TRANSACTION PROCESSING APPLICATIONS AS ORGANIZATIONAL MESSAGE SYSTEMS: IMPLICATIONS FOR THE INTELLIGENT ORGANIZATION

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ABSTRACT

The paper analyzes three types of transaction processing systems which support customer feedback in terms of four message system processes: routing, summarizing, delay and modification. The ability of transaction processing systems to facilitate intelligent decision making is seen as a function of the extent to which an organizations is able to structure the incoming transactions. The amount of structure then determines the extent to which information technology can increase the efficiency of message processing and minimize the amount of individual discretion which can result in message delay and distortion.

1. Introduction

The concept of the "intelligent organization" has recently evolved to describe organizations which are able to acquire and use information to both make and implement effective decisions [8]. Intelligent organizations are characterized by learning and collaboration, and are supported by technology [18]. Changes in organizational environments accompanying the current transition to a post-industrial economy pose particular challenges to organizations. As environments become more complex and turbulent, organizations must respond by making decisions more rapidly and more frequently [7,8]. Further, the dramatic increase in the number of service organizations means that fewer organizations can buffer their core technology from environmental influences through the use of special boundary spanning units, since the core technology of service organizations is located at the organization's boundary [23]. Nonetheless, the intelligent organization will still design special sensor units to buffer the decision-making units from information overload [8]. Recent advances in information technology which supports computing and/or communication provides the tools for organizations to develop information systems to effectively channel to management the information they need to support intelligent decision-making.

One inference that could be drawn is that all of these environmental changes create a mandate for the intelligent organization to scrap its existing portfolio of management information systems and start from scratch. On the contrary, this paper will argue that instead, organizations need to adopt an organization-wide perspective for their traditional information systems, and to build into these existing systems the capabilities to support intelligent decision-making.

The purpose of this paper is to rethink the role of one traditional type of MIS application, the transaction processing system, as a means to promote intelligent decision making by viewing transaction processing systems as organizational message processing systems [6]. First, the characteristics of organizational message systems as they apply to transaction processing will be reviewed. Next, the paper will describe three types of transaction processing systems which support one primary activity in the service segment of the value chain, customer feedback. Each of these examples differs in the degree to which the incoming transactions are structured, and therefore in the extent to which information technology can be used to support transaction processing and ultimately to promote intelligent decision making. The paper will conclude by suggesting potentially fruitful areas for future research.
2. MIS View of Transaction Processing

Transaction processing systems (TPS) form the basis for other information systems which facilitate intelligent decision making within organizations. One predominant view of transaction processing as an organizational activity is that transaction data are aggregated as they move upward in the organization and these data serve as one input to decision-making by middle and top management [1]. Further, organizations seek to gain efficiency by developing rules to structure both the handling of large volumes of routine data as well as the exceptions which invariably arise [15]. Transaction processing systems may be characterized as playing two important roles within an organization: as a major producer of information for other information systems, and as an organizational boundary spanner [12].

The organization-wide role of transaction processing systems has generally not been recognized in the MIS research literature. In many MIS textbooks, transaction processing is viewed as an activity involving primarily operational-level personnel, with emphasis placed on the physical aspects of transaction handling such as choosing among alternatives for sensing and recording transactions, and the types of controls needed to ensure the accuracy and the integrity of the data.

The majority of attention within MIS has also been directed toward the role transactions consisting of highly structured, fixed-field numeric data play in producing the input for other systems based on these structured data. Once these kinds of data have been captured, it is a relatively simple matter to provide organizational access to these data through a wide variety of information systems ranging from structured reporting systems to less-structured decision support systems which support ad hoc queries. This view of transaction processing, however, oversimplifies the information reality faced by most organizations. In addition to highly structured transactions (such as a sales order or a warranty card), organizations also need procedures to sense, capture and process unstructured transactions (such as complaint letters consisting entirely of text).

2.1 TPS As Organizational Boundary Spanners

The second major role that transaction processing systems perform for organizations, that of spanning the boundary between the organization and its environment, has only recently begun to receive attention in the MIS literature. For example, interorganizational transaction processing systems are seen as providing competitive advantage to an organization as in the case of electronic linkages between suppliers and customers [2,9,19].

