Information flow over process

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Abstract

Every process in a business is accompanied by information flow. How to make each process obtain the information needed in order to carry out the procedure, has become a major factor of operation efficiency.

The synchronization of business operation process and information flow, an often underestimated problem, is discussed here. When designing an information system to meet the real-time requirement, the generation of information must be closely combined with the way it is used.

Based on the models of organization and group communication, as well as the personnel and time aspects, eight models of information flow are presented here, to help managers to locate systematically and efficiently the bottlenecks of business procedures.

Also presented here is a graphical method to chart and simplify the business procedure, which can be used by managers to specify the current business procedure, analyze the procedures to find out discontinuity of information flow, and use available information technology to further increase the efficiency of business procedures.

Keywords: Businesses process reengineering, information technology, information flow pattern, process innovation.

I. Introduction

The invention of the computer has benefited humanity by simplifying the creation and processing of information. Computers have three major
data processing functions, namely memorizing, computing, and controlling, which allow extensive data processing (Masuda, 1990). Information technology (IT) has increased communications and altered social structures, transforming the old industrial society into the present information society. In information societies, the key to the survival of businesses and administrations is that all business activities must be coordinated and based on the efficient application of information.

Facing a rapidly changing environment, companies must continuously maintain their competitiveness and meet customer requirements. IT and business process reengineering (BPR) have accelerated the transformation of business organizations (Attaran, 2004). Information technology integrates computers, software applications and Internet technology to achieve business objectives. Moreover, business process reengineering involves analyzing and redesigning internal organization structures and interactive work processes to enhance efficiency and meet customer demands.

Information technology and business process reengineering have an interactive relationship. Companies considering adopting information technology must consider which reengineering processes can be empowered by technology and not merely consider the application of technology to individual units or functions. Moreover, companies considering BPR should also consider how technology can improve innovative process design. Figure 1.1 shows the interactive relations among information technology and business process reengineering.

Applying the power of computers and communication technology to enhance internal processes, create innovative ideas and technologies
and reconsider business process related issues thus have become urgent issues for management. This study takes business process as a starting point for discussing the use of information flow to investigate business process operation, and also explores the various information technology methods which can be used to accelerate business process operation to achieve the twin goals of customer satisfaction and business efficiency.

II. Literature review

A. Definition of business processes

Pall (1987) believed that a business process involves the combination of people, material, energy, equipment, and so on to achieve a certain goal. Murray (1991) placed greater emphasis on effectiveness and proposed that business process involves a combination of functions or tasks, which can be integrated to create products and services. Moreover, Murray also noted that business processes can be improved and redesigned to maximize process efficiency and effectiveness.

Davenport and Short (1990) define business process as “a set of logically related tasks intended to achieve a defined business outcome”. A process is “a structured, measured set of activities designed to achieve a specified output for a particular customer or market”. A process thus implies a strong emphasis on how work is done within an organization (Davenport 1993, Mooney et al, 1996). Davenport and Short consider that processes have two important characteristics:

(i) customer (internal or external) involvement, and
(ii) crossing organizational boundaries, i.e., they occur across or between organizational subunits.

One technique for identifying business processes in an organization is the value chain method proposed by Porter and Millar (1985). Take purchasing from suppliers for example: this process often involves employees in the production, purchasing, inventory control, and accounting units. From the procurement process demonstrates that successful business processes depend on inter-unit cooperation.

In summary, using the scholarly definition of a business process, this study concludes that a business process can achieve certain goals, including various activities required by tangible production and intangible services and support. Additionally, each activity within the business process must know the information required to support the operation.
A business process can be considered an information flow process for achieving a certain target.

B. Influence of information technology on business processes

IT significantly influences modern business processes. Information technology increases business process efficiency since limitations of space are overcome and thus time spent is reduced (Davenport and Short, 1990). For example, before the advent of IT, goods were ordered manually by filling out forms, a process that involved numerous different people. However, IT has enabled the minimization of labor costs, time spent and mistakes.

Furthermore, organization operational model is limited by organization technology adoption. The introduction of new technologies challenges old operational models and rules. Moreover, the advance of information technology revises old theories and business operation regulations step by step (Hammer and Champy, 1993).

From the above discussion, information technology can be applied directly in daily organizational operations. However, the direct use of IT to support operations only improves efficiency in limited areas. If the required information can flow quickly to the appropriate places during business operations, then efficiency will be improved, a process termed the “linear” improvement effect. This study attempts to adopt a business process view to identify a “linear” effect and thus enhance overall efficiency.

