize the cause of deviation. Sometimes, managers

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redraw their plans or modify their goals to correct deviations. In order to rectify a problem, managers may have to train the subordinates, recruit additional staff, or remove inefficient subordinates. Sometimes, the established standards may not be realistic. In such situations, managers may conclude that the standards are inappropriate and need to be modified.

Adjusting Standards and Measures when Necessary

The performance standards should be reviewed regularly to match the environmental conditions and organizational situations. It is important for managers to conduct a periodic review of standards due to changing conditions like use of sophisticated machinery or improvement in employee skills. It is also required in case of existing standards becoming obsolete. Further, if the current standards set have been exceeded, it may indicate unforeseen opportunities for the organization. It encourages the organization to further raise standards in order to effectively tap the potential of the employees to meet the new standards.

7. Direct Control vs Preventive Control

In direct control, the cause of an unsatisfactory outcome is traced back to the individuals responsible for it and they are made to correct their practices. Preventive control, however, focuses on developing better managers who will skillfully apply concepts, principles and techniques and view managing and managerial problems from a systems point of view, so that the undesirable outcomes caused by poor management are eliminated.

Direct Control

In every organization, numerous standards are developed to compare the actual output of goods or services, in terms of quality, quantity, cost, and time, with the planned output. Negative deviations imply that the performance is below normal standards and that the results are not congruent with the plans. The deviations are measured in terms of goal achievement, labor hours, machine hours, price, and cost.

Causes of negative deviations from standards

Negative deviations indicate sub-standard performance and that the results are not congruent with the plans. There are two main reasons why the deviations occur:

Uncertainty: Uncertainty of environmental conditions and other factors may cause deviations in the planned performance. In such a situation, control systems are not useful in tracking the deviations.

Lack of knowledge, experience or judgment: The plans may be a failure due to lack of adequate knowledge, experience or judgment on the part of the individuals who made the decisions or implemented them. By educating managers, such errors could be reduced, rotating them under different jobs in order to give them a broad idea of different jobs in the organization, or providing them with guidelines that help them understand and deal with difficult situations.

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Questionable assumptions underlying direct control

- i. Performance can be measured
- ii. Personal responsibility exists
- iii. The time expenditure is warranted
- iv. Mistakes can be discovered in time
- v. The individual who is responsible can take corrective steps
- vi. Many aspects of these assumptions are questionable.

Assumption one: Performance can be measured: Every organization identifies numerous performance standards that are determined to control quality, cost, price, time, complaints, inputs, and outputs. These standards have two types of shortcomings: measurement and location. Certain aspects of performance such as the amount of creativity, the ability of a manager to develop potential managers, foresight and judgement in decision-making, the effectiveness of research and the like can rarely be measured accurately.

The second type of shortcoming is concerned with the location of control. Managers are aware that certain critical stages exist during the operations, right from acquiring the input factors, processing them to produce a finished product or service, to finally, selling the product or service. Exercising effective control during these stages will minimize costs.

Assumption two: Personal responsibility exists: Sometimes, managers cannot be held responsible for an organization's poor performance. Certain external factors which are beyond the control of management, such as interest rates, inflation, scarcity of a particular fuel may have a negative impact on the performance of the organization.

Assumption three: The time expenditure is warranted: When a particular problem arises, an inquiry into the problem is conducted by the manager or someone delegated by the manager to carry out the inquiry. The process of inquiry requires managers to spend time identifying the causes of poor results. By the time the meeting is held, the individuals concerned may have forgotten some of the facts regarding the problem. These drawbacks may convince management that the cost of investigation exceeds the benefits derived from it.

Assumption four: Mistakes can be discovered in time: Although most managers assume that mistakes can be discovered in time, it rarely happens. By the time the deviations have been identified, it could be too late for effective action. Since most managers have historical data, this data should therefore be utilized to interpret its implications for the future.

Assumption five: The person responsible will take corrective steps: Assigning responsibility may not lead to correction of deviations. Suppose high production costs are traced to a marketing manager. The marketing manager may argue that slight modification in the product design will make the product attractive and easier to sell, and that this modification involves "really" no change in the

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production process. The investigator, who may be from a lower level of the organization, may feel intimidated by such a response and may not question the manager further.

Preventive Control

Preventive control focuses on anticipating the occurrence of possible deviations and preventing them. The principle of preventive control is based on the idea that negative deviations can be eliminated by the application of management principles. The principle of preventive control can be stated as “the higher the quality of managers and their subordinates, the less will be the need for direct controls.”

Example: Preventive Control at Toyota

Toyota Motor Corporation, the world’s third largest automaker, practices the preventive control system in its production process. The teams involved in the production process adopt the company’s philosophy regarding quality control. Toyota’s quality control at every stage of the production process ensures that correct materials and parts are used and fitted with precision and accuracy. It tries to avoid defects in the production process through preventive control.

Adapted from “Toyota Quality: People Drive Us,” Toyota Motor Manufacturing, Kentucky, Inc. <<http://www.toyotageorgetown.com>>

Assumptions of the principle of preventive control

The principle of preventive control is based on three assumptions. They are:

Assumption one: The application of management fundamentals can be evaluated: Periodic evaluation should be conducted to assess the skills of managers in applying management fundamentals.

Assumption two: Well qualified managers make minimum mistakes: Even good managers commit a few mistakes. Therefore, the manager concerned should be held responsible if he commits errors. Further, his performance should be evaluated regularly to ensure that it is in conformance with the management fundamentals.

Assumption three: Managerial performance can be measured by using management fundamentals: The application of management principles varies with the knowledge and abilities of managers. The managerial fundamentals are useful to provide a benchmark for managerial performance.

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Advantages of preventive control

- Identifying the weaknesses of the managers and providing training to them in those areas, help bring about greater accuracy at work and more effective performance.
- Preventive control methods enable managers to detect their errors and take corrective action.
- Preventive control encourages control by self-control. Since managers are aware that deficiencies would be uncovered during evaluation, they determine their responsibility and make voluntary corrections wherever required.
- Since it is easier to prevent problems from occurring than to correct them after deviations have been noticed, preventive control reduces the managerial burden.
- Preventive control helps to bring about psychological contentment among subordinates by enabling them to understand the relationship between performance and measurement.

Activity: Dinesh Kumar is chairman of Boss Electronic Manufacturers Ltd. The company has recently been getting an increasing number of complaints from customers about defective items. Dinesh Kumar asked some members of the top management to form a team to find out why so many defective items were being produced. The team found that the individuals manufacturing the goods were responsible. Therefore, Dinesh Kumar and the top management asked the managers concerned to correct their practices and minimize production of defective items. But, even after the announcement, there was not much change in the outcome. What type of control mechanism did Boss Electronic Manufacturers Ltd., use? What is the other alternative control mechanism that the company can apply to minimize production of defective items?

Answer:

Check Your Progress

7. In the control process, a/an _____ is known as the permissible deviation from the standard.

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- a. Cover
 - b. Cushion
 - c. Amplifier
 - d. Animator
8. The higher the quality of managers and their subordinates, the less the need for _____.
- a. Direct control
 - b. Preventive control
 - c. Tactical control
 - d. Strategic control
9. In which of the following types of controls, the source of an unsatisfactory outcome is traced back to the individuals responsible for it so that they can correct it?
- a. Direct control
 - b. Preventive control
 - c. Strategic control
 - d. Management control
10. The principle of _____ control is based on the belief that most of the negative deviations from standards can be overcome by applying the fundamentals of management.
- a. Successive
 - b. Directive
 - c. Preventive
 - d. Indirect
11. Which one of the following is not an assumption underlying direct control?
- a. Personal responsibility exists
 - b. Time expenditure is warranted
 - c. Performance cannot be measured
 - d. Mistakes can be discovered in time

8. Types of Control

Organizations exercise various types of control systems. They are:

Control Based on Timing

Controls are classified into three types based on the timing or stage in the production process. They include:

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Feedforward control: In feedforward control, inputs are monitored to ensure that they meet the standards necessary for the transformation process. Feedforward control enables managers to prevent serious difficulties from arising in the production process. Since feedforward control is future-oriented control, it is referred as precontrol, preaction, or preliminary control. Feedforward control is considered as preventive control since it involves implementation of control measures before the activities are performed.

Concurrent control: Concurrent control regulates ongoing activities that are a part of the transformation process to ensure that they conform to organizational standards. This is also known as steering control. The concurrent control system checks actual performance and ensures that it conforms to the set standards. This control technique is used during the implementation of the activity. Concurrent control techniques help managers identify deviations from predetermined standards and allow remedial measures to be taken while the activity is being performed.

Since concurrent controls involve checkpoints at which decisions are made regarding the continuance of a process, they are sometimes referred to as screening or yes-no controls. Quality control inspections, approval of requisitions, and safety checks are some examples of concurrent control.

Feedback control: Feedback control is also known as post action control. In this control system, actual performance is compared with the established standards to detect any deviations. Based on information about the results of performance, corrective action is taken to adjust the performance. Accounting records, disciplinary action, etc., are some of the examples of feedback control. Concurrent/ steering/yes-no controls and feedback controls are known as corrective controls since they involve the implementation of control measures while the activities are in progress or after the activities have been performed.

Multiple controls: Multiple control systems use two or more control processes and involve several strategic control points. Such control systems were developed because of the need for different controls for different phases of a firm's operations. Firms that do not have such control systems experience difficulties, forcing managers to reevaluate their control process.

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Activity: Raghu is the marketing manager of Innovative Designs, a company that markets interior design products. The company wants to launch a new product for commercial and residential purposes. Raghu has developed marketing strategies for the launch of the new product. In order to ensure effective implementation of the strategies and to check any deviation from the standards, what type of control system can be applied to such situations, if it is based on the timing or stage of the production process?

Answer:

Check Your Progress

12. _____ control measures the results and compares them with the predetermined standards.
 - a. Feed forward
 - b. Concurrent
 - c. Feedback
 - d. Standard
13. Which of the following is not a corrective control?
 - a. Concurrent control
 - b. Feedforward control
 - c. Feedback control
 - d. Yes-no control
14. In _____ control inputs are monitored to ensure that they meet the standards necessary for the transformation process.
 - a. Concurrent
 - b. Feedforward
 - c. Feedback
 - d. Standard
15. Concurrent controls are not referred to as _____.
 - a. Steering control
 - b. Screening control
 - c. Preliminary control
 - d. Yes-no control
16. Which of the following is a preventive control?

Controlling

- a. Feedforward control
- b. Concurrent control
- c. Feedback control
- d. Steering control

17. Feedforward control is not known as _____.

- a. Pre control
- b. Preliminary control
- c. Preaction control
- d. Reaction control

Cybernetic and Non-cybernetic control

Control systems are classified as cybernetic and non-cybernetic based on the degree of human discretion.

Cybernetic control system: A cybernetic control system is a computerized and self-regulating control system, which monitors situations and takes corrective actions.

Non-cybernetic control system: A non-cybernetic control system depends on human discretion. Complex areas of control need managerial discretion for corrective action to be taken and deviations to be minimized.

Example: Cost Control Techniques at MUL

MUL has its focus on cost control. It took it as a challenge to control material costs, which account for 70-75 per cent of total cost. And that could be done only if it started from the basics, say from the development of vendors, setting up their plants, automating the process, and finally, doing value engineering. An initiative on cost cutting includes the company's encouragement to those vendors who are located in far away places to build a warehouse near Gurgaon, where its car plant is located, and compensating its vendors for actual and justifiable expenses incurred in maintaining the warehouse.

Source: Venkatachari Jagganathan, "New Maruti initiatives", cost control measures, 9 march 2000 <domain-b.com>

9. Requirements for Effective Controls

- *Controls should reflect plans, positions and structures:* A control system should provide managers relevant information about the progress of plans that they are responsible for. Managers should use controls that are appropriate for their positions and departments. The type of organization structure helps determine the authority that managers at each level in the organization are vested with. The organization structure defines who is responsible for the execution of plans and any deviations in them.

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- *They should be understandable:* Individuals tend to distrust things they do not understand. Therefore, control systems as well as the information generated by them should be easy to understand.
- *They should be cost-effective:* The cost of controls is an important consideration. The benefits of controls should outweigh the cost of implementing them. Efficient control systems locate the actual or potential deviations from plans at the minimum cost.
- *Controls should identify only important/major exceptions:* Controls that concentrate on exceptions from planned performance make use of the exception principle. They allow managers to benefit from this time-honored principle by identifying only those areas that require their attention.
- *Control systems should be flexible:* The control system must be flexible enough to accommodate change. Flexible controls allow managers to react quickly to overcome adverse changes or take advantage of new opportunities.
- *Control systems should provide accurate information:* Effective control is usually based on accurate information regarding performance. When data from a control system is inaccurate, it can cause the organization to take action that will either fail to correct the problem or create a problem that does not exist.

