CHAPTER 8
INFORMATION IN ACTION

Management Information Systems, 10th edition,
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Learning Objectives

• Recognize that the transaction processing system processes data that describes the firm's basic daily operations.
• Become familiar with the processes performed by a transaction processing system for a distribution firm.
• Recognize that organizational information systems have been developed for business areas and organizational levels.
• Understand the processes performed by a marketing information system.
• Understand the processes performed by a human resources information system.
• Know the basic architecture of an executive information system.
Learning Objectives (cont.)

• Know what customer relationship management is and why it requires a large computer storage capability.
• Know how a data warehouse differs from a database.
• Know the basic architecture of a data warehouse system.
• Know how data is stored in a data warehouse.
• Know how a user navigates through a warehouse data repository.
• Know what on-line application processing is.
• Know the two basic ways to engage in data mining.

Introduction

• This chapter gives examples of how information is used in today's firms
• Transaction Processing Systems process data that describe the firm's daily operations and produce a database used by other firm systems
• A related application is Customer Relationship Management (CRM)
• CRM uses data warehousing, meaning data accumulates over time and can retrieved for use in decision making
THE TRANSACTION PROCESSING SYSTEM

• This term TPS is used to describe the IS that gathers data describing the firm’s activities, transforms the data into information, and makes the information available to users both inside and outside the firm.

• Figure 8.1 is a model of a TPS where data is gathered from the firm’s physical system and environment, and entered into a database.

• Data processing software transforms the data into information for the firm’s management and for individuals and organizations in the firm’s environment.
System Overview

- Data flow diagrams (DFDs) are used to document the system in a hierarchical manner.
- The diagram in Figure 8.2 represents the highest level, called a **context diagram** because it presents the system in the context of its environment.
- The data flowing from the distribution system to management consists of the standard accounting reports.

**Figure 8.2** A Context Diagram of the Distribution System
The Major Subsystems of the Distribution System

- While context diagrams define the system boundary, other DFDs are used to describe the major subsystems in the firms data processes
- When a series of DFDs are used in a hierarchy, they are called leveled DFDs
- Figure 8.3 which is a Figure 0 diagram showing three major subsystems
- These subsystems are identified by the numbered upright rectangles in Figure 8.3

**Figure 8.3** A Figure 0 Diagram of the Distribution System
Systems That Fill Customer Orders

- Figure 8.4 shows the four main systems involved in filling customer orders:
  - The **order entry system** enters customer orders into the system
  - The **inventory system** maintains the inventory records
  - The **billing system** prepares the customer invoices, and
  - The **accounts receivable system** collects the money from the customers

- Figure 8.4 expands Process 1 shown in the Figure 0 diagram, and is called a **Figure 1 diagram**
Systems That Order Replenishment Stock

- The subsystems concerned with ordering replenishment stock from suppliers are shown in Figure 8.5, which is called a Figure 2 diagram since it explodes Process 2 of the Figure 0 diagram
  - The purchasing system issues purchase orders to suppliers for the needed stock
  - The receiving system receives the stock, and
  - The accounts payable system makes payment

Figure 8.5 A Figure 2 Diagram of the Systems That Order Replenishment Stock
Systems That Perform General Ledger Processes

- Figure 8.6 shows the detail for the last of the three processes in the Figure 0 diagram
- The **general ledger system** is the part of the accounting system that combines data from other accounting systems to present a composite financial picture of the firm. Two subsystems are involved:
  - The **update general ledger system** posts records that describe the various actions and transactions to the general ledger
  - The **prepare management reports system** uses the contents of the general ledger to prepare the balance sheet and income statement

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**Figure 8.6** A Figure 3 Diagram of the Systems That Perform General Ledger Processes

1. Receivables ledger data
   - Inventory ledger data
   - Payables ledger data

2. Update general ledger
   - Updated general ledger records
   - General ledger records

3. Prepare management reports
   - Management report data
   - Other reports
   - Budget reports
   - Balance sheet
   - Income statement

4. General ledger
   - Management
ORGANIZATIONAL INFORMATION SYSTEMS

- Other specialized information systems used in a firm include the marketing information system (MKIS) and the human resources information system (HRIS).
- Another IS that is implemented at the organizational level is the executive information systems (EIS), used by upper level managers in an organization.
- The MKIS, HRIS, and EIS are described below.