C. Information definition

The Oxford dictionary defines information as the communication of specific facts, persons, or events. Davis and Olson (1975) believed that information refers to managed and transferred data that is meaningful to receivers, and can facilitate current or future decision-making. Finally, Ide (1983) summarized information simply as being any facts that can be communicated, learned or saved.

This study defined information based using a business process perspective as “auxiliary data or messages needed for business process activities, which can be communicated through media such as text, documents, telecommunications or computers”.

D. Definition of information flows

People require information to assist them in making decisions. From
a business process perspective, to enable a process to proceed, each activity in that process must use the information generated from the previous activity combined with the relevant knowledge. Thus, communication during each activity will become an information flow. Scholarly definitions of information flows based on information systems and business processes are given below:

Regarding information systems, Waples and Norris (1992) proposed that information flow involves a set of interconnected information systems. However, this structure uses information for communication so that an information flow is formed. According to Blum (1992), information passes numerous different people or organizations on the Internet, enabling information seekers to obtain the information they desire and also to send that information to others via the Internet. Therefore, an information flow is formed.

From the business process perspective, Bowman (1989) noted that information flow can be enhanced by connecting departments within or outside the organization via a computer network. This practice enables the organization to understand changing customer demands and thus maintain managerial efficiency. The connections between the organization and its departments comprise the information flow. Radding and Tuck (1991) identified the following as important questions regarding information flow within a company: Where does the information come from? Where the information should be sent? Who is in charge of filing? Who provides the information? Who needs the information?

This study defined information flows from the perspective of business processes. During a business process, the information flow in each activity forms the information flows. From the definition that information flow in a business process comprises the information required in each activity. Each activity can be divided into five parts:

1. information source;
2. knowledge required to carry out the activity;
3. information flow following activity completion;
4. operator of the process activity;
5. media used for information flow.
III. Information transformation model construction

A. Discontinuous reasons for information flows

A business process mainly comprises process activities, where each activity requires support from information. Activities within business processes must be conducted based on the information generated from the previous activities plus the relevant knowledge. Therefore, rapidly delivering activity relevant information influences the efficiency of the whole business process.

Information communication mainly relies on media. The selected media significantly influence the information dissemination efficiency. Moreover, influences include operation methods, job allocation, experience sharing, and so on. For example, official documents previously were produced manually and the filings stored on paper rather than in computers. This approach caused delays owing to paper work and inefficient manual searching, checking, and modification of documents. Consequently information flow was very slow. Additionally, job related experience and expertise (namely knowledge) tended to concentrate in particular individuals; meaning that once these individuals left the job then others had difficulty in taking over. These characteristics caused discontinuous information flows.

This study identified three factors as causing discontinuous information flows:

1. Operational discontinuity. This discontinuity is caused by inefficient job allocation and time consuming preparation. Examples of this discontinuity include unbalanced workload, and manual information searching, inspection, verification, and document delivery or mailing.
2. Time discontinuity. During activities, required information cannot be obtained on time, and delays are caused by batch processes designed to enhance work efficiency.
3. Space discontinuity. Process operators may come from different organizations, units, departments or offices, slowing information flows.

To understand the bottleneck of business process, the work model of information flows within an organization first must be discussed. After analyzing the work models, methods of improving efficiency and solving operational, time, and space discontinuous problems can be proposed. The following section discusses information flows in a business process.
B. Information flow

Information flow complexity increases with organization structure complexity and vice-versa. Consequently, organizations wishing to gain a competitive edge can use two strategies: first, simplify organization structure to simplify information flow; second, exploit IT to handle and manage documentary work while also improving communication to obtain competitive advantage. In a business process, the key benefits of IT include:

1. direct and flexible interpersonal communication;
2. enhancing information accessibility;
3. reducing barriers to reaching information;
4. advancing the understanding of information technology at the managerial level and removing unnecessary administrative processes.

IT can enhance inter-organization and inter-group efficiency communication. Communication within an organization can be classified into three types: bottom-up, top-down and horizontal. Regarding group communication, according to Leavitt (1964) it can be classified into five communication networks, chain, circle, star, Y, and web as displayed in Figure 3.1.