Check Your Progress

18. Which of the following is a self-regulating control system that can automatically monitor the situation and take corrective action when necessary?
 - a. Cybernetic control system
 - b. Non-cybernetic control system
 - c. Multiple control system
 - d. Feedback control system
19. Which of the following is not a type of control based on timing or stage in the production process?
 - a. Feedforward control
 - b. Feedback control
 - c. Cybernetic control
 - d. Concurrent control
20. Concurrent control is also known as _____.
 - a. Steering control
 - b. Stealing control
 - c. Primary control
 - d. Steaming control

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21. Control systems are classified as cybernetic and non-cybernetic control systems on the bases of _____.
- Timing
 - Stage of production process
 - Degree of human discretion required
 - Degree of deviation from standard

10. Certified Management Audit and Enterprise Self-Audit

A management audit aims at evaluating the quality of management and the quality of managing a system. An enterprise self-audit is a much broader type of audit. It evaluates where an organization is and where it is going, keeping in view present and future economic, social and political developments.

Two types of audits are practiced in organizations. They are certified management audit and enterprise self-audit.

The Certified Management Audit

A certified management audit may be defined as an independent appraisal of an organization's management by an outside firm. To ensure the objectivity of the audit, an outside firm, which has expertise in appraising a company's managerial system, should be entrusted with the responsibility of conducting the audit. A certified management audit report should be based on a thorough study of the quality of managers and the system within which they operate.

The Enterprise Self-audit

According to J.O. McKinsey, a business organization should carry out an audit on a periodic basis in order to appraise all its aspects in the light of its present and probable future environment. Enterprise self-audit has a wide scope. It evaluates the status and position of the organization from the point of the present and future economic, social, and political developments. Enterprise self-audit is designed to enable managers to adapt to the changes of the external environment. It can be conducted annually or every 3-5 years. The process of enterprise self-audit consists of several steps. They are described in detail as follows:

Example: Quality Control at Motorola

Motorola is widely known for its consumer electric and electronic products. The company is particular about the quality of its products. Many tests like electrical and mechanical tests are conducted to check the quality of the products before they are released into the market. Quality assurance people take samples of the product and test them in order to check for quality, as the organization prefers to play a preventive role. The quality assurance people reject any product if it is below the acceptable quality standards, thus saving any further manufacturing costs that would have had to be incurred on the product.

Source: Management control systems-Robert N. Anthony, Vijay Govindarajan

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Procedure

Step-I: The environmental condition in which an industry is functioning is analyzed. Factors such as the company's product, the recent trends and prospects of the product, the technological developments affecting the industry, changes in demand, social, and political factors that influence the industry, and the position of the market are analyzed.

Step-II: The company's position in the industry is evaluated from the point of present and future conditions through enterprise self-audit. In order to find out its position in the market, certain factors like competition, customer response to the firm's products, etc., are examined.

Step- III: The enterprise self-audit reviews the firm's objectives, plans, policies, and facilities. These are amended according to the firm's requirements for the next few years. This process helps managers to face the changes in the future.

Contribution of the enterprise self-audit

Enterprise self-audit forces managers to appraise the overall performance of the organization in relation to both its current and long-range goals. Top executives who carry out enterprise self-audit will be surprised to find that most of their day-to-day decisions are simplified by having a clear picture of where the organization is heading.

A similar audit is often carried out when an organization evaluates a firm it wishes to acquire. Thus, when evaluating a firm, a study of the financial strengths of the firm should be supplemented by a study of the firm's research and development strengths and weaknesses, product line, marketing strengths, personnel, quality of management, and quality of customer relations. All the above mentioned factors are significant for a firm to survive and to face the competitive atmosphere, an enterprise self-audit has to be carried out on a regular and continuing basis.

Check Your Progress

22. Which one of the following types of control techniques is concerned with the regulation of ongoing activities that are a part of the transformation process to ensure that they conform to organizational standards?
 - a. Feedforward
 - b. Concurrent
 - c. Standard
 - d. Operational
23. A/an _____ helps organizations adapt to the changing external environment.
 - a. Enterprise self audit
 - b. Social audit
 - c. Environment audit
 - d. Organization audit

Controlling

24. A _____ aims at evaluating the quality of management and the quality of managing a system.
- Enterprise self audit
 - Management audit
 - Organization audit
 - Quality audit
-

11. Summary

- Control is a continuous process of measuring actual performance against standards or targets and taking corrective action if there are any deviations in the actual performance.
- Planning and controlling are two interrelated managerial functions.
- Controlling plays an important role in helping managers detect irregularities, identify opportunities, handle complex situations, decentralize authority, minimize costs, and cope with uncertainty.
- Different managerial levels exercise different degrees of control like strategic control, tactical control, and operational control.
- The control process varies with different organizations. But there are certain basic steps that are exercised in companies. They are: determining the areas of control, establishing standards, measuring performance, comparing performance against standards, recognizing positive performance, taking corrective action, and adjusting the standards.
- Direct control is a control system where the cause for the deviation is identified and the individual responsible for it is made to rectify the mistakes committed.
- Preventive control focuses on anticipating the occurrence of possible deviations and preventing them.
- Control systems are classified into various types based on timing -- feedforward control, concurrent control, and feedback control. Control systems are classified as cybernetic and non-cybernetic control systems based on the degree of human discretion.
- All managers need adequate and effective systems of control to help them make sure that events conform to plans.
- A certified management audit may be defined as an independent appraisal of an organization's management by an outside firm.
- Enterprise self-audit is designed to enable managers to adapt to the changes of the external environment. It can be conducted annually or every 3-5 years.

12. Glossary

Concurrent Control: A control type based on timing that involves the regulation, monitoring and adjusting of ongoing activities that are part of the transformation process to ensure that they conform to organizational standards.

Corrective Controls: Control techniques applied during or following the completion of an activity.

Cybernetic Control System: A self-regulating control system that, once put into operation, can automatically monitor the situation and take corrective action whenever necessary.

Feedback Control: A control type based on timing that involves regulation exercised after a product or service has been completed to ensure that the final output meets organizational standards and goals.

Feedforward Control: A control type based on timing that focuses on the regulation of inputs to ensure that they meet the standards necessary for the transformation process.

Non-cybernetic Control System: A control system that relies on human discretion as a basic part of its process.

Preventive Controls: They are used prior to beginning operations and designed to eliminate the causes of any deviations that might occur in the implementation of organizational plans.

Steering Controls: Control techniques used to detect deviations and allow corrective actions to be taken while the activity is being performed.

Yes-no Controls: Control techniques used at one or more screening points when specific approval is needed to permit the activity to continue.

13. Self-Assessment Test

1. Define the control function and describe its significance.
2. Briefly explain the levels of control.
3. Explain the various steps that are included in the control process.
4. What is direct control? Discuss the causes of negative deviations from standards.
5. Define preventive control. What are the various advantages of preventive control?
6. Describe briefly controls based on timing and cybernetic and non-cybernetic controls.
7. Describe the certified management audit.
8. What is enterprise self-audit? Discuss the various steps involved in enterprise self-audit.

Controlling

14. Suggested Readings/ Reference Material

- “Management Function of Coordinating/Controlling: Overview of Basic Methods”
<<http://www.managementhelp.org/cntrlng/cntrlng.htm>>
- “Controlling as a Management Function”
<www.uh.edu/~wagon/OD_09.ppt>

15. Model Answers

15.1 Model Answers to Check Your Progress Questions

Following are the model answers to the Check Your Progress questions given in the Unit.

1. (d) Control

Control helps managers measure and compare the actual performance with the desired or planned performance and provides inputs for improving the performance.

2. (c) Regulating activities to reach goals

Controlling can be defined as the continuous measurement and analysis of actual operations against the established standards developed during the planning process and corrections of deviations, if any.

3. (a) Operational errors

Control systems help managers detect undesirable irregularities, such as product defects, cost overruns, etc. Early detection of such irregularities can prevent minor problems from mushrooming into major ones and often save a great deal of time and money for the organization.

4. (c) Increase in personnel turnover

The use of effective control systems helps organizations improve output per unit of input, eliminate waste and lower labor costs. Increase in personnel turnover is not a good sign for the organization and certainly not a result of employing effective control systems.

5. (c) Tactical

Middle-level managers exercise tactical control to test the impact of the tactical initiatives of their departments on the organizational environment.

6. (b) Strategic

As top-level management is involved in strategic issues, strategic control is mainly the function of top-level managers. These managers exercise tactical or operational control to ensure that strategic plans are implemented as intended or planned.

The Control Function

7. (b) Cushion

Unforeseen situations may necessitate changes in established standards. To avoid frequent changes in established standards, a 'cushion' is provided in the control process. This 'cushion' is known as tolerance. It specifies the acceptable level of variation from the established standards.

8. (a) Direct control

Direct control identifies the cause of an unsatisfactory outcome and traces it back to the individuals responsible for it so that they can rectify their mistakes.

9. (a) Direct control

Direct control is carried out when deviations from the plan are observed.

10. (c) Preventive

According to the principle of preventive control, the higher the quality of the managers and their subordinates, the less the need for direct control.

11. (c) Performance cannot be measured

Every organization identifies numerous performance standards expressed in terms of goal achievement, time, ratios, averages and indexes. All these standards are determined to control quality, cost, price, time, complaints, inputs and outputs. Thus, the first underlying assumption of direct control is that performance can be measured.

12. (c) Feedback

Feedback control is exercised after a product or service has been produced to make sure that the final output meets quality standards and goals. The main aim of feedback control is to provide information that facilitates the planning process.

13. (b) Feedforward control

Concurrent and feedback controls are known as corrective controls because in these type of controls, control measures are implemented during the progress of activities or after the activities have been performed. Feedforward or preliminary control is referred to as preventive control because it involves implementation of control measures before the actual activities are performed.

14. (b) Feedforward

Feedforward control helps managers prevent serious difficulties from arising in the production process.

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15. (c) Preliminary control

As concurrent control regulates the activities of the transformation process to ensure that they meet organizational standards, it is also known as steering control. Concurrent control is also known as screening and yes-no control as it uses checkpoints to determine the continuance of a particular process. Preliminary control is a feedforward control, not a concurrent control.

16. (a) Feedforward control

Feedforward control is a preventive control because it involves the implementation of control measures before the actual activities are performed.

17. (d) Reaction control

As feedforward control is future oriented, it is also known as pre control, preliminary control or pre-action control.

18. (a) Cybernetic control system

As this control system can automatically monitor the situation, it does away with the need for human intervention.

19. (c) Cybernetic control

Timing or stage in the production process forms the basis for feedforward control, feedback control and concurrent control. Based on the degree of human discretion required, control systems is classified into cybernetic control system.

20. (a) Steering control

As concurrent control regulates the activities of the transformation process to ensure that they meet organizational standards, it is also known as steering control.

21. (c) Degree of human discretion required

Control systems as classified into cybernetic and non-cybernetic on the bases of the degree of human discretion required. A cybernetic control system is a self-regulating control system, while a non-cybernetic control system depends on human discretion.

22. (b) Concurrent

Concurrent control techniques help managers identify deviations from predetermined standards and allow remedial measures to be taken while the activity is being performed.

23. (a) Enterprise self audit

An enterprise self-audit appraises an organization's position and helps to determine where it (the organization) is, where it is heading with its current plans and programs, whether it is meeting its objectives, and whether any revision of plans is required to enable the organization to achieve its predefined goals and objectives.

24. (b) Management audit

A management audit focuses on evaluating the entire system for managing an enterprise. It does not evaluate managers.

Unit 20

Control Techniques

Structure

1. Introduction
2. Objectives
3. Major Control Systems
4. Financial Control
5. Budgetary Control
6. Quality Control
7. Inventory Control
8. Summary
9. Glossary
10. Self-Assessment Test
11. Suggested Readings/ Reference Material
12. Model Answers

1. Introduction

In the previous unit, the control function was discussed. In this unit, various control systems will be discussed. Control techniques enable managers to ensure that the actual performance of the organization is in tune with the planned performance.

Managers exercise control using a variety of tools and techniques. The major control systems that assist a manager in exercising control are financial control, budgetary control, quality control, and inventory control.

This unit discusses major control systems.

2. Introduction

By the end of this unit, students should be able to:

- Classify major control systems
- Explain common financial control techniques
- Determine types of responsibility centers
- Identify tools of quality control
- Recognize the significance of inventory control

3. Major Control Systems

There are six major control systems – financial control, budgetary control, quality control, inventory control, operations management, and computer based information systems. These control systems help managers to ensure that the

Control Techniques

actual performance matches with the performance standards. Financial control systems help managers keep track of money matters and take necessary steps if the organization is not able to make a profit or meet its profit goals. The budgetary control system provides quantitative tools that help managers compare the actual and the planned revenues and costs of various organizational activities. Quality control is an important issue for every organization that wishes to survive in a competitive environment. The quality control system provides a means of measuring the quality of a product or service.

