Chapter 8

Operations and Information Systems

This chapter brings typologies of information systems. Then, it discusses two basic types of IS that support operations in almost every organization -- Transaction Processing System and Management Processing System. The second part of the chapter will discuss a case of a problematic marketing process in a telecommunications company. Concepts of as-is and to-be process and system are introduced and applied to the case.

Typology of Information Systems

There are many different information systems in organizations. They are developed for different purposes, serve different user groups, and have different capabilities and limitations. Here is the list of IS being explored in this course:

- Transaction Processing system (TPS)
- Management Information System (MIS)
- Decision Support System (DSS)
- Knowledge Work System (KWS)
- Group Support System (GSS)
- Communication Systems
- Office Automation System (OAS)
- Enterprise Resource Planning System (ERPS)

The above systems can be grouped in several ways in order to understand their similarities and differences. A particular grouping is usually called typology or taxonomy. A typology must have a clear, single basis on which it is created. We will explore three typologies based on:

- Organizational function
- Time orientation
- User group.

These typologies will map the systems listed above in different ways. In other words, a particular IS may appear in different typologies. Some systems may not show up in each typology.
Organizational Function-Based Typology of Information Systems

The most natural typology of IS is based on organizational function. People in organizations usually talk about their production system, or purchasing system, or human resources information system (HRIS), or accounting information system (AIS), payroll system, sales system, marketing system, etc. Therefore, the similarity between these systems is that each type is defined by a particular organizational function or the domain of business it supports. (Organizational function is similar to organizational department, but sometimes there is no full match between the two as a function can be carried by more than one department.)

What differentiates these systems is the content of data. So for example, a marketing system manages data about customers and markets; an HR system manages data about employees; and so on. Recall the schemas for different domains of business, which were explored as part of the data analysis topic.

Any organizational department may have TPS and MIS. DSS may be serving a department’s executive but it is also likely to be found in an executive office at the corporate level. KWS are usually located in the functions where knowledge is intensively used and/or created (R+D, and engineering units). GSS, communication systems, OAS, and ERPS can be in all departments.

Time Focus-Based Typology of Information Systems

The next IS typology is based on time orientation. Some systems are focused on the past and present, while others have the future focus. The time focus is expressed in the recorded data and in system outputs. Here again we meet some of the systems from the list above, but in a different light (see Figure 1).

![Figure 1. Time-based Typology of IS](image)

TPS support and record ongoing operations. On the output side, TPS deliver queries and short range reports on the business that has transpired. MIS build directly on TPS, and so they have the same present and past focus. In contrast, DSS are focused on the future, such as scenario building and longer range planning.
User Group Focus-Based Typology of Information Systems

The last IS typology is based on the target user group. This is the most detailed typology. The user groups are:

- Executive management
- Mid-level management
- Supervisory management
- Professionals
- Clerks.

The user groups are depicted in Figure 2 along with matching IS types.

Executive managers (sometimes called strategic management) are served by DSS. DSS combine outputs from MIS with data from the organizational environment. DSS assist executives in getting a comprehensive picture of business and in strategic planning, among other tasks.

Mid-level managers (sometimes called tactical management) are supported by MIS. These systems report on business operations completed in the last month or quarter. MIS build TPS.

Supervisors are supported by TPS. Having transactional databases at their core, TPS record everyday operations. A great level of detail is provided, but not much on the side of summary figures beyond daily and weekly figures. Although at the bottom of management hierarchy, TPS are indispensable as they feed MIS that, in turn, feed DSS. In a way, all the management of business data starts with TPS.

Remember that function-based systems can be TPS, MIS, and sometimes DSS, supporting management hierarchy in an organizational function.
Figure 2 also cites KWS. Professionals that use this system type may be grouped in bigger numbers in particular departments, as mentioned above. Still, the users of KWS may be found at any place where knowledge work is performed. For example, a pool of KWS users can include the analysts that support executive management. This staff resides outside typical knowledge work functions.

Moreover, clerks as the occupational group use various Office Automation Systems, such as those for business document production and organization. Communication systems and systems for group support may be used by all employees rather than exclusive user groups.

Table 1 cross-references the department typology and the user typology applied to managers. The example shown is from the HR domain, where three systems are used for managing travel expenses – TPS, MIS, and DSS. Each serves a different level of management. In a given organization, each of these could be called by “HRIS” by its respective user group.