These two kinds of classification only showed the differences between the communicators in an organization hierarchy. Meanwhile, the interacting correspondents, namely information flow content and communication efficiency were not indicated clearly. This study is based on the concept of information flows considering the operator and time factors, and divides information flows into the following types. “sequential”, “deferred”, “real-time”, “parallel”, “wheel”, “one-to-many”, “many-to-many” and “M-1-M”. The symbols used are illustrated as follows:

1. “” denotes information processing content;
2. “” represents information flow direction;
3. “D” is information flow delay, including document collection, waiting for the next step, the leave off caused by two space segments and so on.
4. “” denotes information flow direction using an electron as a medium.
The information flow models are illustrated individually as follows:

1. **Sequential information flows.** Sequential information flows are those in which information is transmitted sequentially from the previous activity to the following one. Sequential information flows are the most common type within organizations, as presented below in Figure 3.2.

   In a business process, the use of paper and official documents as a communication media is often restricted by time and space. Therefore, sequential models are commonly adopted. However, the involvement of many units/departments and extensive approval and auditing steps, such sequential model is costly and time consuming.
2. *Deferred information flows*. Information flow is delayed due to discontinuities of time, space and operations between activities.

In a business process, the accumulation of a certain amount of work by an operator often causes delays. Consequently, delays and discontinuity of information flows are frequent. However, another reason for deferred information flow is the limitations of transformation media. For example, mailing is quite time consuming since delivery takes time. The delays associated with mailing include information flow discontinuity, causing deferred information flows. See Figure 3.3 below.

![Figure 3.3](image)

*Deferred information flows*

Deferred information flows are quite common, particularly inter-department or inter-organization and such flows are usually where bottlenecks occur.

3. *Real-time information flow*. Real-time information flow describes rapid communication between a business process and an activity. The next activity starts immediately after the completion of the previous one. Consequently, no time delay occurs.

Because of the limitations of information storage and media transformation, the information flows become deferred information flows. If information technology can be used to change information flows from deferred type flows to real-time flows, waiting times for customers in obtaining the required information can be minimized. Furthermore, the real-time information flow model not only eliminates the time delays suffered by the deferred information flow model, but also can react to abnormalities more quickly using information technology, meaning that information flows can be controlled on time (namely avoiding delays). However, this real-time information flow enables members within the organization to access required decision making information faster and more conveniently, enhancing management efficiency. Figure 3.4 illustrates the real-time information flow model.

![Figure 3.4](image)

*Real-time information flow model*
The time and space limitations can be overcome by adopting information technology, allowing the immediate obtaining of the required information. The support of “real-time information” makes “real-time management” a reality.

4. Parallel information flows. In a business process, when two activities without sequential relations are conducted simultaneously, information communication is termed parallel information flow.

In many business processes, documents and information can be passed to different people through carbon copying and photocopying. This information flow occurs in a parallel state.

The storage, high-speed handling and network transmission capacities of computers allow information to be passed on to different regions or departments simultaneously to conduct the next business process and thus enable parallel information flows. Figure 3.5 presents parallel information flow.

![Figure 3.5](image)

*Figure 3.5 Parallel information flows*

The sequential information flows model often requires the notification and signature of relevant departments. These processes are extremely time consuming and difficult to track. Moreover, if amendments are needed then the applicant must repeat the process. The adoption of the Internet, integrated databases, and improved communications and decision-making information have accelerated the decision-making process and the associated paper work, and even decision-making processes involving departments without superior and subordinate relations can be processed rapidly. Moreover, user authorization and encryption can protect confidential information. Additionally, priority settings such as CPM and PERT can be used for sequential work. This enables sequential information flows to be changed into parallel information flows. A number of processes can be operated simultaneously to reduce work hours and improve efficiency.
5. **Wheel information flows.** During a business process, if the same information needs to be sent to multiple other processes, and feedback also is required, then wheel information flows are formed.

For example, during a meeting, a secretary acts as an intermediary since she needs to contact participants to provide meeting information such as place and time. The same information can be transformed by continuous contacts, and this frequently causes bottleneck of loading or information flows. Therefore, the process speed is slow. Presently, information flows are shaped like a wheel, as shown in Figure 3.6 below.

![Figure 3.6 Wheel information flows](image)

Wheel information flows rely on continuous transformation and thus are time consuming. With the support of information technology, the repetitive tasks can be performed automatically by a machine. For instance, during a meeting, a secretary can send a letter to multiple recipients effectively via e-mail regardless of distance.

Moreover, receivers also can return information to the sender via e-mail. Hence, information technology enhances work efficiency and minimizes operating process time.

6. **One-to-many information flows.** If the same information needs to be passed on to multiple precipitants, then one to many information flows are formed.

Owing to the use of different media, transmission scope and speed vary. For example, company policy is often announced through public notification or internal communication, meaning notification scope is limited. Figure 3.7 illustrates One-to-many information flows.

