Chapter 6

Process View of Organization and Information Systems

This chapter explored relationships between IS and the business process. Analyzed will be the relationships between IS and business process design and process performance. These relationships make the essence of the business process management (BPM) model which was introduced in Chapter 5. Effects of IS on process performance – indirectly via process design and directly – will be explained. It will be shown that IS play three role in relation to business processes – the process design optimizer, building block of process design, and process performance booster. The terminology in this chapter is elaborate and requires attention (taking notes, such as drawing the different relationships discussed may help).

The basic model of managing organization from the process perspective, or Business Process Management (BPM), was previously introduced. As depicted in Figure 1, the BPM model relates IS with process design (composition, coordination, complexity, and flexibility) and directly with process performance (process time, cost, and customer value). IS influences process design by IS functionality (specific tasks performed) and by technological properties (e.g., by mobile capabilities of the IT deployed).

The BPM model in Figure 1 also shows that process design influences process performance. Since IS influences process design, it follows that IS indirectly impacts on process performance as well. However, IS also make a direct impact on process performance via non-functional characteristics (e.g., the speed). Therefore, IS play three roles with regard to the management of business processes – the process design building block, the process design optimizer, and the process performance booster. This chapter will discuss each of these.

The Impact of Systems’ Technological Properties on Process Design

Since information systems supporting operations are literally built into business processes, the technological, physical properties of an IS make part of process design. IS Properties refers to the coverage and technological aspects of an IS supporting a business process. In other words,
this role of IS reads as building block for business processes. Refer to Figure 1 and the horizontal dotted line in the beginning of the chapter.

The building block role of IS becomes apparent when you look at the part of a process that is automated, that is, rests on IS. Professionals call this a “system footprint.” Processes differ on the level of automation. The larger the system footprint, the more the system properties are the aspect of process design. For example, a modern university course registration system may have a large footprint that pretty much defines the registration process. In contrast, in the past this process was largely manual and just deployed a database for storing registration records.

There are several technological properties of IS that influence process design. One is the types of IT used in an IS, such as computers, mobile devices, computer networks, etc. A process with more mobile devices has more of a mobile design as opposed to static design based on stationary computers.

Another important technological property is database design. For example, databases can be in one place or distributed in space. In the latter case, a process needs to stretch over geographical space and to involve computer networks. Finally, the look of user interface is also important. Screen sizes, screen items (e.g., images, buttons, and graphics), and formatting (colors, fonts) are apparent features of process design in the eyes of a process performer.

Figure 1. BPM Model: IS, Process design, and process performance

The Impact of Systems’ Functionality on Process Design

This section discusses the broadest area of IS impacts – how systems’ functionality improves (optimizes) process design. It also discusses how an optimized design aspect has effects on the process performance (customer value, cost, and time).

Optimizing Process Composition with Information Systems and Process Performance Effects

IS can help in optimizing process composition, so that all the needed steps are included and connected in a flow leading toward the process deliverable. An example is the well-known car
manufacturer Ford. The company was struggling with the management of car parts delivered by its many suppliers. When ordered parts would arrive at Ford, a unit numbering 400 clerks had to check whether the deliveries matched order specifications. Most of this work was manual. At the same time, Toyota employed about a dozen people on the same task. Ford decided to turn the leaf. The company redesigned the process by resting it on a new IS. The system compared product numbers appearing on electronic orders with the product numbers of received parts that were bar coded into the system. Mismatches were thus automatically detected and odd parts were slanted for reordering.

From the perspective of process performers, the process became leaner, with a fewer number of steps to be performed. Many of the previous manual steps were encoded in the system. Therefore, looking from the process performer perspective, process composition was optimized.

Although this was not a sophisticated system but rather a standard TPS, Ford ripped significant benefits from it. For instance, just the number of workers performing in the parts checking process was reduced by 10 times. This change reduced process costs. In addition, savings were generated in processing time per order. This change reduced process time. Finally, the internal customer to the parts checking process – the inventory staff – was served with fewer mistakes and faster. In other words, the customer value of new automated process had increased.