Inventory control systems help managers control the inventory in such a way that the inputs are available at the right time, at the right place and in the right quantity, thus minimizing costs such as delivery cost, warehousing cost and the floor space occupied.

Control systems vary at different levels of management and with the nature of the time period.

Managerial level – Types of control system

As shown in Figure 20.1, Managers at different levels operate different control systems. The top-level management deals with financial control while middle-level managers are involved in evaluating financial matters that are related to the different functional departments. The middle and lower level management exercise budgetary control to implement activities in keeping with the budgetary plans. Almost all the levels are involved in quality control, which cannot really be confined to any one level. The middle and lower level management exercise inventory control. However, there is always an overlap in the use of control systems.

Nature of timing – Types of control system

The time period varies from one control system to another. If the control system comes into operation before the process of transformation, it is called a feed forward control system. If it operates along with the process of transformation, it is called a concurrent control system, and if it comes at the end of a prescribed period, it is called a feedback control system. Financial control is a feedback control as its performance is evaluated at the end of the time period. Budgetary control and quality control are concurrent control systems as they are performed during the activity. Inventory control is a feed forward control system as it ensures that the inputs are supplied in time.

Check Your Progress

1. Which of the following control systems helps managers ensure that actual performance is in tune with planned performance?
 - a. Budgetary control systems
 - b. Financial control systems c.
 - Inventory control systems
 - d. All the above

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2. Which of the following control systems helps managers by providing quantitative tools to compare the actual with the planned revenues and costs of various organizational activities?
 - a. Budgetary control systems
 - b. Financial control systems c. Inventory control systems
 - d. Quality control systems
3. Which of the following control systems is a type of feedback control system?
 - a. Financial control system
 - b. Inventory control system
 - c. Budgetary control system
 - d. Quality control system
4. _____control systems help managers manage inputs in such a way that they are available at the right time, at the right place and in the right quantity at minimum cost.
 - a. Budgetary
 - b. Inventory
 - c. Financial
 - d. Quality
5. _____are implemented along with the transformation process.
 - a. Feedback control systems
 - b. Feedforward control systems
 - c. Standard control systems
 - d. Concurrent control systems

Example: DHL Solution

Deutsche Post World Net integrated Deutsche Post Euro Express, DHL, and Danzas under one brand name DHL. DHL provides solutions for all logistics problems and needs, and express, package, and logistics services. Recently, a leading company in the IT sector had a problem in dealing with inventory management. The company's customers depended on it for smooth and quick service. But the company had to transport parts required for replacement from its 40 warehouses situated in Europe. So urgently needed parts could not be distributed within the required time and customers were kept waiting. DHL offered a solution. It stored all the products and replacement parts of the company in its decentrally-structured, area-wide network of Strategic Parts Centers (SPCs). From there, sprint couriers of DHL transported the products and replacement parts directly to the customer within two to four hours, irrespective of whether it was day or night.

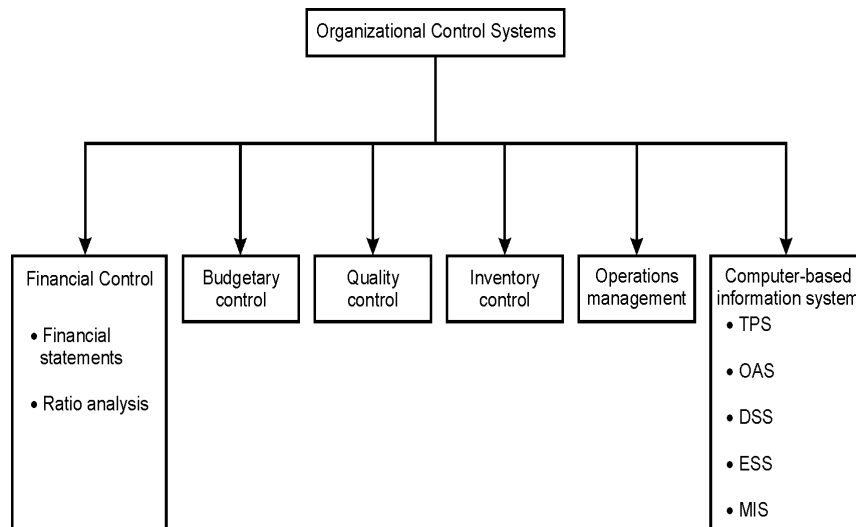
The central DHL call center controlled warehousing, transport, information, and communication. All SPCs were networked with each other via the DHL call centre. This ensured complete transparency of inventory, reduced administration and cost of warehousing, and cut down on delivery time.

Source: "Strategic inventory management- profit from our experience",
<<http://www.dhl.de/dhl>>

4. Financial Control

Financial control can be exercised through the use of various tools and techniques. Some widely known financial control techniques that are helpful in measuring organizational performance are financial statements and ratio analysis.

Figure 20.1: Major Organizational Control Systems



Financial Statements

A financial statement is a summary of the major aspects of an organization's financial status. It provides information regarding the company's financial position. The financial statement enables the manager to assess the organization's liquidity, general financial condition, and profitability. Financial statements provide insights into an organization's performance and long-term prospects. Managers, creditors, investment analysts, shareholders, unions and other stakeholders use the financial statement to evaluate the performance of the organization. The most common financial statements are:

Balance sheets: "A balance sheet shows the financial condition of a business at a given point of time." A balance sheet describes a company in terms of its assets, liabilities, and net worth at a given point of time. A comparative balance sheet, which shows figures from various years, helps track the growth in assets, the state of liabilities and current net worth.

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Income statements: An income statement is a brief presentation of the financial results of a company's operations, revenues, and expenditures over a specified period of time. Thus, an income statement clearly shows revenues and expenses and how much profit the organization has made over a given period of time. The value of goods and services sold is called revenues and the costs incurred in producing and selling the goods and services are called expenses. The income statements for different time periods are often compared to monitor the financial condition of the organization.

Cash flow: Sources and uses-of-funds statements: Cash flow statements summarize the financial performance of an organization in terms of the sources of origin of funds during the year and the areas of fund utilization. A cash flow statement differs from a balance sheet or an income statement because a cash flow statement indicates how the cash or funds were raised and where they were applied, rather than how much profit was made or loss was incurred in business in a given year.

Ratio Analysis

Ratio analysis is the process of determining and evaluating financial ratios. A ratio is an index that measures one variable relative to another and it is expressed as a percentage or a rate. Ratio analysis is useful in comparing data such as current performance with past performance, the firm's performance with its competitors, etc. The important types of ratios used in organizations are liquidity ratios, asset management ratios, debt management ratios and profitability ratios.

Liquidity ratio

Liquidity ratios are the financial ratios that measure the ability of an organization to meet its short-term obligations (current liabilities) by using its current assets. Some of the liquidity ratios used by organizations are the acid test, working capital, receivables to payables, tangible net worth, and current ratios. The current ratio is the most widely used liquidity ratio. The current ratio is the ratio of total current assets to total current liabilities and measures an organization's ability to meet short-term obligations using only its current assets. It is of special interest to short-term creditors who are interested in knowing how quickly an organization can liquidate its assets and disburse short-term liabilities. The current ratio differs from industry to industry.

Asset management ratios

Asset management ratios (also called activity ratios) measure the effectiveness of an organization in managing its assets. An activity ratio is a test of the relationship between the sales and various assets of a firm. The higher the activity ratio, the better the profitability and lesser the investment needed in assets. One of the most widely used asset management ratios is inventory turnover. A low inventory turnover is a sign of excessively slow moving or obsolete inventory. High inventory turnover usually indicates efficient management of inventory.

Debt management ratios

Debt management ratios (also called as leverage ratios) determine the extent of debt used by a company to finance its investment and its ability to meet the long-term obligations that result from such a measure. The debt ratio measures the percentage of total assets financed by debt (including current and long-term liabilities). If an organization uses more debt to finance its needs, it has to allocate more funds to pay interest and repay the principal. Thus, this ratio indicates what percentage of the organization's assets is financed by creditors. A higher percentage indicates that the creditors have greater claim over the assets of the organization than the owners.

Profitability ratios

Profitability ratios measure the profitability of an organization in relation to variables such as sales and assets. They indicate the management's ability to control expenses and earn profits through the optimum utilization of organizational resources. These ratios also indicate the organization's ability to pay debt and the scope for internal financing. Gross profit margin, net profit margin, and return on investment (ROI) are commonly used as profitability ratios. ROI is the ratio of net income to total assets.

Check Your Progress

6. Which of the following financial ratios shows the ability of a firm to meet its short-term obligations by utilizing its current assets?
 - a. Liquidity ratio
 - b. Asset management ratio
 - c. Debt management ratio
 - d. Profitability ratio
7. Which of the following ratios measure the effectiveness of a company in managing its assets?
 - a. Liquidity ratios
 - b. Activity ratios
 - c. Debt management ratios
 - d. Profitability ratios
8. _____ are also known as leverage ratios.
 - a. Liquidity ratios
 - b. Asset management ratios
 - c. Debt management ratios
 - d. Profitability ratios
9. The ratio of net income to total organizational assets is known as _____.
 - a. Tangible net worth
 - b. Return on investment

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- c. Net profit margin
 - d. Gross profit margin
10. A _____ inventory turnover ratio indicates the efficient management of inventory.
- a. Low
 - b. High
 - c. Negative
 - d. Zero
11. The _____ ratio indicates the extent of debt used by a company to finance its investment and its ability to meet the long-term obligations that result from such measure.
- a. Activity
 - b. Profitability
 - c. Liquidity
 - d. Leverage

5. Budgetary Control

Budgeting is the process of formulating plans for the organization for a given period of time and estimating the amount of resources required to carry out the planned activities. "Budgets are the formal quantitative statements of the resources allocated for the execution of activities over a given period of time and include information about projected income, expenditure and profits."

Budgets are used for several reasons. They are a means of translating diverse activities and outcomes into a common measure, such as currency. Stating the budget in monetary terms helps managers convey the information on the key organizational resource (capital) and organizational goal (profit) in a simple form. Budgets provide clear and unambiguous standards of performance for a given time period, usually one year. Also, the interaction between managers and subordinates during the budget development process helps them understand each others' problems and improve cooperation in the future.

Budgets are typically prepared for the organization as a whole, as well as for various sub-units such as divisions and departments. For budgetary purposes, organizations define sub-units as responsibility centers.

Responsibility Centers

"A responsibility center is a sub-unit headed by a manager who is responsible for achieving one or more goals." Thus, any organizational or functional unit that is headed by a manager, responsible for the activities of that unit is called a responsibility center. The responsibility centers make use of resource inputs to produce output of value and earn revenues. There are five types of responsibility centers: standard cost centers, discretionary expense centers, revenue centers, profit centers, and investment centers.

Standard cost centers

A standard cost center is a responsibility center whose employees control costs but do not control its revenues or investment level. The budgetary performance is determined on the basis of the center's ability to achieve goals within the given standard cost constraints. These centers are also called „engineered expense centers" as standard costs are often determined using engineering methods. In a standard cost center, output levels are determined by requests from other responsibility centers

Managers of these cost centers have to ensure that their centers produce the desired output within the specified cost constraints. The manager's budget for each performance measurement cycle is determined by multiplying actual output by standard cost per unit. The difference between the actual costs and standard costs is used as the basis to measure performance.

Discretionary expense centers

A discretionary expense center is a responsibility center whose budgetary performance is determined on the basis of expense constraints established at the discretion of the manager. The inputs necessary for the expense centers are measured in monetary terms but not the output. The reason being that output of the expense centers cannot be measured directly to calculate revenues. Hence, the budgets for such cost centers are developed only in terms of the maximum resources that can be consumed by them in a particular period of time. Besides, the budgets in a discretionary expense center have fixed spending targets, which does not vary with the increase in volume.

Revenue centers

A revenue center is a responsibility center whose employees control revenues but do not control the cost of the product or service they sell or the level of investment in the responsibility center. Its budgetary performance is determined by its ability to generate a specified level of revenue. A notational revenue (transfer price) is given by the manager as a result of the activities carried out by its employees. Here, outputs are measured in monetary terms but are not directly compared with input costs. Sales and marketing divisions are examples of revenue centers.

It is difficult to hold the revenue center responsible for changes in profit levels because the unit is responsible only for revenues and has no control over the costs associated with the product or service.

Profit centers

A profit center is a type of responsibility center whose manager and other employees control both the revenues and the costs of the product or service they sell or deliver. Its financial performance is measured in terms of profits, that is, the difference between revenues and expenses. In a profit center, performance is measured by the numerical difference between output (revenues) and input (expenditure). The manager of the business unit is responsible for improving the

Controlling

profits of the center. Thus, a profit center is used to determine how well an organizational unit is doing economically and how well the head of the center is performing.