The Marketing Information System

- An MKIS is made up of input and output subsystems connected by a database (Figure 8.7).
- The Input Subsystems are:
  - Transaction processing system
  - The marketing research subsystem
  - The marketing intelligence subsystem
- Each output subsystem provides information about four critical elements in the marketing mix:
  - The product subsystem
  - The place subsystem
  - The promotion subsystem
  - The price subsystem
The Human Resources Information System

- Figure 8.8 illustrates the **human resources information system (HRIS)**
- The figure shows three main HRIS input subsystems:
  - The transaction processing system provides input data
  - The human resources research subsystem used for gathering specialized research information
  - The human resources intelligence subsystem that gathers environmental data that bears on HR issues
The Executive Information System

- The **executive information system (EIS)** provides information to top-level managers on overall firm performance.
- A firm’s EIS usually includes executive workstations networked to a central server (shown in Figure 8.9)
- Some executives prefer more detail, so EIS designers build in flexibility so their systems fit the preferences of all executives, whatever they are
- One approach is to provide a **drill-down** capability, giving executives the ability to bring up a summary display and then display successively greater levels of detail (Figure 8.10)
Figure 8.9 An EIS Model

- Executive database
- Personal computer
- Information requests
- Information displays
- Executive workstation
- Corporate database
- Electronic mailboxes
- Software library
- Make corporate information available
- Current news, explanations
- Central computer
- External data and information
- To other executive workstations
- To other executive workstations

Figure 8.10 The Drill-Down Technique

<table>
<thead>
<tr>
<th>AMERICAN ELECTRONICS</th>
<th>STANDALONE FINANCIAL REPORTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Month</td>
<td>Actual</td>
</tr>
<tr>
<td>Profit before Tax</td>
<td>1,234</td>
</tr>
<tr>
<td>Sales</td>
<td>4,567</td>
</tr>
<tr>
<td>Costs</td>
<td>2,345</td>
</tr>
<tr>
<td>Gross Profit</td>
<td>2,222</td>
</tr>
<tr>
<td>Operating Income</td>
<td>1,111</td>
</tr>
<tr>
<td>Interest Incomes</td>
<td>333</td>
</tr>
<tr>
<td>Income Tax Income</td>
<td>111</td>
</tr>
<tr>
<td>Net Income</td>
<td>1,666</td>
</tr>
</tbody>
</table>

Source: Courtesy of Plan Executive Software
CUSTOMER RELATIONSHIP MANAGEMENT (CRM)

- CRM systems are used to manage relationships between a firm and its customers so both can receive maximum value from the relationship.
- Using more effort to cultivate long-term client relationships makes good marketing sense since it's usually cheaper to keep existing customers than to obtain new ones.
- The CRM system accumulates customer data over a long period and uses the data to produce information for users. A CRM system’s central element is the data warehouse.

DATA WAREHOUSING

- Until recently, computer technology could not support a system with such large-scale data demands.
- The term data warehouse was coined to describe a data store with the following characteristics:
  - Very large scale storage capacity
  - The data is accumulated into new records instead of updating existing records with new information
  - The data is easily retrievable.
  - The data is used for decision making, not for the firm's daily operations.
The Data Warehousing System

- A **data warehousing system** (Figure 8.11) enters data into the warehouse, transforms the data into information, and makes the information available to users.
- Data is gathered from data sources and goes through a staging area before being entered in the warehouse data repository.
- An information delivery system obtains data from the warehouse data repository and transforms it into information for the users.
- The data warehousing system also includes a management and control component.

**Figure 8.11** A Model of a Data Warehousing System
How Data Is Stored in the Warehouse Data Repository

• The warehouse data repository stores two types of data in separate tables, which are combined to produce an information package.

• Identifying and descriptive data are stored in **dimension tables** (Figure 8.12).