Information technology can be used to improve and promote interpersonal communication. For example, e-mail allows information
to be sent to multiple destinations thus preventing inefficient communication. However, as for communications and information flows between organizations and their members of staff, e-mail facilitates effective opinion sharing and exchange. Consequently, information can be shared and flowed faster and over longer distances.

![Figure 3.7](image-url)

**Figure 3.7**
**One to many information flows**

7. *Many-to-many information flows.* When information needs to be sent between two groups via the one to many method, many to many information flows are formed.

From information exchange among suppliers and retailers, a retailer needs to order material from a number of different suppliers, and one supplier needs to provide goods to different retailers. Thus a many to many information flow is formed. This model is presented in Figure 3.8.

![Figure 3.8](image-url)

**Figure 3.8**
**Many to many information flows**

In many to many information flows, many operations are repeated and the information flow complexity is $N^2$. Thus, many to many information flows are cost and time inefficient.
8. **M-1-M Information Flows.** If the information flows use one agent as the center for gathering and handling information, and sends this agent to its final destination, then an M-1-M information flow is formed. This information flow is presented in Figure 3.9 below.

![Figure 3-9 M-1-M information flows](image)

The use of agents can simplify information flows among organizations. For example, a value added network center can gather and compile data for several retailers and retransmit it to suppliers. This information flow falls into the type M-1-M and its complexity can be reduced from $M^2$ to $2M$.

**IV. Use of information flows to improve business processes**

A. **Introduction to information flow diagrams**

This study analyzed a business process from the perspective of information flows, and the process was compiled in an information flow chart demonstrating information transformation and identifying discontinuities and improving effectiveness achieved through IT support. This section presents an explanation of analytic technique.

Process analysis comprehensively examines relations among units. Process analysis addresses problems such as repetitive work, inappropriate handling, and delay with techniques to remove, combine, rearrange, and simplify processes to create a rational and efficient work environment.

Process flow diagrams are widely used for analysis. Generally, process flow diagrams are used to identify relations among relevant units, and are based on research to review original processes to enhance efficiency.

Data Flow Diagrams are often used to analyze information systems involving relations between information transformation and data storage.
This study used the advantages of work relations among units described in the process flow diagram and the abstraction of handling function and the data transformation method described in the data flow diagram to describe the information transformation process among the required knowledge and activities, and then drew a data flow chart accordingly. From the above discussion, sufficient information is required to conduct the business process activity. This activity can only be carried out if the executors have the necessary knowledge and information from the previous executed activity. To understand the role of handling process and knowledge transformation information in the business process, this study used a data flow diagram to show the analysis. The symbols used are shown in Figure 4.1:

<table>
<thead>
<tr>
<th>Class</th>
<th>Symbol</th>
<th>Name</th>
</tr>
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<tbody>
<tr>
<td>Flows</td>
<td>.......</td>
<td>Process flow</td>
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<tr>
<td></td>
<td></td>
<td>Information flow</td>
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<td></td>
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<td>Electronic information flow</td>
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<tr>
<td>Processing activity</td>
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<td>Process</td>
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<td></td>
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<td>Delay</td>
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<td></td>
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<td>Checking</td>
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<td>Storing activity</td>
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<td></td>
<td>Computer file</td>
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<tr>
<td>Knowledge</td>
<td></td>
<td>Knowledge</td>
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<tr>
<td>Starting/ending</td>
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<td>Starting/ending</td>
</tr>
</tbody>
</table>

Table 4.1
Symbols used in the data flow diagram

The symbols are defined as follows:
1. ....... : process flow – representing the sequential relations in each process activity, ordered from left to right.
2. information flow – representing the information source required for carrying out the activity.

3. electronic information flow – representing the information source required for conducting the activity in an electronic form.

4. process – representing the actions involved in handling information in an activity, including written information, data entry, and so on.

5. delay – representing the delay or interruption of information flows. Delays occur when a scheduled activity does not take place at the scheduled time (mainly owing to handling and inspection delays) thus creating a time gap. Examples include mail and files left on the table awaiting handling and so on.

6. checking – representing checking, inspection, and auditing for information content (including accuracy and consistency of information content, and so on). For example, comparing various receipts and re-checking and so on. This kind of activity does not generate substantial added value for information flows.

7. document file – storing data for reference;

8. computer file – using electronic media for information storage.

9. knowledge – a list of knowledge required in an activity.

10. starting and ending – representing the beginning and end of a process.