TPS tracks all travels claims submitted by employees in an organization. In its simplest form, this TPS can be a database of travel claims with some queries implemented. Once employees or clerks (primary users) enter data, supervisors (the secondary user) can query and tally them. MIS adds more queries and implements reports that will provide aggregate figures on travel expenses for a month, a quarter, or a half year. An HR manager uses MIS directly or with help of assistants.

Moving up the hierarchy, a head of HR function may be supported by a DSS. This system will use outputs from the MIS to generate aggregate annual figures. The DSS may have a module for creating projections of future expenditures and budgetary needs. Data on pricing alternative travel services could be entered in the DSS in order to build optional scenarios of future. These data come from the organization’s environment. (DSS will be a subject of a separate lecture.)

<table>
<thead>
<tr>
<th>Organizational Function-based IS Type</th>
<th>Management User-based Information System Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Resources IS (HRIS)</td>
<td>TPS</td>
</tr>
<tr>
<td></td>
<td>MIS</td>
</tr>
<tr>
<td></td>
<td>DSS</td>
</tr>
<tr>
<td>Management Level</td>
<td>Supervisory</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Description</td>
<td>Database of travel claims with some queries</td>
</tr>
</tbody>
</table>
Operations

We looked into the topic of operations when discussing two basic types of business processes – operational and strategic. In everyday life, managers usually talk about operations, rather than operational processes. The very term has a military origin, as in “military operation.”

Operations are the basis of business. That is what fills daily life in companies. Examples are production operations, supply, sales and marketing operations, and support operations, such those in areas of IS, accounting, and HR. Operations are recurring activities that generate income and increase value of organizational assets. They also generate ongoing costs.

“Business transaction” or just “transaction” is another name for operation. A transaction is a daily atomic event, such as an act of buying, selling, billing, paying, etc. From Chapter 5 you already know that operations are best understood as business processes. You also know that operations look like routines, with small and predictable variation. In process design terms, the composition of operations is determined upfront, and thus their flexibility is low. For example, a customer order is always created via a defined set of steps.

Operations can be in various degrees of complexity. For example, scheduling a production process is less complex than a quality control process. Complexity may depend on how an organization is modeled. The bureaucratic model of organization tends to make some processes unnecessarily complex, involving too many steps and people. Typical examples are government organizations, court of law, military, and large public organizations in various domains including education. In contrast, in the professional model of organization, many operational processes are simplified, made to be “lean.”

Coordination in operational processes may also be different from one process to another. Simpler processes with predefined variation are usually coordinated better than more complex and more flexible processes.

How do technological properties of IS, as an aspect of process design, influence operational processes? Often times, operational processes are carried out by TPS to the extent that it is nearly impossible to say what the system is and what the process is. The system and process make a whole. The consequence is that the composition of operational processes is determined by TPS. These ideas are depicted in Figure 3.
Chapter 8  *  Operations and Systems  *  Bob Travica ©

Transaction Processing System

The name of TPS apparently comes from the term “transaction” mentioned above. This is a system that “processes transactions.” TPS is historically the oldest type of IS for business. The first TPS was used for processing payroll. TPS stores and processes data created in operational processes. Technically speaking, the main parts of a TPS are databases and stored queries and reports (Figure 4). The data are created in different business functions, and so TPS can be for production, accounting, sales, purchasing, HR, inventory and other functions.

Outputs from a TPS result from querying databases and creating reports. The queries reflect shorter periods, such as day, week, and month. The level of summarizing data is not high. These characteristics suit the supervisory level of management.

Queries can be stored and ad-hoc (random, for the purpose at hand). When a TPS stores a query, it is only the query statement that is stored. These statements are written in the SQL code discussed earlier. A user can create a query by using a convenient visual facility, while the DBMS will always translate a query to an SQL statement. Only such statements are stored when a query is permanently saved. Therefore, when a query is executed, the retrieval is performed always on the latest version of data.

Examples of TPS outputs are sorted lists of parts expended in the production, and records and basic summaries reflecting transpired purchases, sales, inventory, work hours, and so on.

Figure 3. Operations processes and systems support

Figure 4. Model of TPS
Management Information System

MIS was developed soon after the arrival of TPS. The name of this system was used for naming the entire discipline of Management Information Systems. This label is still in use, although it is increasingly being replaced by the more inclusive term “Information Systems.”