• **Fact tables** contain the quantitative measures of an entity, object, or activity (Fig. 8.13).

• An **information package** identifies all of the dimensions that will be used in analyzing a particular activity. Figure 8.14 shows the format and Figure 8.15 includes some sample data.

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**Figure 8.12** A Sample Dimension Table

<table>
<thead>
<tr>
<th>Customer number</th>
<th>Customer name</th>
<th>Customer phone number</th>
<th>Customer e-mail address</th>
<th>Customer territory</th>
<th>Salesperson number</th>
<th>Customer credit code</th>
<th>Customer standard industry code</th>
<th>Customer city</th>
<th>Customer state</th>
<th>Customer zip code</th>
</tr>
</thead>
</table>
Figure 8.13 A Sample Fact Table

Commercial Sales Facts

- Actual sales units
- Budgeted sales units
- Actual sales amount
- Budgeted sales amount
- Sales discount amount
- Net sales amount
- Sales commission amount
- Sales bonus amount
- Sales tax amount

Subject Name of Business Activity Being Measured

<table>
<thead>
<tr>
<th>Dimension name</th>
<th>Dimension name</th>
<th>Dimension name</th>
<th>Dimension name</th>
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<tr>
<td>Dimension key</td>
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<tr>
<td>Dimension n</td>
<td></td>
<td></td>
<td>Dimension n</td>
</tr>
</tbody>
</table>

Facts: Numeric measures of the business activity.

Figure 8.14 Information Package Format
The Star Schema

- The key that identifies the dimension and provides the link to connect the dimension tables to the fact table is called a star schema.
- Figure 8.16 shows how the keys in four dimension tables are related to keys in the information package in the center.
- Fig. 8.17 is an example using the four dimension tables: customer, time, salesperson, and product.
- The warehouse data repository contains multiple star schemas – one for each activity type to be analyzed.
Figure 8.16  Star Schema Format

Figure 8.17  A Sample Star Schema
INFORMATION DELIVERY

- The final element in the data warehousing system is the information delivery system.
- Information is obtained from the data repository, transformed into information, and made available to users.
- Figure 8.18 shows how the user can navigate the data repository to produce summary information, detailed information, and detailed data.
- Figure 8.19 shows the results of a drill-across navigation, producing outputs in different hierarchies.

Figure 8.18 Navigating through the Warehouse Data Repository

- Roll up
- Drill across
- Drill down
- Drill through
ONLINE ANALYTICAL PROCESSING

- **OLAP** is a type of software especially developed for data warehouses.
- Using OLAP, users can communicate with the data warehouse either through a GUI or Web interface, and quickly produce information in a variety of forms, including graphics.
- There are two approaches to OLAP (Figure 8.20):
  1. **ROLAP** (for *relational online analytical processing*) that utilizes a standard relational DBMS.
  2. **MOLAP** (for *multidimensional online analytical processing*) that utilizes a special multidimensional DBMS.
ROLAP and MOLAP

- Both OLAP types include a data warehouse server and a second server that houses OLAP software
- A major difference is that the MOLAP workstation includes a downloaded multidimensional database
- The data in this database has already been formatted in various dimensions so that it may be made available quickly rather than go through time-consuming analyses
- Figure 8.21 illustrates a report that is the type that ROLAP can easily prepare
- MOLAP can produce information in many dimensions
- Figure 8.22 illustrates a summary report in four dimensions: store type, product, age, and gender
**Figure 8.21** An Example of a Report That Could Be Produced with ROLAP

![Analysis of Retail Price Discounts](image)

**Figure 8.22** An Example of a Report that Could Be Produced with MOLAP

![Product Sales by Customer Gender](image)
DATA MINING

- Data mining is the process of finding relationships in data previously unknown to the user
- Data mining helps users discover relationships and present them in an understandable way so the relationships can be used in decision making
- The two basic data mining techniques are:
  - **Hypothesis Verification** where data is used to test theories
  - **Knowledge Discovery** in which users search for common characteristics within the data

END OF CHAPTER 8