Figure 4.2 presents the profile of the data flow diagram, in which the vertical axle represents an employee or unit and the horizontal axle represents time. The activities are drawn in the diagram sequentially by connecting diagram symbols and process direction line. The next step is to discover the source of information for drawing the information flow. If the direction of process and information flows is the same then the information flow is used to represent this. The following section presents detailed analysis.
Figure 4.2
Profile of the data flow diagram

The sequence of activities in the above diagram means that after an order is placed by telephone or fax, employees compile the form for approval by the relevant unit. For example, employees send the form to the production unit to obtain a confirmed delivery date, to the accounting unit to check customer credibility, and so on.

The following section discusses the simplification principle and analytical steps of the “information flow diagram”.

B. Principles for simplifying information flow process

Based on the information flows transformation models mentioned above, this study lists some principles for improving information flow, as follows:

1. Simplifying business process principles: Information generated during business process activity contributes to overall information flows (i.e. process activity may generate added value). For processes, which do not generate any added value the information, flows should be removed for process simplification. Letting one person handle a process or combining activities can simplify the process and remove processes that do not add value. Moreover, the use of IT can eliminate processes that do not add value, such as repetitive paper work, and so on. The
principle of process simplification is presented in Figure 4.3(a) and (b) below:

A. Sole decision making power: The job previously was shared among a group, but now is assigned to an individual to avoid information flow delay.

![Figure 4.3(a)](Figure 4.3(a) Principle of process simplification – sale decision-making power)

Activities previously were shared by Units x and y, but following simplification Unit y (or x) has taken over both activities A and B.

B. Combining no value-added activities: Activities that do not add value are removed to simplify the process.

![Figure 4.3(b)](Figure 4.3(b) Combine activities that do not add value)

Initially activities A, B and C are performed by different units, but after simplification activity B is merged into activity A or C.

2. Knowledge integration principle: This principle explores the professional knowledge and skills needed in each process activity. If the knowledge required in each process does not differ significantly, then it should be handled and merged into a single integrated process activity. Combining information technology with proper authorization can achieve improved auditing control and a smoother and more efficient process. Consequently, processing time can be cut, while simultaneously employees can achieve more decision making power, richer work experience and amplification. See Figure 4.4 below for an illustration of the principle of knowledge integration:
3. Real-time process principle: Using deferred for information flows is often the main reason for business process inefficiency, especially for cross-department and cross-organization processes. However, waiting may occur when material and information flows are discordant. Therefore, the use of computers and the Internet can eliminate the above waiting problem by enabling information to be shared and obtained in real-time. That is, real-time information can support “Real-Time Management”.

Figure 4.5 illustrates the real-time process principle diagram:

**Illustration:** Information technology can overcome limitations of time, space, and transformation media to enable information sharing and maximize business process efficiency.

4. Integrated storage principle: Traditionally, information storage has been scattered and poorly managed because of the use of people, paper, and documents as storage media. This process has caused information flow
discontinuity as manually tracking old data is very time consuming, and finding replacement personnel in the event of an emergency is also a major problem. The use of information technology can assure the consistency of the stored data so that information can be stored and retrieved faster and organizational knowledge and experience can be accumulated. Figure 4.6 summarizes the principles involved in merging and storing data:

![Figure 4.6](image)

Illustration: Using the integrated database to store the required process activity data together so this data can be updated in real-time and information flow time can be reduced.

5. Parallel process principle: When a process activity does not require information from the previous process then the two processes can be handled simultaneously to accelerate operations. In the current situation, when certain information needs to be passed to numerous relevant units or departments, the general tendency is to use paper based documents with multiple copies, a process called the horizontal process. Figure 4.7 illustrates the parallel process principle:

![Figure 4.7](image)

Illustration: When the information source is the same as the diagram shown above, B and C can be processed simultaneously to accelerate the process since C sources information from A and has no relations with B.
6. **Agent usage principle:** Because of the restrictions of transformation media, if the information needs to be passed from different sources to the same destination then the information flows resembles a many to many model (for example, many factories place orders with numerous similar suppliers). If information technology is used to collect and compile the information before sending it to the destination, the information flow model will change from a many to many to M-1-M. Minimizing information flow complexity can increase efficiency. Figure 4.8 presents the diagram of the transformation agent principle:

![Figure 4.8](image)

**Figure 4.8**
Agent usage principle

Illustration: The transformation frequency when adopting the direct transformation method was $N \times M$. When a common agent is introduced, the transformation frequency can be simplified to $N + M$.