Another example of composition optimization is also from the automotive industry. Korean car manufacture Kia had experienced quality problems. Seeking solutions, Kia introduced a computer network that connected its engineering units with dealerships running service shops. The systems at the Kia premises were linked with those at dealers’ premises. Each failing part identified by service shops was reported automatically back to Kia’s engineering. Engineers studied the failures and proceeded to improving problematic parts.

Information systems and the connecting network deployed by Kia and dealerships represented a significant improvement over a manual, delayed monitoring of part problems. The composition of the revamped quality control process was this inter-organizational. Process optimization involved new steps, such as the feedback from service shops, and feeding it into Kia’s engineering work. Data flows worked always in a certain way without variation that characterized the manual handling of data.

Payoffs resulted in the process performance. The effectiveness in identifying and fixing part failures had increased. Kia’s production process was served with better parts, thus the internal customer’s value increased. Over time, Kia managed to reduce significantly failure rates and the overall quality of its cars. Kia’s consumer (external customer) benefited from this improvement, getting the cars that were cheaper to maintain. Kia’s stakeholders gained as well from an increase in market demand and customer loyalty.
Optimizing Process Complexity with Information Systems and Process Performance Effects

An IS can be the instrument for reducing process complexity, simplifying a process. A good measure of process complexity is the ratio between the number of step in a given process and the number of steps in a benchmark process, as this formula shows:

\[
\text{Complexity} = \frac{\text{Number of Steps}}{\text{Number of Benchmark Steps}}
\]

This ratio indicates whether a given process needs to be simplified because a higher complexity usually causes higher expenses in process time and cost.

One way of IS reducing complexity is by moving manual steps to software, that is automation. Thus, an IS can “absorb” complexity, so that a process appears simpler to the process performers. As a system performs some activities and decisions instead of people, the process scope appears smaller from the stance of process performers. Apparently, this effect can be similar to that of composition. So the Ford case is also an example of complexity reduction. The difference is that an IS affects a process composition with regard to what the steps are, while the number of steps may not be reduced. The example is the Kia case where composition of the quality control process changed but complexity increased.

An example of complexity reduction is the systems supporting decision making of higher management and of professionals – Decision Support Systems (DSS). DSS can perform very complex calculations on behalf of the user, which would be difficult to do even for a group of experts. Such calculations are actually whole sub-processes. The decision making time and costs are therefore reduced in part of these complex steps that are absorbed by a DSS. This way, any organization deploying DSS benefits from time and cost savings.

Another example of optimizing complexity with IS is historical in character. With the deployment of a transaction processing system (TPS) supporting supervisory management, some tasks traditionally performed by mid-level managers were shifted downward. A typical task of mid-level managers used to be summarizing figures on organizational performance for reporting up the hierarchy. The database software with querying capabilities (that is, DBMS) was improving over time. At some point, it became simple enough for the supervisors equipped with TPS to perform a part of reporting tasks.

The change in the supervisors’ reporting process triggered an opportunity for reducing the size of middle management in many organizations. The remaining ones were served with improved supervisors’ reporting that could be easily turned into reports for top management. Therefore, complexity was optimized with TPS in both the supervisory reporting and in the middle management reporting. Improvements in these management processes generated gains on the process performance side. The supervisory reporting was performed more quickly and accurately. The middle management reporting required a smaller number of people and, therefore, smaller costs.
Optimizing Process Coordination with Information Systems and Process Performance Effects

Systems can enhance process coordination. One aspect of coordination is that all process activities and performers equally contribute to the end deliverable. The supply process at Walmart is a good example of how this can be done. The process involves Walmart stores, distribution centres, and suppliers. It rests on Walmart’s corporate computer network that connects all these players together. Business documents are in electronic format and they are moved via electronic channels between the supply chain partners. Many companies do the business this way today. However, Walmart introduced its supply network decades ago, and it has undergone several technological transformations since then.