Investment centers

"An investment center is a responsibility center whose budgetary performance is based on return on investment." The manager and employees are responsible for controlling the revenues, costs, and the level of investment in an investment center. In an investment center, apart from measuring the monetary value of inputs and outputs, the control system examines the role of assets in generating profit. Thus, investment centers encourage managers to concern themselves with making good decisions about investments in facilities and other assets by requiring them to measure the contribution of assets in producing a profit. Thus, the budget in an investment center is approved by their own responsibility center as opposed to other responsibility centers.

Uses of responsibility centers

An organization's choice of a responsibility center depends to a great extent on the structure of the organization. For example, organizations with a functional organization design and organizations with functional units in a matrix design may choose standard cost centers, discretionary expense centers, and revenue centers.

Organizations that have a divisional structure may opt for profit centers because the large divisions in these organizations generally have control over both the revenues and expenses associated with profits. However, the various departments operating under the divisions may choose other types of responsibility centers. Organizations that treat their divisions as autonomous businesses may also consider them as investment centers.

Activity: Delicacies is a restaurant and fast food centre run by Rohit Verma (Rohit). It is a popular restaurant known for its quality and wide variety of food items. But of late, customers have been complaining to Rohit that the prices of the food items are being increased too frequently and that the items are too expensive. Rohit is aware that he charges high prices. But as he faces the problem of expenditure exceeding budget, he has to compensate for the increased expenditure by charging higher prices. Suggest a control strategy that Rohit can use to overcome the problem he is facing.

Answer:

Check Your Progress

12. Sales and marketing divisions are examples of _____.
a. Standard cost centers
b. Revenue centers
c. Discretionary expense centers
d. Investment centers
13. Which of the following responsibility centers may be chosen by organizations with a functional organization design and organizations with functional units in a matrix design?
a. Standard cost center
b. Revenue center
c. Discretionary expense center
d. All the above
14. Which of the following types of responsibility centers is suitable for an organization with a divisional structure?
a. Investment center
b. Revenue center
c. Standard cost center
d. Profit center
15. Any organizational or functional unit that is headed by a manager, who is responsible for the activities of that unit, is called a/an _____ center.
a. Revenue
b. Standard cost
c. Responsibility
d. Investment
16. A responsibility center whose budgetary performance is measured primarily by its ability to generate a specified level of revenue is called a/an _____.
a. Profit center
b. Revenue center
c. Standard cost center
d. Investment center
17. _____ are also known as 'engineered expense centers.'
a. Standard cost centers
b. Discretionary expense centers
c. Revenue centers
d. Profit centers
-

Controlling

6. Quality Control

According to the American Society for Quality Control, "Quality is the totality of features and characteristics of a product or service that bear on its ability to satisfy stated or implied needs." Quality control will be discussed in terms of quality circles and total quality management.

Quality Circles

A quality circle can be defined as a group of people formed to tackle work problems. A group consists of 6-12 members who belong to a particular department. They conduct regular meetings to discuss problems at the workplace. The members are educated about statistical control techniques and they apply these techniques to solve the problems. Each group has a facilitator who prevents members from diverting to non-productive and lengthy discussions. Quality circles receive recognition, but not monetary rewards, for their work.

Quality circles evolved from suggestions programs, which seek the participation of workers in solving their (day-to-day) problems. Problems related to quality circles are complex, and require the involvement of several team members comprising rank and file workers as well as supervisors. However, the heads of department are excluded from the team because the workers may not be able to express their opinions freely in the presence of the higher official, thus curbing creativity.

Example: Quality Circles at Mahindra & Mahindra

Mahindra and Mahindra launched the quality circle movement in the organization. Each quality circle comprised six people working in the same area and was led by the first line officer from the same area. The quality circles helped to solve many operational problems, resulting in improved quality, safety and housekeeping, and reduced costs.

Source: Venkatachari Jagannathan, "Rich harvest", 23 December 2003<domain-b.com>

Total Quality Management (TQM)

Total quality management is a technique to improve the quality of operations at all levels. It is a continuous process of building quality into the procedures and methods of an organization. It calls for the active participation of members at all levels of the organization, so that customers' expectations are not just met, but exceeded.

To ensure quality management, it is necessary to analyze the needs of the firm's customers and to fill the gap between the existing features of the products or services and the desired features. The success of TQM depends on the top management's commitment to the program. They should provide a vision, constantly reinforce the values of the program, emphasize quality and set quality goals for the TQM program. They should allocate the resources required for the implementation of the quality program and facilitate free flow of information in all directions, i.e. vertical, horizontal, and diagonal.

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The employees are encouraged to apply statistical quality control techniques and acquire new skills through regular training and development programs. This requires the organization to develop an environment conducive for learning and emerge as a “learning organization”.

TQM is not a one-time effort but a continual, long-term endeavor which has to be recognized, reinforced, and rewarded by continuous monitoring of the ongoing data collection, evaluation, feedback, and improvement programs. The success of the program requires the management from the top to the bottom levels and non-managerial employees to work as a team. Employees should be taken into confidence and empowered to initiate and implement the changes that contribute to quality improvement.

7. Inventory Control

Inventory control involves stocking the materials and resources needed for the execution of organizational activities. Maintaining the inventory at proper level helps managers to overcome the problem of uncertainty of supply and demand.

Organizations maintain three kinds of inventory – raw materials, work-in-progress, and finished goods. Raw material inventory is the stock of parts, ingredients and other basic inputs to a production or service process. Work-in-progress inventory is the stock of items currently being transformed into a final product or service. Finished goods inventory is the stock of items that have been produced and are awaiting sale or transit to a customer.

The reliability of supply sources, seasonal nature of production, and anticipated sales are factors that affect the level of raw material inventory. Work-in-progress inventory is influenced by the length of the production cycles. Finished goods inventory level is determined by the time period of the shipment.

Different organizations use different methods (e.g. ABC analysis, Just-in-Time) to control inventory. However, the basic purpose of inventory control in an organization is to minimize the total costs of maintaining inventory. Proper inventory control must, on the one hand, ensure that the costs of investment are minimized and, on the other hand, make sure that there is no risk of lost sales or interrupted production schedules due to lack of inventory at a given time.

Example: Quality Control Strategies of Tata Infotech

Tata Infotech, a leading IT company, belongs to the multibillion dollar Tata group, one of India's most trusted business groups. Tata Infotech provides customers worldwide with innovative system integration offerings that integrate hardware, software solutions and services in the IT and telecom sectors. All the products of the company are manufactured as per international specifications and certifications, and are subjected to rigorous quality checks. Quality systems and processes have been certified for ISO 9001:2000 and many products manufactured are certified under UL / CSA / TuV. In fact, Tata Infotech has won several national export and quality awards over the years.

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Activity: Panther Leathers is a company that manufactures various leather products such as shoes, bags, and overcoats. The manager of the company, Viswanath, is more concerned about introducing new models in the market at regular intervals than in improving the quality of the products. This policy has, in no way, deterred customers. The company is doing well without any drop in sales volume. In such a situation, where customers don't seem to be really bothered about the quality of the products, do you think there is any need on the part of the company to maintain quality standards and apply quality control?

Answer:

8. Summary

- Managers use a variety of methods and systems to exercise control at different levels. There are six major control systems – financial control, budgetary control, quality control, inventory control, operations management, and computer based information systems. These control systems help managers to keep a check on whether the actual performance is in conformance with the performance standards.
- Financial control can be exercised through the use of various tools and techniques. Two widely known financial control techniques that are helpful in measuring organizational performance are financial statements and ratio analysis.
- Budgeting is the process of formulating plans for the organization for a given period of time and estimating the amount of resources required to carry out the planned activities.
- Quality control is the process of monitoring specific projects to determine the compliance of their quality with relevant quality standards and identifying ways to eliminate causes of unsatisfactory performance.
- Inventory control involves stocking the material and resources for the execution of organizational activities.

9. Glossary

Balance Sheet: Statement of a firm's financial position on a particular date.

Current Assets: Items such as cash, accounts receivable, marketable securities, and inventories – assets that could be turned into cash at a reasonably predictable value within a relatively short time period (typically, one year).

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Current Liabilities: Debts, such as accounts payable, short-term loans, and unpaid taxes, that have to be paid off during the current fiscal period.

Debt Management Ratios: Financial ratios that assess the extent to which an organization uses debt to finance investments, as well as the degree to which it is able to meet its long-term obligations.

Discretionary Expense Center: A responsibility center whose budgetary performance is based on achieving its goals by operating within predetermined expense constraints set through managerial judgment or discretion.

Financial Control: Tools relying on financial ratios based on accounting statements, breakeven analysis, and the creation of budgets to control organization activities.

Financial Statement: A summary of a major aspect of an organization's financial status that is used as a financial control technique.

Inventory Control: A method of balancing the need to have sufficient raw materials, work-in-progress, and finished goods on hand to meet demand with the costs involved in carrying the inventory.

Investment Center: Organizational unit that not only measures the monetary value of inputs and outputs, but also compares outputs with assets used in producing them.

Leverage Ratio: Financial ratio measuring the firm's ability to generate revenues in excess of operating and other expenses.

Liquidity Ratios: Financial ratios that measure the degree to which an organization's current assets are adequate to pay its current liabilities.

Long-term Liabilities: Debts including mortgages, bonds and other debts that are being paid off gradually.

Profit Center: A responsibility center whose budgetary performance is measured by the difference between revenues and costs, in other words, profits.

Profitability Ratio: Financial ratio that measures the firm's ability to generate revenues in excess of operating and other expenses.

Quality Circle: Small group of operations employees who periodically brainstorm on how to increase the firm's output, improve quality, or improve the efficiency of the workplace.

Ratio Analysis: A performance evaluation technique that involves determining and evaluating financial ratios.

Responsibility Center: Any functional unit within an organization having one individual who is responsible for the activities of that unit.

10. Self-Assessment Test

- 1) Write a brief note on major control systems.
- 2) Explain financial control in detail.
- 3) Define responsibility center. Explain the types of responsibility types.

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- 4) Describe quality circles and total quality management.
- 5) Give a brief note about the inventory control and its significance in an organization.

11. Suggested Readings/Reference Material

- “Budgetary Control”
<<http://www.acca.co.uk/publications/studentaccountant/43925>>
- “Budgeting and Budgetary Control”
<<http://www.duncanwil.co.uk/budg.html>>

12. Model Answers

12.1 Model Answers to Check Your Progress Questions

Following are the model answers to the Check Your Progress questions given in the Unit.

1. (d) All the above

There are six major control systems financial control system, budgetary control system, quality control system, inventory control system, operations management and computer-based information systems enable managers to ensure that the actual performance of the organization is in tune with the planned performance. Financial control systems help managers monitor an organization's ability to meet its profit objectives. Inventory control systems help managers control the inventory in such a way that the inputs are available at the right time, at the right place and in the right quantity, thus minimizing the delivery and warehousing costs. Budgetary control systems provide quantitative tools that help managers compare the actual with the planned revenues and costs of various organizational activities.

2. (a) Budgetary control systems

Budgetary control systems are mostly used by middle-level and lower-level managers for planning and controlling activities. They help managers control the various activities of the organization by comparing the planned revenues and costs with the actual revenues and costs.

3. (a) Financial control system

Financial control systems evaluate performance at the end of a particular period (like quarterly, half-yearly or annually). They constitute feedback control systems operating at the end of the transformation process. The recommendations given by feedback control systems are used when planning for future.

4. (b) Inventory

Inventory control is another important control system adopted by organizations. It involves decisions regarding the amount of assets that should be held in inventory.

5. (d) Concurrent control systems

Feedforward control systems are implemented before the transformation process, concurrent control systems are implemented along with the transformation process, and feedback control systems are implemented at the end of the transformation process.

6. (b) Activity

An asset management ratio or activity ratio measures a company's effectiveness in managing its assets. A high activity ratio indicates improved profitability and a decrease in the need for investment in assets.

7. (a) Balance sheet

A balance sheet shows the financial condition of a business at a given point of time. In the balance sheet, the company is described in terms of its assets, liabilities and net worth.

8. (b) Activity ratio

A financial ratio which shows the ability of a firm to meet its short-term obligations by utilizing its current assets is known as the liquidity ratio. Acid test ratio, current ratio and working capital ratio are examples of liquidity ratios. Asset management ratios are also known as activity ratios and measure the effectiveness of an organization in managing its assets.

9. (a) Liquidity ratio

Liquidity ratios measure the degree to which an organization's current assets can cover its current liabilities. Acid test, working capital, receivables to payables, current ratios and tangible net worth are a few liquidity ratios.