In reality, even the most traditional transaction processing systems have always served as boundary-spanners by connecting an organization's customers with its warehouse or marketing department, its purchasing department with sources of raw materials, or its public affairs department with interested stakeholder groups [12]. These results from these and other transactions have the potential to inform managers at all levels not only about the status of internal operations, but also about the external environment, and therefore to promote more intelligent decision-making.

2.2 TPS As Message Processing Systems

In their boundary-spanning role, transaction processing systems are really organizational message processing systems. Messages in the form of both raw and summarized transaction data and exception reports, flow upward, providing feedback for management control. At the top of the organization, aggregated transaction data are combined with other inputs and used by top management to formulate an organization's strategy. The resulting goals are subsequently communicated downward and are used to adjust the decision rules which operational-level personnel use to make structured decisions associated with the processing of individual transactions at the bottom of the organization.

When transaction processing systems are viewed as message systems, transaction processing systems may then be designed and evaluated in terms of four fundamental organizational processes which characterize all message systems: message routing, message summarizing, message delay and message modification [6]. Message routing causes any particular message to be selectively distributed, thereby minimizing the risk of information overload by not routing messages to receivers who have little or no use for the information. Message summarizing serves a similar role by reducing the physical size of the message without any loss in content. Message delays may be routine or excessive, and may occur in conjunction with message summarization.
Message modification refers to the distortion of the meaning of a message, whether due to the motivations or the cognitive limitations of the sender or receiver [6]. These four processes affect the availability of information for intelligent decision-making throughout an organization by either facilitating or inhibiting the timely dissemination of information. The efficiency of the message system is a function of ability of the system to route and summarize messages. Delays and distortion result when organizational sub-units exercise discretion in message processing [6]. The failure of "messages" from the transaction processing system to reach the appropriate decision-maker in an appropriate format and in a timely manner can negatively affect the organization's overall performance.

Consider the example of an inventory control system for a manufacturing firm. For each sales transaction, the level of inventory on hand for a particular product is decreased by the quantity sold. The inventory levels maintained by the system for each of the organization's products are in reality messages to management about customer preferences for each of these products. When management receives a "message" from transaction processing about either unexpected stockouts or excessive inventory on-hand, the message should serve as a trigger to adjust the original marketing forecast for a particular product (e.g. put an item on sale or adjust the EOQ or the reorder point), or perhaps even to discontinue the product altogether. For an airline, messages about flights which are continuously overbooked or regularly fly nearly empty serve a similar function as the inventory system in the manufacturing firm, as seats on a flight represent one "inventory" maintained by an airline.

The inventory control examples above may be used to illustrate how the four processes defined by Huber apply to transaction processing systems. Message routing occurs whenever a printed report is distributed to a selected group of individuals, or when a manager chooses to access the report using a DSS. When a manager receives an exception report showing stockouts or excessive inventory on hand by product category, by quarter or by warehouse location, message summarization has taken place. Message delays occur when printed reports are not distributed on a timely basis, or if excessive delays occur in the actual transaction processing which updates the inventory database, so that even the online system doesn't reflect the current status of the firm's inventory. Message modification is less likely to occur in this situation where the report (message) has a pre-defined format and travels electronically to the intended recipient where it is accessed at the discretion of the receiver, rather than being transmitted through a number of communication links [6].

From even this brief example, it is clear that the transaction processing systems as message-routing systems function most effectively when the data are received and processed at a single location, when the data are structured, and when the system itself is computer-based with online access. Based on the propositions advanced by Huber (1982), these system characteristics promote message routing and message summarization based on the needs of the user, and minimize the likelihood of message delay and message modification. If the effective functioning of these message systems promote intelligent organizations, the challenge facing organizations is to build structure into their unstructured transaction processing activities so as to capitalize on available information technology for message dissemination.

The remainder of this paper will discuss organizational strategies for applying information technology to the development of transaction processing "message" systems to support one activity in the value chain, customer service.