Walmart’s computer network passes the figures on inventory depletion from stores in a city area to a regional distribution centres (Figure 2). These centres deliver the needed supplies if they are available. If the needed goods are not on stock, a Walmart centre sends an electronic order to a supplier. The supplier acknowledges the order and organizes a delivery right away. If the goods are not available, the supplier places the order up the supply chain by contacting its own suppliers. Figure 2 depicts this electronic supply process between Walmart and one of its suppliers. The figure cites technology called RFID (Radio Frequency Identification). RFID includes electronica tags placed on boxes in a warehouse. A tag contains a product number and the quantity of the boxed product. As the boxes move out, their tags are automatically read, so the inventory level is adjusted in a database.

Smooth moving of electronic data apparently facilitates efficient moving of physical goods along the supply chain. There are the time and cost savings gains for all the customers involved in this well-coordinated supply process – Walmart stores, distribution centres, as well as suppliers.

Process coordination is also about time-related dependencies between process steps. Steps can run one after another, in which case dependence is sequential. Or the steps can run at the same time, creating parallel dependence between them. A business process is optimized by turning sequential dependence into parallel. This change always yields time savings.
In situations of group brainstorming that may be part of strategic planning, group decision support systems (GDSS) are used for enabling work in parallel. A group of planners may sit in the same or different places, and type their ideas on their computers (Figure 3).

Computers are connected into a network, and the meeting is usually guided by a human facilitator. After the members have done some writing, the facilitator may suggest that the individual contributions get displayed anonymously on a shared white screen. A further task would usually be to seek similarities between items and to create a more compact list of ideas out of initial contributions. Apparently, a GDSS allows for brainstorming to be performed in a parallel fashion. In contrast, members in a face-to-face meeting can talk only one at a time.
Therefore, sequential dependence between talking steps is transformed into parallel
dependence. IBM used parallel brainstorming with GDSS a lot when the company was going
through a major period of transformation.

The parallel brainstorming via GDSS saves the meeting time. When a price tag is attached to the
saved labor hours, one can see how much money is saved due to the meeting efficiency. This
process may also increase the satisfaction of the process customer – managers. More honest
and higher quality ideas can be generated since the process performers can express their
thoughts anonymously and have more time available.

*Optimizing Process Flexibility with Information Systems and Process Performance Effects*

Systems can assist in bringing process flexibility – the extent of variation – at a desired level.
Remember that optimizing flexibility is less straightforward than optimizing process design
aspects discussed so far. Operational processes need less variation than strategic processes.
Therefore, a process analyst may need to drive out variation from an operational process, while
necessary variation may need to be introduced in a strategic process. IS can be the means to
either end.

It helps to think of variation in terms of (A) availability of options, and (B) deviation from a
benchmark. Variation form A may be desirable, while form B may not be so. Take for example
various reservation processes (hotel, travel, university course). Initial activities in a reservation
process engage an external customer. To increase convenience for the customer, different IS
can be used – the landline telephone, the smart phone, email, and a Website with a form to fill.
In effect, the reservation process has several composition versions. The consumer gets a larger
convenience as the value delivered by such a process.

In contrast, the quality control process in manufacturing needs to meet a benchmark
composition and consequently performance. It rests on controlling variation between a part
under production and desired size, shape, and other characteristics. In modern car
manufacturing, the quality control process is automated via IS that continuously inspect and
report on the state of assembly lines. Executing this quality control process as it was designed
warrants the product quality that the consumer will eventually enjoy. Deviations are risky. In
addition, reducing the parts fallout (waste) is a cost reduction effect of the automated quality
control in car manufacturing.