10. (b) Activity ratios

Asset management or activity ratios measure the effectiveness of an organization in managing its assets. An activity ratio is a test of the relationship between the sales and various assets of a firm. Inventory turnover is one of the widely used activity ratios.

11. (c) Debt management ratios

Debt management ratios assess the degree to which an organization uses debt to finance investments and the extent of an organization's ability to meet its long-term obligations.

12. (b) Return on investment

Profitability ratios measure the operating efficiency of an organization in relation to sales and assets. Gross profit margin, net profit margin and return on investment are profitability ratios. ROI indicates management's ability to generate profits from its total investment in assets.

13. (b) High

A high inventory turnover ratio indicates the efficient management of inventory. It also indicates organization's ability to forecast its sales patterns and maintain only the required amount of inventory.

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14. (d) Leverage

Debt management ratios (also called as leverage ratios) determine the extent of debt used by a company to finance its investment and its ability to meet the long-term obligations that result from such a measure. A high leverage ratio indicates that creditors have a greater claim than the owners on the organization's assets.

15. (b) Revenue centers

A revenue center is a responsibility center whose performance is determined by its ability to generate a specified level of revenue. Sales and marketing are types of revenue centers. These departments are evaluated on the sales that they generate and the resources that they are allocated.

16. (d) All the above

The structure of an organization determines the selection of an organization's responsibility center. For example, organizations with a functional organization design and organizations with functional units in a matrix design may choose standard cost centers, discretionary expense centers and revenue centers. Such organizations may treat manufacturing units as standard cost centers; and human resources, research and development and finance as discretionary expense centers.

17. (d) Profit center

An organization with a divisional structure should have a profit center because the large divisions in these organizations generally have control over both the revenues and expenses associated with profits. However, the various departments operating under the divisions may choose other types of responsibility centers.

18. (c) Responsibility

A responsibility center is a sub-unit headed by a manager who is responsible for achieving one or more goals. Standard cost centers, discretionary expense centers, revenue centers, profit centers and investment centers are types of responsibility centers.

19. (b) Revenue center

Revenue centers cannot be held responsible for changes in profit levels because they are responsible only for revenues and have no control over the costs associated with the product or service. Revenue centers measure output in monetary terms, but do not compare them directly with input costs.

20. (a) Standard cost centers

A standard cost center is a responsibility center whose budgetary performance is determined on the basis of its ability to reach goals within the given standard cost constraints. These centers are also called „engineering expense centers" as standard costs are often determined by using engineering methods.

Unit 21

Productivity and Operations Management

Structure

1. Introduction
2. Objectives
3. Production and Productivity
4. Productivity Problems and Measurement
5. Operations Research, Production and Operations Management
6. Some Operations Research Techniques
7. Limitations of Operations Research
8. Summary
9. Glossary
10. Self-Assessment Test
11. Suggested Readings/ Reference Material
12. Model Answers

1. Introduction

In the previous unit, various control techniques were discussed. In this unit, the concepts of productivity and operations management will be discussed. Productivity is one of the major concerns of managers as it helps organizations survive in a competitive environment. Productivity is considered an essential element in the control process as it measures the efficiency and competitiveness of employees, or departments, or organizations.

Operations management is the process of designing, operating, and controlling a productive system, that is capable of transforming physical resources and human talent, into the needed goods and services.

This unit discusses the significance of productivity and the importance of operations management in improving productivity. The unit also explains some of the operations research techniques and limitations of operations research.

2. Objectives

By the end of this unit, students should be able to:

- Define production and productivity
- Identify the ways to measure productivity

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- Explain the concepts of operations research, production, and operations management
- Discuss operations research techniques
- List the limitations of operations research

3. Production and Productivity

Production is the process in which inputs such as men, materials, money, information, and energy are transformed into finished products or services. Productivity is a measure of the efficiency of an organization in terms of the ratio of the outputs to inputs. The higher the numerical value of this ratio, the greater the efficiency. Productivity measures the employees' (or teams' or departments') efficiency in using the organization's scarce resources to produce goods and services. Productivity is an important tool for managers because it helps them track progress in terms of the efficient use of resources in producing goods and services.

There are two types of productivity -- total productivity and partial productivity. Total productivity takes into account all the inputs involved in producing the output to measure efficiency, using the ratio of total output to total input, i.e., total output/total input. Partial productivity measures efficiency by considering the value of all outputs relative to a particular input by using the ratio -- total output / partial input. Total and partial productivities are expressed as follows:

$$\text{Total Productivity} = \frac{\text{Goods and services produced (output)}}{[\text{Labour} + \text{capital} + \text{energy} + \text{technology} + \text{materials}] (\text{inputs})}$$

$$\text{Partial productivity} = \frac{\text{Goods and services produced (output)}}{\text{Labour hours (input)}}$$

4. Productivity Problems and Measurement

Productivity is one of the major concerns of managers as it helps organizations survive in a competitive environment. The concern about productivity is seen all over the world.

As productivity measures the efficiency and competitiveness of employees or departments or organizations, it is considered an essential element in the control process. Although the need to improve productivity is felt in organizations, there is little consensus about the fundamental causes of low productivity and the ways in which they can be dealt with.

Productivity in organizations is believed to be affected by factors such as follows:

- Rapid changes in the technology that require employees to upgrade their skills constantly.

Productivity and Operations Management

- Organization's productivity suffers if social and legal obligations make it necessary for it to employ people without adequate skills.
- Workers often believe that their employers are exploiting them by increasing their workload from time to time on the pretext of improving productivity. Therefore, they resort to strikes thereby leading to loss of productivity.

Measurement of productivity of knowledge workers

It is easy to measure the productivity of quantifiable tasks but it is difficult to measure the productivity of tasks that cannot be measured in units. In fact, the productivity of skilled workers is difficult because of its dependence on many intangible and qualitative factors.

However, in order to improve planning and control at the organizational level, it is essential to quantify the work and keep track of the productivity of the organization.

The productivity of a knowledge worker is much more difficult to measure than that of industrial workers for the following reasons:

- The quality of a knowledge worker's output cannot be determined immediately.
- Often, the output of knowledge workers contributes only indirectly to the achievement of the end result, and is, therefore, difficult to measure.

5. Operations Research, Production & Operations Management

Operations Research is a discipline of applying advanced analytical methods to help make better decisions. It applies leading-edge analysis and can find the best among many choices in a reasonable period of time. Operations research can consider and balance multiple objectives and helps in measuring, controlling, and reducing risk.

Production management is a process of controlling and coordinating the activities involved in making a product. It converts the inputs into outputs by utilizing the physical resources. The term "Production Management" was used till the early 1970's, but the enlargement of the field, with the inclusion of purchasing, despatch and other allied activities, and the growing influence of the service sector, advocated the need for a more general title. As a result, "Production Management" was replaced by a more general term "Operations Management", which incorporated both production and service-related concepts and procedures.

Operations management is the process of designing, operating, and controlling a productive system, that is capable of transforming physical resources and human talent, into the needed goods and services. Operations managers take decisions regarding designing and implementation of operations strategies. These operations strategies indicate how organizations employ their production capabilities to achieve their corporate objectives.

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Production and Operations Management disciplines are together called as Production and Operations Management (POM), which refers to the transformation of production and operational inputs into outputs in order to meet the needs of the customer. Production and Operations management ensures that the organization manufactures the products in accordance with the organizational plan.

Operations Management and its Importance

Operations management is the application of concepts, procedures and technologies by managers to improve the process of transformation of resource inputs into outputs. The inputs may include manpower, technology, capital, equipment, and information. Operations management requires managers to plan, organize, control, and coordinate all the activities of the production system that convert the inputs into products or services that are of value to customers.

Importance of operations management

The effectiveness and efficiency of an organization depends on operations management. An organization provides economic utility of one kind or another. For example, Indian Airlines creates a service that provides time and place utilities. An organization needs to offer superior quality products and services at the lowest possible price and yet maintain its profitability to survive in the long run. This requires not just a well conceived corporate strategy, but carefully managed operations as well.

Operations management is a tool through which the management can create and improve the operations of the firm.

Operations Research for Planning, Controlling and Improving Productivity

Most of the special techniques employed in planning and controlling are based on mathematical models and the use of quantitative data. These techniques are especially useful in managing operations. Conceptual models and fairly exact quantitative data are available in many areas of production and operations management. The tools of operations research are of special interest to production and operations managers. According to the OR Society of America, "OR is an experimental and applied science devoted to observing, understanding and predicting the behavior of purposeful man-machine systems."

The factors that contributed greatly to the rapid growth of operations research were the development of advanced computing machines, and their ability to handle voluminous data with complex relationships.

The application of operations research techniques to the complex problems of an organization involves taking into account the total system that influences the decision-making process and presenting them in a quantified form, so that the best means of achieving the goals can be determined. In other words, operation research may be called "quantitative common sense."

Productivity and Operations Management

The essentials of operations research

Operations research gives managers a definite framework for solving their problems. OR requires a problem to be represented in a form that can be analyzed and solved mathematically. The goals and constraints in a given situation should be well defined. The management should ensure that the input data is collected carefully and is relevant and accurate. OR experts then evaluate data, establish and test hypotheses, determine the relationships among various variables, develop and verify predictions based on the hypotheses, and devise measures to evaluate the effectiveness of an action.

Some of the essential characteristics of operations research are as given below:

1. Operations research emphasizes the logical physical presentation of a problem in the form of a model.
2. It emphasizes the setting of goals while solving a problem and the development of effective measures to determine whether the solution arrived at will help achieve those goals.
3. Operations research incorporates in a model all the variables that are necessary to solve the problem.
4. It presents, in mathematical terms, the model, the variables, the constraints and the goals that need to be achieved to solve the problem.
5. To the extent possible, operations research quantifies the variables involved in a problem.

In the absence of accurate quantifiable data, operations research fills the gaps by using mathematical and statistical devices such as probability in a situation.

Operations research methodology

The methodology developed for solving business problems through operations research involves the following six steps:

1. Formulating the problem
2. Constructing a mathematical model
3. Deriving a solution from the model
4. Testing the model
5. Providing controls for the model and the solution
6. Putting the solution into effect.

Formulating the problem: The operations research team formulates the management problem and then converts it into an operations research problem in the first stage. Before the operations researcher can formulate the problem, the management has to help him understand the objectives and policies of the organization, its structure and functions, and the communication and control systems.

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Constructing a mathematical model: The problem should be represented in a mathematical model. The general form of an operations research model is

$$E=f(X_i, Y_i)$$

where 'f' represents a system of mathematical relationships between E (the measure of effectiveness of the system) and X_i (controllable variables) and Y_i (uncontrollable variables).

Deriving a solution from the model: The value of the decision variables is determined using two procedures for solving the problem once the mathematical model has been formulated. They are, analytical procedure, which uses the mathematical approach, and numerical procedure, which uses the trial and error method to obtain the optimum solution.

Testing the model: The models that are being used to solve the problem are tested using the past data to ensure their credibility.

Providing controls for the model and the solution: The models should be controlled to detect any deviations in the parameters and the relationships at the earliest and to take corrective action to check the deviations.

Putting the solution into effect: This is the most critical stage in OR, since benefits accrue to an organization only after the model is implemented. Various clarifications in procedures are required before the OR techniques even for a simple program of OR can be understood or used. Employees should also be educated about the application of OR techniques as a solution for complex problems.

Check Your Progress

1. The tool that helps managers track progress in terms of the efficient use of resources in producing goods and services is known as _____.
 - a. Innovation
 - b. Financial resources
 - c. Physical resources
 - d. Productivity
2. Which of the following refers to the total set of managerial activities employed by the organization to transform resource inputs into product outputs?
 - a. Strategic management
 - b. Operations management
 - c. Marketing management
 - d. Resource management
3. The analytical procedure and the numerical procedure are two methods for _____ in operational research methodology.

- a. Formulating the model
- b. Construction of a mathematical model
- c. Deriving a solution from a model
- d. Testing the model

6. Some Operations Research Techniques

There are various operations research techniques available to managers with regard to decision-making. Some of the popular ones are:

Linear Programming

Linear programming is a technique for selecting an optimum combination of factors from a series of inter-related alternatives, each subjected to certain limitations, in order to achieve a desired goal. Linear programming is the most successful OR technique. The basic assumption in this technique is that a linear relationship exists between the variables and that the limits of variation can be determined. The relationship between most of these variables can be expressed in the form of linear equations. A manager or a researcher may solve the linear equations and obtain the optimum solution in terms of machine utilization, cost, time, etc. This technique is widely applied in the fields of shipping and warehouse utilization.

The demerit of this system is that it depends on linear relationships for a solution to the problem.