MIS uses outputs from TPS to create reports on transpired operations in an organization (Figure 5). The level of data summarizing is higher. Statistical functions can be applied to the TPS data, such as variance and averaging. This is different than the way the data are processed in TPS. Another difference is that queries and reports cover longer period of time, such as quarters and half-year periods. An example of MIS outputs are a summary of sales in the last quarter, with a breakdown of totals per product/store, weekly and monthly averages, and variances from the corresponding sales targets. These capabilities cater to business needs of mid-level managers.

MIS includes additional code beyond DBMS capabilities. Software for creating visuals (pie charts, bar graphs, etc.) is usually part of MIS. Reporting is a particular strength of MIS. A MIS report further transforms query outputs from TPS by applying additional calculations. MIS reports are built atop of TPS queries. The reporting capability is expanded by creating MIS-specific queries that do not exist in a TPS.

MIS reports are particularly strong on the formatting side. A report organizes the content into headings and footers, sections, text boxes, and some other items. Reports usually include charts for graphically representing key numerical figures. This helps managers to quickly inform themselves on the transpired operations.

There are two kinds of MIS reports:
- Scheduled report
- Exception report.

The scheduled report is regularly created, for example at the end of a quarter. MIS creates scheduled reports automatically at the push of button by the MIS user. Scheduled reports are necessary for running the business as usual. However, when something unusual happens, the exception report offers help. Unusual events are a sharp peak or a sudden drop in revenues,
too many faulty parts in the production, unusually high number of sick hours, and so on. MIS is programmed to create this report when variance from a plan is significant. An exception report lays out essential evidence on the case, and delivers results of calculations that may indicate the cause of the exception. For example, a report on a drop in sales may correlate sales figures with absence hours or with fluctuations in the sales staff.

The reminder of the chapter will discuss a customer support TPS/MIS at a telecommunications company in the context of a marketing process. The case will combine the process and data analysis approaches.

**Telco Case**

Telco was a telecommunications company that offered typical services in this industry – landline telephone, cable TV, Internet access, and cell phone. As the company was growing in market share and service offerings, it became challenging to support its customers with its marketing and sales processes. The company was introducing new systems without thinking the underlying processes first, and how to sync them together smoothly. This resulted in having several systems for customer support which were not connected properly or at all. Similarly, the related business processes suffered the composition and other design problems.

*Marketing Campaign at Telco – As-Is Process*

The focus on the following analysis is on one part of marketing at Telco – the marketing campaign process. (Technically, marketing campaigning is a sub-process of the marketing process.)

![Diagram of the “As-is” marketing campaign process at Telco](image)
Figure 6 represents the state of the marketing campaign process at Telco. When we talk about a current state of process (or an IS) we label it with the phrase “as-is” process (or system). The figure features a system called Customer Relationship Management System (CRMS) that is used in support of marketing campaigns. This CRMS is a TPS with some MIS capabilities.

Figure 7 shows entities that underlie the as-is market campaign process at Telco.

![Diagram](image)

**Figure 7.** Entities in the as-is market campaign process

Design of the as-is marketing campaign process at Telco has several problems. In terms of composition, the process mixes two domains – marketing campaign and customer ordering. That is why it has two start points, which is a violation in the process composition. Further, the step of storing campaigns in CRMS has no output. An activity without the output is the error called “black hole.”

The coordination in this process is sub-optimal. First, the final deliverable of the process is not clear. Is it the promotion of Telco’s services or order management? With the final deliverable being unclear, it is difficult to assess how each process component contributes to the final deliverable. Still, it is apparent that a black hole cannot contribute at all because it has no downstream impact.

Further to problems of process design, the process is unnecessarily complex since two different technological platforms are used for the marketing part of this process: (1) an electronic bulletin by which marketers inform sales people about new services, and (2) CRMS. And finally, technological characteristics of CRMS leave a small footprint on the process, since this system is apparently underused.

The sub-optimal process design reflects on the process performance (Table 1). The process time is nearly impossible to estimate because it is uncertain when the process will start on the customer side. It is certain, however, that the process is slowed down by reentering market campaigns twice – in CRMS and in the electronic bulletin. The process cost is unnecessarily inflated by deploying multiple IS resources and due to time losses for double data entry.

