

# **Systems Concepts**

## **(Lecture 4)**

**October 2005**

## MODELS

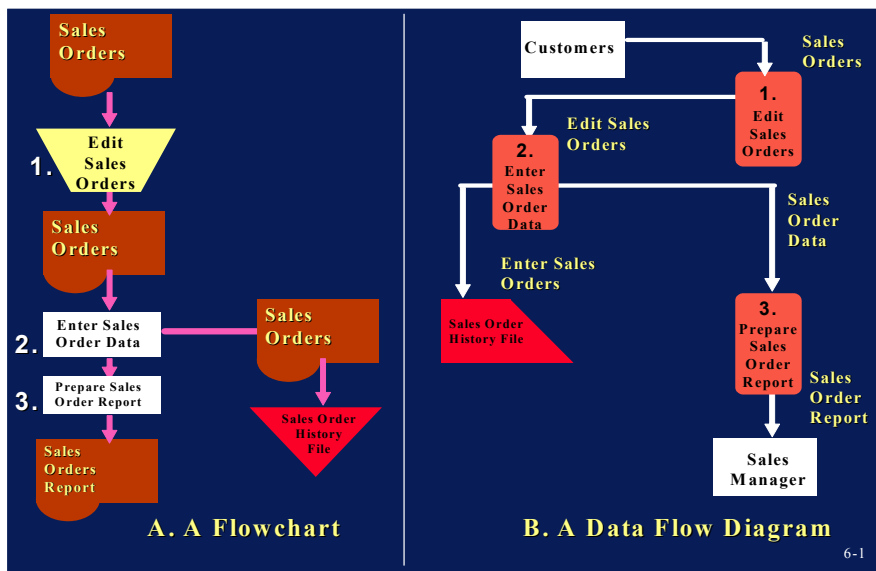
A model is an abstraction of something. It represents some object or activity, which is called an **entity**. Managers use models to represent problems that need to be solved.

### Types of Models

**Physical Models.** A physical model is a three dimensional representation of its entity. It's much less expensive to make design changes in the model than in the final product itself. (e.g., scale models of shopping centers and prototypes of new automobiles.)

**Narrative Models.** The narrative model describes its entity with spoken or written words. The listener or reader can understand the entity from the narrative. (e.g., business communications)

**Graphic Models.** A graphic model represents its entity with an abstraction of lines, symbols or shapes. (e.g., Economic Order Quantity Model). Graphic models are also used in the design of information systems. (e.g., flowcharts, data flow diagrams).



**Mathematical Models.** Any mathematical formula or equation is a mathematical model.

### Use of Models

#### **Facilitate Understanding**

A model is typically simpler than its entity. The entity is more easily understood when its elements and their relationships are presented in a simplified way. Each of the four types of models can vary in detail. A physical model can represent only features of interest; a narrative can be boiled down to a summary; a diagram can show only the main relationships; and a mathematical equation can contain only primary ingredients.

### **Facilitate Communication**

All four types of models can communicate information quickly and accurately to people who understand the meaning of shapes, words, graphics, and mathematics.

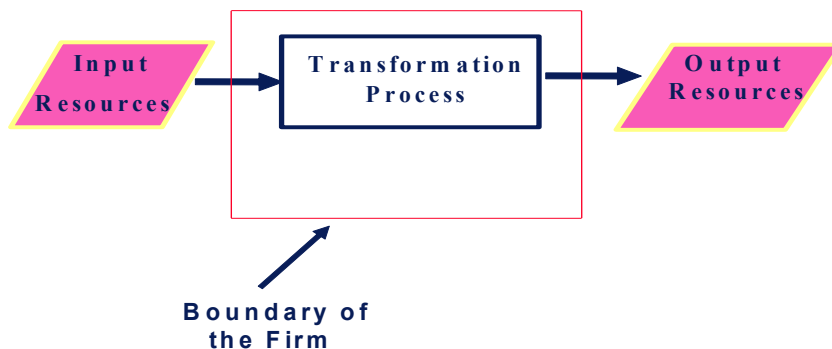
### **Predict the Future**

The precision with which the mathematical model can represent its entity endows it with a special capability that is not available with the other model types. It can predict what might happen in the future, but it is not 100 percent accurate.