3. Customer Service Message Systems

Service was identified by Porter & Millar [19] as one of the five types of primary activities that comprise a firm's value chain. Given basic similarities in many of the products and services currently available, competitive advantage may be especially difficult to sustain where the advantage sought is based solely on the design of the product or service. Lele [13] notes that both technological and feature advantages are short lived. As a result, both firms and customers are focusing on service as a key differentiator. For the firm, service support is emerging as an important source of profits as well as competitive maneuvering. Of particular interest here is one specific service activity, processing of customer feedback such as complaints and inquiries. Each individual complaint or other inquiry represents a transaction which the organization may handle, independent of the communication medium by which it arrives. As messages, these complaints or inquiries have the potential to serve as an early warning system.
As Ives and Vitale [10] point out in their article on post-sale maintenance, this overall area has received little attention in the academic community. While the demographics of complaint behavior have been addressed from the perspective of the individual client in the marketing literature, this research provides no insights on how these messages are managed from the organization’s perspective [5,6,20]. A 1987 study conducted by the Gallup Organization for the American Society for Quality Control found that only 13% of their sample of top executives relied on customer complaints to determine the quality of their products or services. A potential need for more intelligent organizations.

In the next section of the paper, three approaches to processing customer feedback, ranging from highly structured to highly unstructured, will first be described, and then analyzed in terms of their message processing capabilities using Húber’s [6] four processes. For each example, the potential role for information technology will also be discussed.

3.1 Comment Cards: Structured Transaction Processing

The majority of hotels in the United States provide “comment card” forms in the guest rooms to gather feedback from their customers. These pre-addressed forms generally consist of a one-page questionnaire which asks the guest to rate his/her satisfaction with various aspects of the hotel such as the quality of the room, restaurants, and service received from hotel personnel. Space is also provided for the guest’s name and address. An executive with one major hotel chain indicated that his firm received approximately 750,000 completed cards per year. In this organization, each returned form is read by a manager, coded as to whether the form was to receive a reply, and the response (but not the information about the hotel guest) entered into a database. The database is accessible to management personnel throughout the organization, and serves as a means to transmit “messages” about levels of customer satisfaction with each of the hotels operated by the organization. In addition, printed reports were distributed to and read on a regular basis by the CEO.

Where the comment card processing activity is supported by a computer-based information system and a database, the routing and summarizing processes of the message system are likely to promote widespread availability of information which can promote intelligent decision making. If summary reports are available by product or service, the probability of overload to the message recipient is minimized. If the database is available throughout the organization, messages within the database are widely available to support decision-making rather than having access limited by independent of the sender’s perceptions of message relevance to a given individual [6].

The extent to which message availability may be jeopardized by either delay or modification is also a function of technology. Where individual forms may be scanned by an optical character recognition equipment, delays are minimized. At the other extreme, manual processing of forms is likely to result in delayed routing of summarized messages, however, manual processing may insure that individual exceptions meriting immediate attention are handled without delay. Message content may also be subject to delay or modification depending on the point where the forms enter the organization. In the case of hotel chains, if comment forms are returned to the management of the individual hotels, message delays are likely to result in transmission from the individual hotel to the corporate offices. In this situation, the probability that messages about poor performance will be distorted by the offending hotel before the message is transmitted upward is also greater [6]. The benefits of the technology described above are less likely to be realized when comment cards are mailed to individual hotels for both economic and technical reasons.

3.2 Toll-Free Lines: Semi-Structured Transaction Processing

A number of organizations including General Electric, Coca-Cola and Otis Elevator have installed toll-free telephone lines to respond to customer inquiries and complaints. Often these systems are supported by a database containing product information [2,19,21]. These systems are examples.
of semi-structured transaction processing applications because unlike the comment cards described above where the information is collected by means of a fixed-format form, the operator who receives the call must match the caller's query with the appropriate section of the database, at which point further processing becomes routine. Comment cards which include narrative comments are also examples of semi-structured transactions as the written comments require individual analysis before they can be processed.

As in the case of the comment cards, the database system provides a means to generate "messages" about customer satisfaction with and attitudes about the organizations products. As the operator pages through the database to locate the answer to the caller's query, the system can develop the "text" of the message by recording the identity of the various screens that are viewed. This type of system also has the potential to tag messages with demographic data about the caller such as the caller's location. For example, General Electric may receive a number of calls about how to operate a certain feature on one of its products. From these messages, management may infer that it needs to improve the documentation accompanying the product.

As was true for comment cards, the extent to which messages resulting from the use of a toll-free number facilitate intelligent decision making is also likely to be a function of the role technology plays in the system. If the database system described above is used, message routing is likely to occur in the same way as with the comment cards. Safeguards against information overload are again provided by the system. Whether the system is supported by a computer or not, summarization provides the potential for loss of message content when the text of the original message conveyed by a rich communication medium, voice, is summarized either by the person taking the call, or by the system as it records screens which are viewed.