As for customer value as another aspect of process performance, it should be assessed from the perspective of two customers. A consumer is the external customer who is supposed to be served by the market campaign process. However, nobody really reaches out to the consumers.
Rather, they have to take action and call a sale representative. Only that way the consumer may learn about new services. Therefore, the consumer is not served well.

Table 1. Performance of marketing campaign process

<table>
<thead>
<tr>
<th>Performance Aspect</th>
<th>Finding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>Cycle time (promote-sell) unpredictable. Slowness due to doubled data entry of market campaign data.</td>
</tr>
<tr>
<td>Cost</td>
<td>Inflated by deployment of multiple IS resources and time losses.</td>
</tr>
<tr>
<td>Customer Value</td>
<td>Marketing professional: Process doesn’t deliver results of marketing campaigns. Consumer: Must take action to take advantage of service promotion, rather than being served.</td>
</tr>
<tr>
<td>IS Support</td>
<td>Non-functional characteristics of CRMS have no effect on process performance.</td>
</tr>
</tbody>
</table>

Another customer to this process is internal – the marketer. The marketer expects that a market campaign process initiates sales of promoted services. However, this is not accomplished with the as-is process. In addition, a marketer needs to know results of a marketing campaign. A good measure is the ratio between the number of orders placed by the accessed consumers and the number of consumers accessed. However, the process as-is cannot deliver this figure. Consequently, the process does not help the marketing professional to understand results of a marketing campaign.

Finally, non-functional characteristics of CRMS (the last aspect of process performance) make no influence on process performance. It is so because the system is used in a very limited manner, just as storage of marketing campaigns.

*The Market Campaign To-Be Process*

Problems with the market campaign process at Telco boil down to mixing up marketing and customer ordering, a passive role of sales representatives, and the miniscule use of CRMS. In fact, the footprint of CRMS can be extended over the entire process. Improvements are depicted in the process diagram in Figure 8. It shows this process with optimized design – the to-be process.
The to-be process is composed just from the steps related to market campaigns. The whole customer ordering part is deleted (components in red colour shown in Figure 8). CRMS is turned from a black hole into a centerpiece: sales people retrieve campaigns from CRMS and store results of each campaign in CRMS. In addition, the sales function is actively involved in market campaigns. The composition and all other aspect of process design are optimized.

Improvements in data modeling match the process optimization. These are shown in Figure 9.

**Impacts of Organizational Culture**

Roots of the problems with marketing campaigns at Telco are in a corporate culture in which departments act as if they are silos. A silo is a concrete-made structure with impenetrable walls, a whole disconnected from other silos even when touching them. Similarly, Telco’s Marketing and Sales departments are closed and linked just in a very limited manner. This silo culture excludes sales people from the marketing campaign process. It also shrinks the footprint
of CRMS. To be sure, the silo culture is not unique to Telco and it can be found in other companies as well. Wherever it exists, it causes problems to optimizing business processes.

Furthermore, each silo-like department has its own culture. Sales operations are rules-driven and so is the use of IS. The processes are inflexible and closely monitored by supervisors. This situation characterizes a bureaucratic culture. In contrast, the marketing department resembles a professional model of organization. Marketers enjoy more flexibility in conducting their work and can even choose between alternative IS resources. Theirs is the person type of culture. Due to these differences, there is not much understanding between sales and marketing managers. Each side sticks to traditional roles, incapable of seeing a bigger picture with business processes running across departments and IS being used in the same way. The end consequences of this silo culture show up in losses in organizational performance. In Telco’s case, the losses were in a fluctuation of both customers and in revenue streams.

Questions for review and Study

1. What is organizational function-based typology of IS? Give examples of this typology.

2. What is time-based typology of IS? Give examples of this typology.

3. What is user group-based typology of IS? Give examples of this typology.

4. Give an example of cross-referencing IS typologies.

5. Define an operational process, give an example of it, and discuss its design.

6. Compare as-is process and to-be process. Assume that an IS is involved in the as-is process. How can it be changed in the to-be process? (You can use the case in this chapter or some other example.)

7. Describe basic design of TPS.

8. Describe basic design of MIS.

9. Contrast two kinds of MIS reports.

10. What are the similarities and differences between TPS and MIS? (Make sure you know at least three of each.)

11. Discuss two design problems in Telco's market campaign process.

12. Discuss two performance problems with Telco's market campaign process.