## **THE GENERAL SYSTEMS MODEL**

### **The Physical System**

The figure below shows the physical system of the firm that transforms input resources into output resources. The input resources come from the firm's environment, a transformation occurs, and the output resources are returned to the same environment. The physical system of the firm is an open system, interacting with its environment by means of physical resources flows.



### **Material Flow**

Input materials are received from suppliers of raw materials, parts, and assembled components. After transformation, finished products are placed in a storage area until they are shipped to customers.

### **Personnel Flow**

Personnel input originates in the environment. This input is processed by the human resources function and then assigned to different functional areas.

### **Machine Flow**

Machines are obtained from suppliers and usually remain in the firm for a long period—from three to twenty years. Control of the machine flow is diffused among all functional areas that use the machines.

## Money Flow

Money is obtained primarily from the owners, who provide investment capital, and from the firm's customers, who provide sales revenue. Other sources include financial institutions, which provide loans and pay interest on investments, and the government, which provides money in the form of loans and grants.

## The Conceptual System

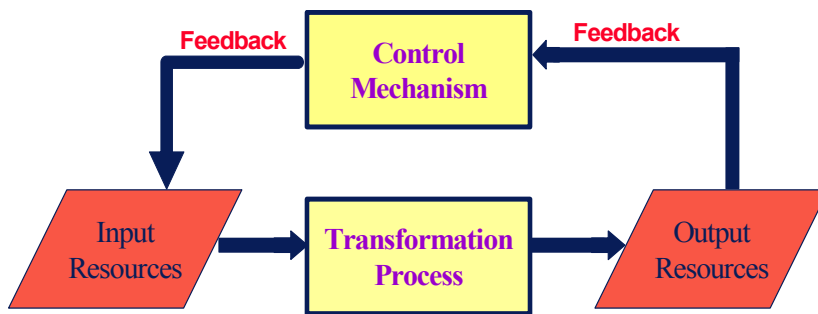
Some open systems can control their own operations via a loop built into the system. The loop called, a **feedback loop**, provides a pathway for signals from the system to a control mechanism, and from the **control mechanism** back to the system.

### **Open Loop Systems**

A system with no feedback loop or control mechanism is called an open-loop system.

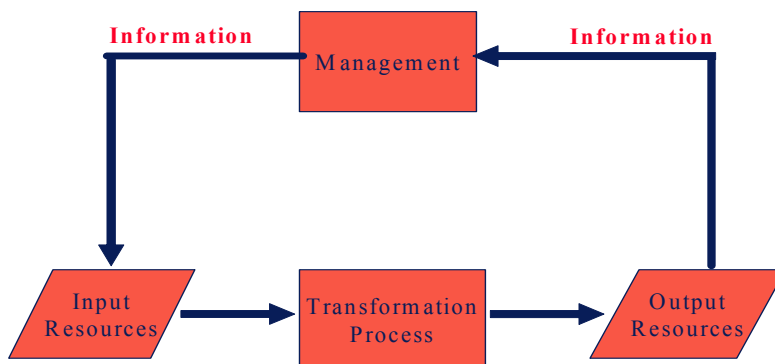
### **Closed Loop Systems**

It's a system with a feedback loop and control mechanism. Such a system can control its output by making adjustments to its input.