Inventory Control

Inventory control can be defined as the scientific method of determining the accurate levels of stock that have to be maintained in order to meet production requirements. The objective of inventory control is to ensure that the right quantities of inventory are delivered to the various departments at the right time and also to deal with uncertainties in demand and supply. Various inventory control techniques are used for the maintenance of inventory at accurate levels. They are:

Significance of inventory

Inventory serves different purposes in an organization. Maintaining sufficient inventory helps an organization deal with uncertainties in supply and demand, make economical purchase of materials by procuring the required material in large amounts to obtain quantitative discounts, and handle anticipated changes in demand or supply such as seasonal fluctuations or an expected shortage.

Costs of inventory

An organization incurs several costs in maintaining inventory, such as item cost, ordering cost, carrying or holding cost, and stock-out cost. Item cost is the price of an inventory item itself. The ordering cost is the expenditure made in placing an order. The expense associated with keeping an inventory item in the

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shelf/warehouse is called holding or carrying cost. For example, the rent paid for storage space, insurance, breakage and pilferage are holding costs. Finally, the cost of not having the stock of the product requested by the customer is called stock-out cost. For example, loss of sale and loss of customer goodwill are stock-out costs.

Economic order quantity

Costs such as the cost of capital, storage space, obsolescence, and the like, increase when the inventory level increases. Other costs such as ordering costs, missed sales and production control decrease with an increase in inventory. EOQ is expressed as $Q_e = 2DO/H$ where Q_e = economic order quantity (EOQ), D = annual demand, O = ordering costs, H = inventory holding costs per item, per year. The economic order quantity (EOQ) is an inventory control method developed to minimize ordering and holding costs, while avoiding stockout costs.

EOQ is helpful for determining desirable inventory levels when demand is predictable and fairly constant throughout the year (that is, there are no seasonal fluctuations). EOQ helps managers to decide how much to order; but they also need to know the reorder point (ROP). Reorder point may be defined as the inventory level at which a new order is placed. In order to calculate the reorder point, lead-time has to be calculated. Lead-time (L) is the time gap between placing an order and receiving it. It can be calculated as follows:

$ROP = LD/365$ where, ROP = Reorder point, L = Lead-time, D = Annual demand, 365 = Number of days in a year.

Inventory control systems deal with the replenishment of cycle stocks. Cycle stocks are the amount of inventory that are to be used during a given period of time (cycle) as specified by a particular system. However, as demand and supply cannot be predicted accurately, organizations often add some slack to the estimates in the form of fluctuation. Thus organizations tend to store some surplus stock in inventory, which is referred to as safety stock.

The EOQ approach may not be useful for determining inventory levels of parts and materials used in some production processes. For example, poor quality products may be returned to the manufacturer, either for replacement or for rectification. Sending back of material to the manufacturer thus increases the demand for production inputs. The demand created is only an intermittent demand. However, since EOQ is not useful in determining the inventory levels of parts and materials used in production processes, the decisions based on EOQ could lead to shortage or excess of inventory. Organizations determining inventory levels in such situations have found that inventory control methods such as just-in-time system and materials requirement planning (MRP) system work better than EOQ.

Check Your Progress

4. Which of the following is widely applied in the areas of shipping and warehouse utilization to determine cost-effective shipping rates and routes?
 - a. Probability
 - b. Dynamic programming
 - c. Linear programming
 - d. Game theory
5. Which of the following refers to the amount of inventory to be used during a particular period of time as specified by a particular system?
 - a. Reorder stock
 - b. Safety stock
 - c. Stockout
 - d. Cycle stock
6. Which of the following terms refer to the time gap between placing and receiving an order?
 - a. Reorder time
 - b. Lead time
 - c. Real time
 - d. Just-in-time
7. Loss of sale and customer goodwill is an example for _____.
 - a. Item cost
 - b. Holding cost
 - c. Ordering cost
 - d. Stockout cost
8. Which of the following costs do not decrease with an increase in inventory?
 - a. Insurance
 - b. Ordering costs
 - c. Missed sales
 - d. Production control
9. The inventory level at which a new order has to be placed is known as the _____.
 - a. Reorder point
 - b. Reorder level
 - c. Reorder time
 - d. Reorder unit

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10. Surplus stock in inventory is also referred to as _____.
- a. Reorder stock
 - b. Stockout
 - c. Safety stock
 - d. Economic stock
-

Just-in-time inventory system

Just-in-time (JIT) inventory control approach stipulates that materials should arrive just as they are needed, in the production process. The JIT philosophy focuses on having the right part at the right place at the right time, so that there is no need to hold backup parts in inventory. Just-in-time inventory is also referred to as “zero inventory” and “stockless production.”

The JIT inventory system emphasizes the utilization of the full capabilities of workers, giving them greater responsibilities in the production process, and inviting their active participation in efforts to obtain continual improvement in the production process.

Just-in-time management philosophy is aimed at improving profits and return on investment by involving workers in the operations process and eliminating waste through cost reduction, inventory reduction and quality improvement.

Kanban

Kanban, a Japanese term by origin (*Kan* – card and *ban* – signal), is a subsystem of the JIT approach. It involves the use of cards and containers to move parts and components from one work area to another. When an empty container is sent to a workstation, it indicates that more parts will be needed shortly. The workstations along the production process produce just enough parts or products to fill the given containers. Once these containers are full, production is stopped. It is only when a card and an empty container arrive from the next workstation that the production starts again. If the process at any workstation stops due to quality problems or a machine breakdown, all the workstations involved in the process produce only until their containers are full and then they stop further production.

Kanban helps avoid flooding the production floor with inventory resulting in improved inventory control.

Distribution logistics

Distribution logistics aims at optimizing the total costs of carrying out the operations, while at the same time, maintaining the quality and customer service. It is easy to reduce the total costs of the material management system as a whole than to reduce it in each and every single function or task. In order to optimize costs, information should be gathered on various areas and analyzed.

Productivity and Operations Management

Activity: Sonu is the owner of Drakes Inn, a bakery where all types of fast food items are sold. There is a good demand for some of the items and they are sold out on the same day that they are made. However, Sonu faces a dilemma. If he maintains a large stock of the items, he finds that a lot of stuff goes waste on days that he is not able to sell the whole stock. But if he stocks less, with an eye on curbing wastage, he finds that he runs out of stock, and so loses the opportunity to sell more. Which OR techniques will be appropriate for Sonu to cope with the uncertainties in demand and also to maintain the right quantity of stock?

Answer:

Time-event Networks

Time-event networks are helpful in planning and controlling the tasks and activities of a project. The program evaluation and review technique (PERT) and the critical path method (CPM) (CPM – it is used to find the minimum time and cost required to complete a project) are examples of popular time-event networks. The improved versions of PERT like PERT/COST are widely used in planning and controlling operations. PERT/COST technique helps in finding out the point to which the project duration could be crashed (reduced) without incurring additional cost.

Value Engineering

Value engineering is a process where the operations of a product or service are analyzed, value of each operation is determined, and the operation is modified or improved to reduce costs. This process is common in engineering organizations. The steps involved in value engineering include:

- Dividing the product into parts and operations.
- Identifying the costs for each part and operation.
- Identifying each part's relative contribution value to the final unit or product.
- Finding a new approach for the items of high cost and low value.

Work Simplification

Work simplification is a process where the work or task is simplified to improve the productivity of workers. It involves educating employees about the concepts and principles of techniques such as time and motion studies, layout of work situations, and workflow analysis.

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Check Your Progress

11. _____ is an approach to inventory control which stipulates that materials should arrive in the production process just as they are needed.
 - a. Linear programming
 - b. Economic order quantity
 - c. Just-in-time inventory management
 - d. Kanban
12. Kanban is a subsystem of the _____ approach.
 - a. Economic order quantity
 - b. Materials requirement planning
 - c. Just-in time
 - d. Linear programming
13. _____ refers to the price of an inventory item.
 - a. Ordering cost
 - b. Item cost
 - c. Carrying cost
 - d. Stock-out cost
14. Which of the following costs does not increase when the inventory level increases?
 - a. Cost of capital
 - b. Storage space
 - c. Ordering costs
 - d. Obsolescence
15. The _____ technique for improving productivity involves analyzing the operations of the product or service, estimating the value of each operation, and modifying or improving that operation so that the cost of production can be lowered.
 - a. Value engineering
 - b. Time-event network
 - c. Work simplification
 - d. Quality circles
16. Which of the following methods helps managers find out the minimum time and cost required to complete a project?
 - a. Program evaluation and review technique (PERT)
 - b. Critical path method (CPM)
 - c. Just-in-time (JIT)
 - d. Computer aided design (CAD)

Productivity and Operations Management

17. Which of the following techniques is an advanced version of the program evaluation and review technique (PERT), and is widely used in planning and controlling operations?
- a. PERT/PRICE b. PERT/VALUE
 - c. PERT/COST
 - d. PERT/TQM

Example: Value Engineering Technique

Maruti engineers achieved cost reduction in the purchase of components by working closely with the component suppliers. The other factor that helped in reducing costs was the increase in the localization levels for components. The company also increased the productivity in in-house manufacturing and at vendors' facilities.

Maruti and the component suppliers both succeeded in value analyses and value engineering efforts. This resulted in reducing the cost of production of the component and at the same time, in retaining its functional utility. The company's efforts resulted in a drop in its expenditure on consumption by Rs 79.7 crore during 2001-02.

Source: "Maruti's after-tax profit at Rs 146.4 crore; PBT up 138.4%," 21 May 2003 <domain-b.com>

7. Limitations of Operations Research

Operations research has certain limitations which cannot be overlooked. These limitations are related to the time and money factors involved in its application rather than its practical utility. Some of these limitations are discussed below:

Magnitude of Computation

The sheer magnitude of the mathematical and computing aspects pushes up the cost of OR. OR tries to arrive at the optimal solution taking all relevant factors into account. But these factors or variables are numerous and expressing complex human relationships and reactions requires huge calculations. These calculations call for the use of a higher order of mathematics which may not be understood by the average person or manager with a non-mathematical background. Thus all organizations cannot afford to adopt OR practices; in most cases, only large organizations that have strong finances use OR.

Gap between Managers and Operations Research

Since OR is a specialist's job, it is handled by a mathematician or a statistician, who may lack an understanding of managerial problems. Similarly, the manager lacks knowledge and appreciation of mathematics and fails to understand the logic used by the OR specialist. Many organizations try to get managers and

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operations researchers to work as a team to fill the gap. But, the inability to understand and appreciate each other's opinions still remains a major limitation.

Lack of Quantification and Involvement of Qualitative Factors

OR provides solutions only when all the elements related to a problem can be quantified. By using probabilities and approximations, unknown quantities can be substituted. Though OR specialists can use various scientific methods and assign values to factors that have never been measured before, a major portion of important managerial decisions still involve qualitative factors. Since the qualitative factors cannot be quantified, operations research will continue to be based on non-quantitative judgment and will have limited application.

8. Summary

- An organization can increase its profitability by producing a higher output with the same or lower level of output, thereby strengthening its competitive position in the industry. Production is the process in which inputs such as men, materials, money, information, and energy are transformed into finished products or services. Productivity is a measure of how efficiently an organization uses the available resources. There are two types of productivity -- total productivity and partial productivity.
- Productivity is considered an essential element in the control process as it measures the efficiency and competitiveness of employees, or departments, or organizations.
- Operations management is the process of designing, operating, and controlling a productive system, that is capable of transforming physical resources and human talent, into the needed goods and services. Operations Research is a discipline of applying advanced analytical methods to help make better decisions.
- Managers use certain tools and techniques to manage operations efficiently. These, in turn, result in improved productivity. They include linear programming, inventory control, distribution logistics, time-event networks, value engineering, and work simplification.
- Operations research has certain limitations which cannot be overlooked. Some of these limitations include magnitude of computation, gap between managers and operations research, and lack of quantification and involvement of qualitative factors.

9. Glossary

Cycle Stock: Amount of inventory expected to be used during a particular cycle.

Economic Order Quantity (EOQ): An inventory control method developed to minimize ordering plus holding costs, while avoiding stock out costs.

Productivity and Operations Management

Just-in-time (JIT) Inventory Control: An approach to inventory control that emphasizes having materials arrive just as they are needed in the production process.

Kanban: A subsystem of the JIT approach involving a simple parts-movement system that depends on cards and containers to pull parts from one work center to another.

Productivity: An efficiency concept that gauges the ratio of outputs relative to inputs into a productive process.

Program Evaluation and Review Techniques (PERT): A network planning method for managing large projects.

10. Self-Assessment Test

- 1) Define production and productivity. Explain the basic types of productivity.
- 2) Describe the factors that affect productivity in organizations.
- 3) The productivity of a knowledge worker is much more difficult to measure than that of industrial workers. Give reasons.
- 4) Define operations management and explain its significance.
- 5) Describe the various steps in the operations research methodology.
- 6) Describe the various techniques of operations research.
- 7) Briefly explain the limitations of operations research.