The discussion so far has addressed examples of the optimization of process design with IS. As
well, the effects of this optimization on process performance were cited. Table 1 summarizes
these effects, that is, process performance improvements in terms of time cost, and customer
value.
Table 1. Examples of process optimization with IS and process performance effects

<table>
<thead>
<tr>
<th>Process Design aspect optimized</th>
<th>Time</th>
<th>Cost</th>
<th>Customer Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Composition</td>
<td>Saved process time at Ford</td>
<td>Labor reduced at Ford</td>
<td>Quality improved at Kia</td>
</tr>
<tr>
<td>Complexity</td>
<td>Savings in decision making process time &amp; cost</td>
<td>Savings on mid-level management</td>
<td></td>
</tr>
<tr>
<td>Coordination</td>
<td>- Efficiencies in Walmart’s supply chain</td>
<td>Price of saved labor hours with GDSS</td>
<td>- Satisfied partners in Walmart’s supply chain - Better ideas for management with GDSS</td>
</tr>
<tr>
<td></td>
<td>- Savings in meeting time with GDSS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flexibility</td>
<td>Automated quality control in car manufacturing faster than manual</td>
<td>Less fallout due to better quality control in manufacturing</td>
<td>- Convenience in consumer’s reservation process - Product quality in manufacturing</td>
</tr>
</tbody>
</table>

The Impact of Systems Non-Functional Characteristics on Process Performance

The IS performance is also a measure of process performance. This is another role that IS play in business processes – the process performance booster. Refer to Figure 1 and the vertical dotted line in the beginning of the chapter. Non-functional characteristics of an IS directly affect the process performance.

The most important non-functional characteristic of an IS is the speed. It depends on many factors, such as the speed of data processing, transfer, and retrieval; size of main memory; the capacity of data transfer channels; and so on.

Another important non-functional characteristic is the IS reliability. It is measured, for example, in the amount of system downtime, recovering capability, and data security. Each is described below. The system downtime is the period during which the system does not function due to system errors (e.g., Random Access Memory is jammed and the system has to be rebooted to be operational). The shorter the system down time, the better the business process performance.

The recovering capability of IS shows up when a system fails to perform entire programmed operations or crashes due to power loss or other problem. Then the system needs to be recovered to the state before the problem occurred. The shorter the system recovery time, the smaller the losses in business process performance.

Security of system data is an increasingly important measure of system reliability. Data security is being continuously challenged by the expansion of computer networks and particularly the
wireless types. The higher the system security, the smaller the losses in business process performance.

**Summary: Three Roles of Information Systems in Business Process Management**

Summarizing the preceding discussion, it can be seen that IS plays three roles in business processes management (BPM):

- Technological characteristics of IS make the *building block* in process design
- IS functionality makes IS the *process design optimizer*
- Non-functional characteristics of IS are the *process performance booster*.

These labels have already been included in the BPM model in Figure 1; Figure 2 depicts the same ideas more directly. Managers should continually take care of the process optimizer role since fine-tuning of an IS for the sake polishing the belonging business process is almost always possible. These changes are incremental (smaller in scope, building on each other). For example, process complexity could be optimized by cutting out unnecessary steps, which implies eliminating some of the data entry; flexibility may be increased so that process performers/system users have alternative ways of completing a particular procedure; and so on. On a longer run, however, a more radical change of the process and its system(s) have to be performed. This usually means redesigning (re-engineering) the process and building a new system for it. For example, reporting today requires a more comprehensive approach that accounts for new sources characterizing Big Data. Decision making processes thus need a revamping with support of new systems for analyzing Big Data.

Technological properties of IS are always a part of the business processes that systems are built into. In this context, the management goal is to adjust these properties to the goals of current and future business. For example, deploying mobile technologies in order to enable spatially distributed processes is one of key requirements today in organizations of all sorts.

As for the direct impact of IS on process performance via a system’s non-functional characteristics, it should also be attended to in regular intervals. The quality of computer hardware and of system software is another name for non-functional characteristics. Therefore, the management should initiate hardware and system software upgrades in accord with technological progress and the company’s IS strategy. This does not necessarily mean, however, that a company must implement every new piece of hardware as soon as it appears in the market. For example, if an IS strategy favors a moderate pace of technological progress, updates are normally slower than with a strategy of early adopter.
Questions for Review and Study


5. How can technological properties of an IS affect process design? What is the label for this IS role?

6. How can non-functional characteristics of an IS affect process performance? What is the label for this IS role?

7. What are the differences and similarities between process design and process performance?