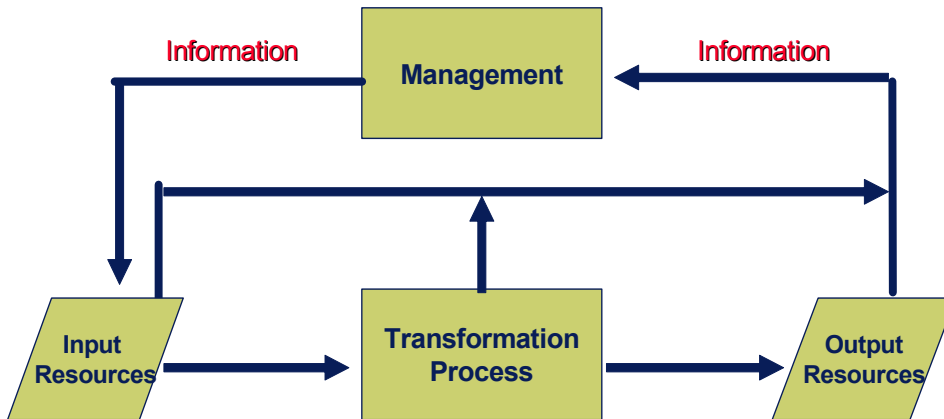
### **Management Control**

Management receives information that describes the system's output. Many management reports include information like production volume, distribution costs, sales analyses .etc.



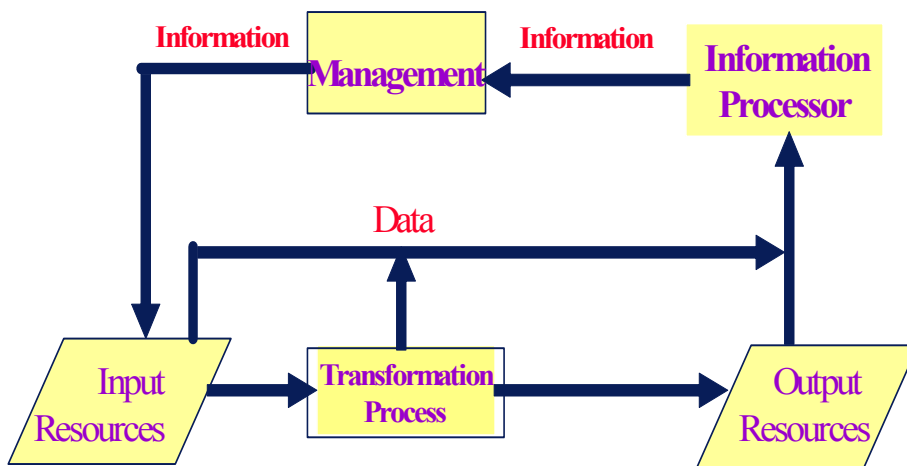
Output feedback is valuable to the managers, but the manager also must know the status of the inputs and transformation processes. For instance, the manager wants information describing both how well suppliers are meeting the firm's needs for input material and production efficiency of the manufacturing operation.

The following figure reflects the addition of information-gathering activities to the input and processing parts of the physical system.



### The Information Processor

Many managers are located some distance from the physical activity. These managers must obtain information from a system or procedure that produces the information from gathered data. This information-producing mechanism is called the **information processor**. The following figure includes the addition of the information processor.



### Dimensions of Information

As managers define the output provided by the information processor, they consider four basic dimensions of information.

#### **Relevancy**

Information has relevancy when it pertains specifically to the problem at hand. The manager should be able to select needed information without going through unimportant information.

#### **Accuracy**

All features that contribute to system accuracy add to the cost. Therefore, managers are forced to settle for less than perfect accuracy.

### ***Timeliness***

Information should be available for problem solving before crisis situations develop or opportunities are lost. The manager should be able to obtain information that describes what is happening now in addition to what happened in the past.

### ***Completeness***

The manager should be able to obtain information that presents a complete picture of a problem or a solution. Managers should avoid **information overload** and be able to determine the amount of details needed.