11. Suggested Readings/ Reference Material

- “Operations Management”
<http://www.mapnp.org/library/ops_mgnt/ops_mgnt.htm>
- “Operations Research”
<http://pespmc1.vub.ac.be/ASC/OPERAT_RESEA.html>
- “Total Quality Management (TQM) Tutorial/Help Page”
<<http://home.att.net/~iso9k1/tqm/tqm.html>>

12. Model Answers

12.1 Model Answers to Check Your Progress Questions

Following are the model answers to the Check Your Progress questions given in the Unit.

1. (d) Productivity

Efficiency and effectiveness in an organization will lead to an increase in productivity. Productivity can be improved by increasing the level of output, with inputs remaining constant; by decreasing the inputs and achieving the same level of output; and by reducing inputs and increasing the level of output.

Controlling

2. (b) Operations management

Operations management requires managers to plan, organize, control and coordinate all the activities of the production system that convert the inputs into products or services that are of value to customers.

3. (c) Deriving a solution from a model

In the operations research method the problem is formulated, then a mathematical model is constructed, and finally, a solution is derived through analytical or numerical procedures. The analytical procedure uses a mathematical approach to solve the problem, while the numerical approach uses a trial and error method to arrive at an optimum solution.

4. (c) Linear programming

Linear programming technique is widely applied in the areas of shipping and warehouse utilization where it helps determine cost-effective shipping rates and routes, and facilitates optimum utilization of production and warehouse facilities.

5. (d) Cycle stock

Cycle stocks are the amount of inventory that is to be used during a given period of time (cycle) as specified by a particular system. Inventory control systems deal with the replenishment of cycle stocks.

6. (b) Lead time

In order to determine the reorder point, the lead time has to be calculated.
 $ROP = LD/365$

Where 'L' is the lead time and 'D' is the annual demand.

7. (d) Stockout cost

The unavailability of a particular item needed by a customer is called stockout cost. This may result in loss of sale and thus lead to erosion of customer goodwill.

8. (a) Insurance

When calculating the economic order quantity, the insurance amount increases with an increase in the inventory level (because more items have to be insured).

9. (a) Reorder point

The reorder point helps managers find out when they should place a new order. The reorder point can be calculated using the following formula;

$$ROP = LD/365$$

Productivity and Operations Management

Where ROP is the reorder point, L is the lead time (gap between placing and receiving an order), D is the annual demand, and 365 is the number of days in a year.

10. (c) Safety stock

Organizations maintain additional inventory as safety or surplus stock to deal with unforeseen situations like reorder delays, quality problems and stockouts.

11. (c) Just-in-time inventory management

The JIT philosophy focuses on having the right part at the right place at the right time, so that there is no need to hold backup parts in inventory.

12. (c) Just-in-time

Kanban is a subsystem of the JIT approach involving a simple parts-movement system that depends on cards and containers to pull parts from one work center to another. Both Kanban and just-in-time aim at reducing the inventory level at the production floor.

13. (b) Item cost

When holding inventory, an organization has to bear certain costs like item cost, ordering cost, etc. Item cost is the price of an inventory item itself.

14. (c) Ordering costs

Ordering costs are the costs incurred for placing an order (for example, postage, documentation, etc.). These costs decrease with an increase in the inventory level as the number of units ordered increases and cost per unit decreases.

15. (a) Value engineering

Generally, value engineering is used in engineering organizations. The employees, and sometimes the customers are invited to make suggestions for improving the products.

16. (b) Critical path method (CPM)

CPM is used to find out the minimum time and cost required to complete a project. CPM is an example of time-event networks and is used for planning and controlling the activities of a project.

17. (c) PERT/COST

The PERT/COST technique is a time-event network used for finding out the point to which the duration of a project can be reduced without incurring additional costs.

Unit 22

Management Information Systems

Structure

1. Introduction
2. Objectives
3. Management Information
4. Components of an Information System
5. Types of Information Systems
6. Management Information Systems
7. Summary
8. Glossary
9. Self-Assessment Test
10. Suggested Readings/Reference Material
11. Model Answers

1. Introduction

In the previous unit, productivity and operations management were discussed. In this unit, management information systems will be discussed. An information system is a set of interrelated components working together to provide useful information as needed by problem solvers and decision makers. The five components of an information system are: hardware, software, people, data, and procedures.

A management information system (MIS) may be defined as a complex interaction among people, computer and communication technologies, and procedures designed to quickly provide relevant data or information, collected from both internal and external organizational sources, for organizational use. MIS is designed to acquire, store, and convert data into timely, relevant information to help managers carry out the planning, control, and operational functions of organizations.

This unit discusses the concept of MIS, significance of information systems and its components. The unit also explains the types of information systems.

2. Objectives

By the end of this unit, students should be able to:

- Define management information
- List the basic components of an information system
- Classify the types of information systems
- Explain management information systems

3. Management Information

Information is a major resource for managers. Problems arise in many organizations due to a gap between the actual and the desired state. This gap can be bridged with the help of information -- by identifying the gap and finding ways to overcome it.

Meaning of Information

Information is based on data, which refers to unanalyzed and unorganized facts and figures. It can be described as data that has been processed into a meaningful form, which is useful for decision-making.

Attributes of Information

For information to be useful to managers, it must possess the attributes-- of accuracy, timeliness, relevance, and completeness.

Information Needs of Managers

Managers need information to perform their managerial activities. Information that is created within an organization is known as internal information. This type of information is essential for managing day-to-day operations. Some examples of internal information are daily receipts and expenditures, quantity of an item in hand or in inventory, cost and selling price of the item, and salespeople's quotas. Information created outside the organization is known as external information. External information is useful to top-level managers for planning and controlling processes. Some examples of external information are demand for new products or services, information describing customer satisfaction with products and services, information describing change in policies of suppliers, knowledge of promotional campaigns, price changes, or products planned by competing firms, and details of changes in government regulations.

Check Your Progress

1. _____ refers to unanalyzed and unorganized facts and figures describing entities.
 - a. Information
 - b. Intelligence
 - c. Data
 - d. Systems
2. Which of the following is not an attribute of information?
 - a. Accuracy b. Timeliness
 - c. Completeness
 - d. Irrelevance

Controlling

3. Which of the following is not an example of internal information?
 - a. Daily receipts
 - b. Quantity of an item in inventory
 - c. Cost price of an item
 - d. Demand for new products
4. External information is more useful for _____ managers.
 - a. Top-level
 - b. Middle-level
 - c. Lower-level
 - d. Link-level

4. Components of an Information System

An information system can be defined as an organized collection of data, equipment, procedures, and people involved in the collection, storage, and processing of data to produce the information required for the management of an organization. Collecting, organizing, and distribution of information are some of the functions of information systems. There are five key components of an information system – hardware, software, people, data, and procedures.

Hardware

Information system hardware refers to the equipment in the system that is used to input, store, and retrieve data. Input devices allow data to be entered in machine-readable form into the Central Processing Unit (CPU), the main memory and processing section of a computer. Input devices include keyboards, bar-code readers, optical scanners and digital voice transmission synthesizers. Output devices allow a computer to produce information in a form that is useful to the users. These devices include printers, visual display monitors or terminals, and graphic plotters. Storage devices allow information to be stored and retrieved when needed. Floppy discs, magnetic discs and laser-generated compact discs are some examples of storage devices.

Software

Information systems software is the means by which the system hardware and the total information system is controlled. Software can be defined as a set of programs, documents, procedures, and routines related to the operations of a computer system. Software programs are useful to instruct the hardware to read inputs, store data, retrieve data, transform data into usable formats, and print system outputs.

People

People are an essential component of the information system -- the system cannot function without them. People should possess various skills to operate the information systems. Data-entry people are required to feed input data into the system and extract the required information from it. Data processing managers

Management Information Systems

are required to direct the overall use of the system, the transmission of information to users, and the preparation of reports. Systems analysts are responsible for configuring the hardware and software in the overall system. They analyze the functioning of the existing systems and design the architecture for the new system. Programmers develop the software according to the specifications of the systems analyst. End users work on the system to obtain the information required for problem solving or decision-making.

Data

The information system is based on data, which is a collection of unorganized facts and figures. Specialists like data administrators or data managers are responsible for checking the accuracy of the data. They provide guidelines to employees regarding data collection, storage, and retrieval to maintain accuracy and update the data.

Procedures

Information system procedures enable managers to ensure that the information generated is complete, timely, and of high quality. Some of the essential system procedures include:

1. *Data entry and validation* specifies the way data should be calculated and verified for accuracy and completeness.
2. *Data management* minimizes data redundancy and ensures the uniformity of data for all users.
3. *Security and integrity* ensures that the data will be protected from loss or destruction and that only authorized individuals will be allowed to access the system.

The lack of adequate procedures can have a negative affect on the value of an information system to an organization.

Check Your Progress

5. Which of the following is not an output device?
 - a. Printers
 - b. Visual display monitors
 - c. Graphic plotters
 - d. Optical scanners
6. 'Company S' wants to configure the hardware and software in its existing system and also wishes to design the architecture for a new system. Whom should 'Company S' employ to carry out this task?
 - a. Data-entry operators
 - b. Data processing managers
 - c. Programmers
 - d. System analysts

Controlling

7. _____ provide guidance to employees regarding data collection, storage and retrieval so that the data in the system is accurate and up-to-date.
 - a. Programmers
 - b. Data administrators
 - c. Data entry operators
 - d. End users
8. Which of the following procedures ensures the availability of accurate and complete data for the organization?
 - a. Data management
 - b. Security
 - c. Integrity
 - d. Data entry and validation
9. 'Company S' recently developed a new software. It wants to restrict access to the software to authorized individuals in the organization. Which of the following procedures will help the company restrict access to the new software?
 - a. Data management
 - b. Security and integrity
 - c. Data entry validation
 - d. Data uniformity
10. _____ are responsible for directing the overall use of a system.
 - a. Data-entry operators
 - b. Data-processing managers
 - c. Programmers
 - d. End users
11. Which of the following minimizes data redundancy and ensures the uniformity of data for all users?
 - a. Data management
 - b. Security
 - c. Integrity
 - d. Data entry and validation

5. Types of Information Systems

There are five types of information systems. They are transaction processing systems, office automation systems, decision support systems, executive support systems, and management information systems.

Activity: Mitra Infotech Ltd., has brought in substantial changes after the firm was restructured. The CEO of the company, Raghav, asked the head of the management information system (MIS), Prahalad, to ensure that the key components of the information system functioned effectively so that decision-making too could be effective. What are the key components of the information system that Raghav is talking about? Discuss them in detail.

Answer:

Transaction Processing Systems

A transaction processing system (TPS) is a computer-based information system that executes and records the routine, daily transactions that take place in an organization. These transactions are essential for the conduct of the organization's business. This type is mostly used in highly structured and repetitive situations. A TPS assists in the operations of an organization by storing transaction data, sorting, sequencing, arranging, or updating transaction records, merging the contents of two or more files, performing calculations on file data, sorting data, and listing data for use by employees.

Office Automation Systems

An office automation system (OAS) is a computer-based information system that allows communication across various departments in an organization and increases employee productivity through automation of document and message processing.

OAS may also include the following applications:

Electronic Calendaring: This allows users to maintain a schedule of appointments electronically.

Voice Mail: This allows the recording and storing of telephone messages in a computer's memory to enable the intended receiver to retrieve it later.

Groupware: This refers to software designed to facilitate meetings. Groupware coordinates simultaneous computer messages from group members.

Teleconferencing: Teleconferencing allows individuals at two or more geographically separated locations to not only have oral communication but also view each other's image on the screen provided for the purpose.

Facsimile transmission: This refers to the transmission of documents through a device attached to a telephone. The documents are received in printed form at the receiving location.

Controlling

Graphics: This application facilitates the conversion of data into digital images.

Decision Support Systems

The decision support system (DSS) is an interactive computer system that provides managers with information that is used in decision-making. DSS provides data in the form of tables and charts that simplifies the process of analyzing the information. It uses the information generated by office automation and transaction processing systems to arrive at complex decisions.

A typical DSS is characterized by the following elements:

- i. an MIS that supports several methodologies for accessing and summarizing data
- ii. a sophisticated database that allows information to be accessed in various ways
- iii. a user-friendly interface that allows users to use simple commands instead of technical computer language to communicate with the DSS
- iv. a database that contains information from external and internal sources so that managers can relate internal events to external forces
- v. rapid response time, which makes the DSS an easy and rewarding system to use.