C. **Information flow diagram analysis**

This study uses a simple order process to illustrate the analytical steps of the information flow diagram adopted in the business process. The example is as follows: the order process begins when a customer places an order by telephone or fax. The salesperson records the content of the order, compiles an order form, and forwards it to the production department. The production department then checks the delivery time on the order form against its production plan and forwards the form to the accounting department to check the credibility of the customer and provide a discounted price list. Finally, the order form is passed back to the sales department who inform the customer regarding order details.

**Step 1: Draw process flow diagram.** As shown in the diagram below, the vertical axle represents the employees or departments, while
the horizontal axle represents time. According to the sequence, activities are marked as diagram symbols and connected by a direction line.

Figure 4.9
Information flow diagram with process direction

Step 2: Identify required information and knowledge. The diagram below presents the knowledge and information required by each process:

Figure 4.10
Information flow diagram including work knowledge
Step 3: Identify information source for each activity. This step traces the information source of each activity – i.e. an information flow line is drawn from the information source to the activity. The diagram is presented below:

![Information flow diagram after adding information flow](image)

**Figure 4.11**
Information flow diagram after adding information flow

Step 4: Apply the simplification principle to the diagram. The simplification information flow principle mentioned earlier is used to simplify the information flow process diagram generated in step 3. While simplifying information flows, the adequacy of the support provided by the current information technology must be considered. A selection of options can then be proposed for the management authority to select from. For example, the order can be received from the customer via the Internet, after which an electronic file can be created for storing the order form information in the computer hard disk. Subsequently, the sales department can key the order details into the computer. Simultaneously, the accounting and production departments can also deal with their activity on the computer. Finally, the sales department can access the computer and retrieve order data for further processing. (see Figure 4.12)

If the production and accounting departments are engaged in structural activity, an ordering process information system may
need to be established to merge each activity to the sales department. The simplified information flow diagram is shown in Figure 4.13.

Figure 4.12
Information flow diagram after adopting IT

Figure 4.13
Information flow diagram following simplification
Simplified work processes not only can speed up the ordering process dramatically, but also can enhance the customer service quality and efficiency.

V. Conclusion and suggestion

Due to rapid changes in the business environment and fierce global competition, companies have been working aggressively to improve their management abilities. Business activity requires support from information. Thus, the timely obtaining of useful information has become essential for enhancing management efficiency. The main disadvantage of conventional business processes is restrictions related to transformation media. Additionally, in existing organizational structures, information flows are a sequential method of transformation, and some processes do not create added value. Identifying a method of improving inefficient business processes thus has become a pressing issue.

This study defines information flows from the perspective of a business process. Information transformation among business processes forms information flows, meaning that information flows comprise the information required for each process. Regarding activities in each process, information flows can be explained in terms of the following five phases:

1. information source;
2. required knowledge;
3. information flows following process completion;
4. operator of activities in a process; and
5. the transformation media.

This study proposed eight information flow transformation models to help managers to understand business process bottlenecks systematically and effectively. These eight models were derived from different dimensions, such as organization and group communication, operator and time. The models included:

1. sequential information flows;
2. deferred information flows;
3. real-time information flows;
4. parallel information flows;
5. wheel information flows;
6. one-to-many information flows;
7. many-to-many information flows; and
8. M-1-M information flows.

From the transformation models of information flows, this study proposed six principles of information flow improvement in business process supported by illustrated diagrams. These six process simplification principles are, knowledge integration, real-time process, data merging and saving, parallel process, and use of agents.

This study suggested that managers use an information flow diagram and a simplified business process to present business process more clearly and easily. Managers can also analyze existing information flow transformation and identify information flow discontinuity. Accordingly, a solution can be identified from among available information technology to improve business process efficiency. The advantages of this study are:

A. *Completeness.* Using process view operator and time as axles to present information flows in business process clearly enables employees to gain a good understanding of information flows among different business divisions that do not involve abstract changes.

B. *Simplicity.* This study used only ten symbols from five diagram types to indicate information flow transformation. This approach is convenient and simple, and is easy for all members of the organization to understand and use.

C. *Validity.* This study proposed six simplifying principles and a set of analytical steps. Combined with the diagram symbols, the method presented here can assist business process simplification and improve business process efficiency.

However, this study did not consider the issues of organizational system, efficiency system, organizational culture, and overcoming member resistance to organization change. Individual workload and safety, supervision, responsibilities among activities also were not considered. We hope to conduct further research on this area to undertake a more comprehensive study of the Information Flow Diagram.

**References**


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