### **Standards**

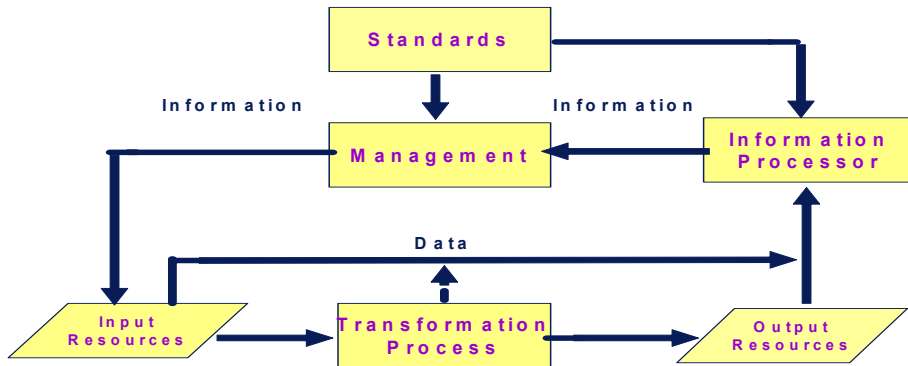
For the manager to exercise control over his or her area of responsibility, there must be information that describes what the area is accomplishing and performance standards that reflect what the area should accomplish. A system must have at least one objective, but multiple objectives are common. Managers need something more specific than objectives; they need **standards**. A standard is a measure of acceptable performance, ideally stated in specific terms.

<b>■ Standards</b>	<b>■ Objectives</b>
<ul style="list-style-type: none"><li>- Measure of acceptable performance</li><li>- Usually stated in specific terms</li><li>- Used to control physical system</li><li>- Consists of:<ul style="list-style-type: none"><li>» Management</li><li>» Information processor</li><li>» Standards</li></ul></li></ul>	<ul style="list-style-type: none"><li>- Overall goal that a system is to obtain</li><li>- Systems have one or more objectives</li></ul>

The following table illustrates the difference between the general nature of objectives and the specific nature of standards.

<b>Objectives</b>	<b>Standards of Performance</b>
<b>Satisfy Customer Needs</b>	Achieve an annual sales volume of at least \$25 million Maintain a 20% share of the market Maintain an annual growth rate of 15%
Produce a return on investment for the owners	Pay dividends to stockholders each quarter Maintain the price of the firm's common stock above \$85 per share
<b>Operate efficiently</b>	Realize an after-tax profit of 15% of sales Maintain a record of accident-free days Keep employee turnover below 10%
Invest in the future	Invest in a minimum of 15% of sales revenue in research and development
<b>Develop sources of supply</b>	Achieve stockout on no more than 2% of the items in inventory during the year Keep the number of backorders to less than 5% of all orders processed
Operate ethically	Have no plant shutdowns due to unavailable materials Have no legal actions filed against the firm by customers, suppliers, and the government

The manager uses standards to control the physical system by comparing actual performance, as reported by the information processor, with the standards. The results of the comparison determine whether action is necessary. The figure below illustrates the addition of the required standards to the general model.



*The conceptual system that controls the physical system consists of three key elements- management, the information processor, and standards.*

### **Management by Exception**

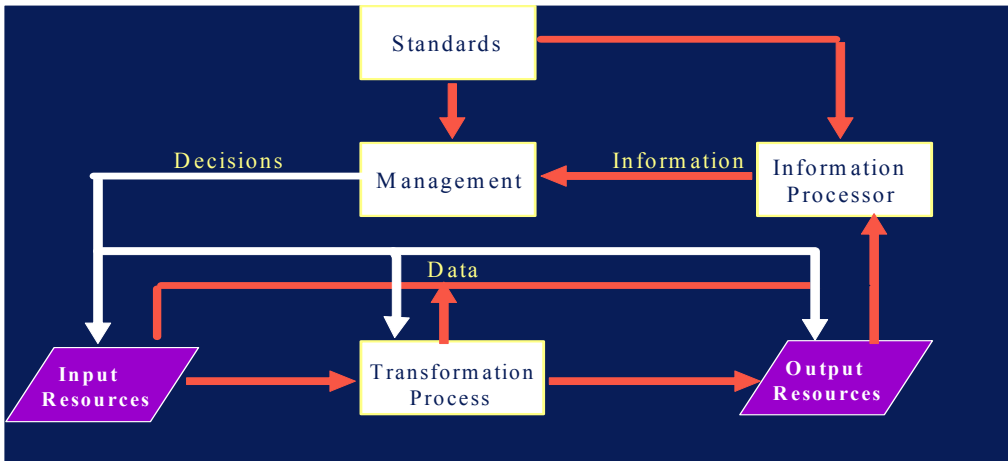
- It 's a style that the manger follows by becoming involved in activity only when it falls outside the range of acceptable performance.
- There must be standards in the form of both upper and lower boundaries of acceptable performance.
- It's a capability provided by the CBIS.