Executive Support Systems

An executive support system (ESS) is a computer-based information system that is helpful in decision-making at the top levels of an organization. Executive support systems are considered effective because they offer more computing capabilities, better telecommunications, and display options. Some of the other benefits of ESS are that it makes less use of analytical models, delivers information from a number of sources, and allows an interaction to solve the general queries. Market intelligence, investment intelligence, and technology intelligence are the essential elements that should be provided by an effective ESS. ESSs are more effective when they are tailored to suit individual work patterns and the needs of executives working in particular situations.

Check Your Progress

12. A/An _____ is a computer-based information system that aims at facilitating communication and increasing the efficiency and productivity of managers and office workers through document and message processing.
- a. Executive support system
 - b. Management information system
 - c. Decision support system
 - d. Office automation system

Management Information Systems

13. Which of the following is not a type of information system?
 - a. Transaction processing system
 - b. Decision support system
 - c. Cybernetic control system
 - d. Management information system
14. Which of the following computer based information systems provides market intelligence, investment intelligence, and technology intelligence?
 - a. Decision support system (DSS)
 - b. Executive support system (ESS)
 - c. Management intelligence system (MIS)
 - d. Office automation systems (OAS)
15. Which of the following is not an application of office automation systems?
 - a. Electronic calendaring
 - b. Photocopying
 - c. Teleconferencing
 - d. Groupware

6. Management Information Systems

Management information systems can be defined as a complex interaction among people, computer and communication technologies, and procedures designed to quickly provide relevant data or information, collected from both internal and external organizational resources for organizational use. MIS is designed to acquire, store, and convert data into timely, relevant information to help managers carry out the planning, control, and operational functions of organizations. It provides routine reports for managers and supervisors and reports on costs, quality, and supplier activities for lower and middle level managers.

MIS is based on four key components – data gathering, data entry, data transformation, and information utilization.

Example: MIS application for Indian Railways

The electrical MIS application developed for the Indian Railways was inaugurated at CST, Mumbai. The MIS application consists of modules such as locomotive maintenance and management, EMU maintenance and management, asset management, energy management, budgeting, and headquarter activities. These were successfully implemented by Cirrius Software India, a Mumbai-based software development firm, at the pilot site in Mumbai. The key benefits of this application are integration of information, security, reduced paperwork, and timely and accurate reports.

*Source: "Cirrius launches software project for railways", 2 October 2002
<domain-b.com>*

Controlling

Evolution of MIS

The concept of MIS has been known for years. Organizations have noticed the importance of computers in processing large amounts of data with speed and accuracy. Electronic data processing (EDP) was developed to help organizations process and analyze large amounts of data. It refers to the use of electronic equipment to process the data. EDP's significance is especially felt in the processing of repetitive data with accuracy, thus eliminating performance degradation. Its primary function is record keeping, which forms the basis for MIS. Many EDP departments were under the control of accounting departments. A natural extension of such accounting applications was payroll and inventory control. Over time, many specialized mechanical and electromechanical accessories for computers were also developed for data processing, the chief among them being card readers, card sorters, etc.

In the seventies, with the digital computers undergoing a rapid change with the introduction of time sharing and interactive computing, the focus was no longer on processing of data alone; it was more on the analysis of corporate data. While timeliness and accuracy were important, relevance, analysis, and insight became key words. The emphasis shifted from the speedy and efficient processing of data to the *effectiveness* of the analysis of the data. Such a shift in emphasis was first conveyed through the term MIS.

Computers and MIS

MIS uses computers for its operations. MIS and computers are two different disciplines and there are significant differences between them. These differences are discussed below:

- Computer systems provide only the *technology* (or automation) component, while successful information systems call for an understanding of organizational dynamics, processes as well as control systems in the organization.
- Information systems are *specific* to an organization or managerial context. Computing systems, however, are far more *generic* and they address problems beyond the managerial context.
- Information systems call for a very high level of *conceptual* understanding of the organization. Computer systems, however, focus on deriving logical solutions and require in-depth knowledge of programming.
- Information systems being an *applied area* call for problem solving skills, an ability to make quick and sensible assumptions to solve specific problems in a time-bound manner, often working under time and budget constraints. Computer systems, however, being a *relatively pure area*, call for a strong theoretical foundation in mathematics and engineering to solve general problems.

Management Information Systems

- The tools of information systems are generally context specific. Many of the successful tools in the present business environment may not be successful in a different environment. The tools of computer systems, like database theory, are far more context independent. A change in technology only modifies them, it does not change them completely.

Advantages of MIS

MIS is designed to deal with tactical and operational issues. It summarizes information from transaction processing systems to produce routine reports for managers and supervisors. It also provides information to capacity planners about the capacity changes that would have to be made in the short-term and long-term. In addition, it produces reports about costs, quality, and supplier activities for lower and middle-level managers. An advanced MIS offers the user organization a wide range of services that can be used by all levels and applied to all functional areas. It also provides external information for top management, tactical information for middle management, and internal information for first-line operations control.

MIS is management oriented and is developed to increase the efficiency of an organization by easing the decision making process. It ensures timely availability of information to the top management at the time of decision making. MIS being an integrated system (collection of subsystems) eliminates redundancy. It provides flexibility in easy modification of data according to the requirements of an organization.

Difference between MIS and DSS

MIS and DSS differ in carrying out the control function. The differences between MIS and DSS are discussed below:

Difference between MIS and DSS

MIS	DSS
Management Information System (MIS) facilitates day to day operations in an organization. MIS makes use of computer-based systems for converting data into information	Decision Support Systems (DSS) are information systems that help the managers in decision-making. DSS are developed using analytical models, specialized databases, and the knowledge and experience of decision makers
The planning, control and operational functions of an organization are supported by an MIS	A DSS supports decision making by solving semi-structured business problems
MIS provides managers with information and support for effective decision making and provides feedback on daily operations.	DSS is an interactive computer based information system, which helps decision makers utilize data and models to solve unstructured problems

Controlling

MIS uses simple analytical tools and reports summaries of transactions taking place from a plan and produces scheduled, demand and exception reports	DSS uses sophisticated tools for analysis and provides reports to managers useful in decision making
MIS uses internal data stored in the computer system	DSS uses data from internal and external data stored on mainframe systems and networks

Compiled from various sources.

Check Your Progress

16. Which of the following facilitates the conversion of data into digital images?
 - a. Groupware
 - b. Facsimile transmission
 - c. Graphics
 - d. Voice mail
17. Which of the following information systems is designed to acquire, store and convert data into timely, relevant information to help management carry out the planning, control and operational activities of the organization?
 - a. Office automation system
 - b. Executive support system
 - c. Decision support system
 - d. Management information system
18. Which of the following is not a major component of management information systems (MIS)?
 - a. Data gathering
 - b. Information utilization
 - c. Risk analysis
 - d. Data transformation

7. Summary

- Information is the key element in the planning and controlling process and is regarded as a significant organizational resource by managers. Information can be described as data that has been processed into a meaningful form, useful for decision-making.
- An information system can be defined as an organized collection of data, equipment, procedures, and people involved in the collection, storage, and processing of data to produce information required for the management of an organization. Collecting, organizing, and distributing information are some of the functions of information systems.

Management Information Systems

- There are five key components of an information system -- hardware, software, people, data, and procedures.
- There are five types of information systems. They are: transaction processing systems, office automation systems, decision support systems, executive support systems, and management information systems.
- Management information systems can be defined as a complex interaction among people, computer and communication technologies, and procedures designed to quickly provide relevant data or information, collected from both internal and external organizational resources for organizational use.

8. Glossary

Data: Unanalyzed facts and figures.

Electronic Data Processing (EDP): The transformation of data into meaningful information through electronic means.

Hardware: Physical computer equipment, including the computer itself and related devices.

Information System: A set of procedures designed to collect (or retrieve), process, store, and disseminate information to support planning, decision-making, coordination and control.

Information: Data that has been analyzed or processed in a form that is meaningful.

Management Information System (MIS): A computer-based information system that is designed to quickly produce relevant data or information needed by managers mainly at the middle and first-line levels.

Office Automation System (OAS): Computer-based information system used to make office workers more productive at their work.

Telecommunications: A system or process in which information or data are sent over some type of transmission medium.

Transaction Processing System (TPS): A computer-based information system that executes and records the routine day-to-day transactions required to conduct an organization's business.

9. Self-Assessment Test

- 1) Explain the concept of management information.
- 2) Discuss the components of an information system.
- 3) Explain the various components of an information system.
- 4) Define the management information system (MIS). Give a brief description of its evolution.

Controlling

10. Suggested Readings/Reference Material

- “Components of an Information System”
<<http://www.blurtit.com/q594022.html>>
- “Decision Support System”
<<http://dssresources.com/history/dsshhistory.html>>
- “Information System”
<<http://www.geocities.com/rehanaq/bachelor/informationssystem.htm>>
- “Types of Information Systems”
<<http://www.ii.metu.edu.tr/~ion501/demo/21.html>>
- “Management Information Systems” <http://www.fact-index.com/m/ma/management_information_systems.html>
- “The Continuing Evolution of Distributed Systems Management”
<http://www.dmtf.org/zdata/e86-d_11_2256.pdf>
- “A Brief History of Decision Support Systems”
<<http://dssresources.com/history/dsshhistory.html>>

11. Model Answers

11.1 Model Answers to Check Your Progress Questions

Following are the model answers to the Check Your Progress questions given in the Unit.

1. (c) Data

All information is based on data, but not all data forms the basis of useful information.

2. (d) Irrelevance

Data that has been processed into a form that helps managers take decisions is known as information. The important attributes of data are accuracy, timeliness, completeness and relevance.

3. (d) Demand for new products

Internal information is necessary for managing day-to-day operations. Daily receipts and expenditures, cost and selling price of an item, salespeople’s quotas, and quantity of an item in hand or in inventory are examples of internal information. Demand for new products is an example of external information.

4. (a) Top-level

Information that originates outside the organization is known as external information. Top-level managers make important strategic decisions on the basis of this information.

5. (d) Optical scanners

Output devices help users by providing information in a useful form. Printers, visual display monitors and graphic plotters are output devices. Optical scanners are input devices.

Management Information Systems

6. (d) System analysts

System analysts analyze the functioning of present systems and configuring the hardware and software in the overall system. They are also responsible for designing the architecture for a new system.

7. (b) Data administrators

In order to provide up-to-date information to the organization, data administrators provide guidelines to employees regarding data collection and the maintenance of accurate data.

8. (d) Data entry and validation

Data entry and validation ensures the availability of complete and accurate data. Incomplete and inaccurate data is of no use to the management or to the organization.

9. (b) Security and integrity

Security and integrity allow an organization to protect data against loss or destruction by restricting access to authorized individuals. It also limits the actions of individuals regarding the entry, retrieval or modification of data in the system.

10. (b) Data-processing managers

Data processing managers are responsible for directing the overall use of the system, for ensuring the transmission of information to users, and for supervising the preparation of reports.

11. (a) Data management

Data management ensures access across a variety of applications and uses, thus, minimizing data redundancy and ensuring the uniformity of data for all users.

12. (d) Office automation system

The earliest office automation systems were word-processing systems. Office automation systems allow quick and easy generation, editing and printing of text. They may also include applications like electronic calendaring, voice mail, groupware, teleconferencing, facsimile transmission, graphics, etc.

13. (c) Cybernetic control system

A cybernetic control system is not an information system. It is a control system based on the degree of human discretion required. Transaction support systems, decision support systems, and management information systems are forms of information systems.

14. (b) Executive support system (ESS)

The executive support system is used by top management when framing strategic decisions that have an affect on the entire organization. An effective ESS provides market intelligence, investment intelligence and technology intelligence.

Controlling

15. (b) Photocopying

Office automation systems are computer-based information systems which help in the automation of document and message processing to facilitate communication throughout the organization and increase the efficiency and productivity of employees. Photocopying is not an office automation system.

16. (c) Graphics

Graphics is an office automation system application which facilitates the conversion of raw data into digital images.

17. (d) Management information system

Management information system is a computer-based information system that is designed to quickly produce relevant data or information needed by managers.

18. (c) Risk analysis

MIS is a system for gathering, organizing, and summarizing comprehensive data to offer customized solutions to managers. Data entry, data gathering, data transformation, and information utilization are major components of MIS. Risk analysis is a technique for making decisions under conditions of uncertainty.

Principles of Management

Course Components

BLOCK I	Introduction to Management
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Unit 3	Social and Ethical Responsibilities of Management
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Unit 5	Management by Objectives
Unit 6	Strategies, Policies and Planning Premises
Unit 7	Managerial Decision Making
BLOCK III	Organizing
Unit 8	Fundamentals of Organizing
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Unit 10	Strategic Organization Structure
Unit 11	Effective Organizing and Organizational Culture
BLOCK IV	Staffing
Unit 12	Human Resource Management and Staffing
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BLOCK VI	Controlling
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Unit 21	Productivity and Operations Management
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