### **Critical Success Factors**

A critical success factor (CSF) is one of the firm's activities that has a strong influence on the firm's ability to meet is objectives. The CSF concept is similar to management by exception in that it focuses attention on a portion of the firm's operations rather than on the whole. The two concepts differ in that the CSFs are relatively stable, whereas the exception items can vary from one time period to the next.

### **Decision Flow**

Another modification to the general model is necessary to reflect how management decisions can change the physical system. Just as the manager must gather data from all three elements in the physical system- input, processing, and output- so the manager must also be able to make changes in the performance of all three elements.

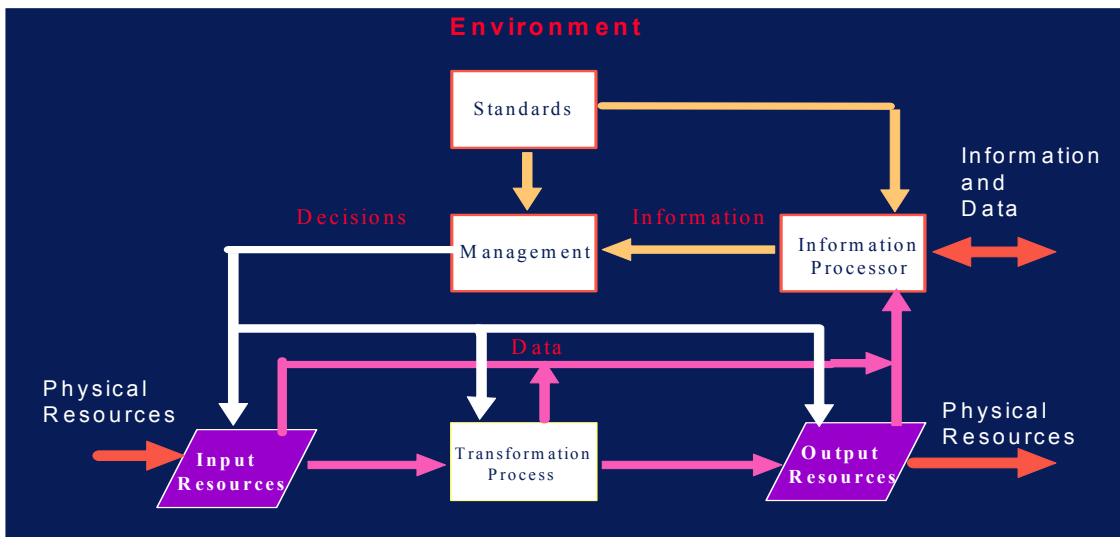


*Data is transformed into information by the information processor, and information is transformed into decisions by the manager. The information processor and the manager work together to transform data into decisions.*

### **The Environment**

The final form of the general model recognizes that resources flow into the firm from the environment and out of the firm and back into the environment.

- Physical resources flow through the physical system at the bottom of the model.
- Conceptual resources enter the information processor, where they are either stored or made available to the manager.



### **Putting the General Systems Model in Context**

- Helps to adjust the firm
- Provides a sense of stability
- Provides mental picture of what to expect

## **Problem Solving**

A problem is a condition that has the potential to cause exceptional harm or produce exceptional benefit. Thus, problem solving is the act of responding to problems so as to suppress their harmful effects or capitalize on the opportunity for benefit.