Technology will also affect message delay and message modification. Without automated data collection, delays in information availability are likely to occur. As the workload of the unit processing the incoming calls increases [6]. Message modification is more likely to occur as the number of links over which a message must travel increases [6].

A variation of this type of system is IBM's INFOExpress system which allows certain IBM customers direct online access to technical support information and information about various IBM publications, rather than accessing the system through an intermediary. IBM still has the ability to electronically track "inquiries" by customer.

3.3 Individual Letters: Unstructured Transaction Processing

All organizations that deal with the public receive mail, whether or not they have instituted other mechanisms such as those described above to promote access to the organization from the client's perspective, and facilitate message processing and information availability from the organization's perspective. Unless an organization is the target of an organized mail campaign where a large volume of identical letters or postcards are received, mail processing tends to be a highly labor-intensive activity as every letter must be read and analyzed and tabulated in order to create messages which are potentially useful to management. For example, a chain which developed a sophisticated decision-support system to analyze comment cards, was unable to apply the same system to letters it received. For the letters, the primary "messages" developed for consumption by management consisted of simple cross-tabulations for each property. In small organizations, messages are likely to be transmitted orally, given the difficulties in structuring and summarizing the messages [3].

One way that an organization may build some structure and intelligence into the handling of mail is to develop a computerized library of standard responses. New entries are created for the library as new issues arise. When a letter is answered, the obvious assumption is that the reply is responsive to the subject of the incoming letter. By tabulating the number of times a particular paragraph or letter is sent, the system generates messages similar to those generated for toll-free lines when the system records the screens used by an operator to respond to a phone call. In addition, by using structured fields in the reply letter, the organization augment the message content with demographic information such as zip code [14].

Because letters consist of unstructured text, technology plays a minimal role in improving the efficiency of message processing. To fully utilize the proce-
dures described above where summary messages about the content of incoming letters are inferred from the content of the replies, all letters must be answered as unanswered letters are not included in the summary totals. In the event of mass mailing campaigns, one form of summarization occurs when the identity and position of the organization behind the mailing campaign is learned [3].

Routing delays may occur because because of the amount of manual screening that is required or because letters are not addressed to the unit within the organization which is assigned responsibility for answering mail. For example, an individual may write to the CEO of an organization when in fact, the mail is to be answered by the unit with actual responsibility for the customer's concern. If the text of the letter is ambiguous, additional routing delays may result. In contrast, for the case of the comment cards, the cards are preaddressed to arrive at the department which has responsibility for their processing, thereby minimizing routing delays.

Messages resulting from the processing of mail are more prone to modification than messages resulting from either comment cards or toll-free lines. First, due to the amount of individual handling required to process a single letter, there is a high probability that the unit responsible for processing the mail will be subject to overload: message distortion is one strategy to cope with this overload [6]. For example, anecdotal evidence exists about employees in legislative offices and at the U.S. Internal Revenue Service destroying correspondence when the volume of incoming mail exceeded the ability of existing personnel to process this mail within the workrules of the sub-unit.

4. Conclusions

From the above discussion, it is clear that a range of methods are available for individual consumers to communicate with organizations ranging from the use of a highly unstructured medium, letters, to a highly structured medium, comment cards. Each method carries with it a different set of costs and benefits to the organization. In general, transaction processing viewed as an organizational message system functions most efficiently when the organization implements a method which promotes structuring of the incoming transactions so as to promote efficiency, and minimize the risks of delays and distortion. It was also shown how the use of information technology minimizes the risk of message delay and modification, and promotes intelligent decision-making by facilitating access to information. However, current technology is most readily applied to structured rather than unstructured applications.

While the discussion above illustrates the general advantages to the organization of taking the initiative and implementing a method which structures the communication process between the customer and the organization, and makes optimal use of information technology, the intelligent organization will clearly choose a method which maximizes the information gathered at a minimum cost to the organization. For example, one organization found it made great business sense to implement an extensive system for handling individual comments from its hotel customers, but not from the patrons of its family restaurants. Instead, the firm has an employee visit each of its restaurants on a regular basis and complete a "comment card" for the restaurant which is processed using similar procedures to those employed for the hotels.

The functioning of transaction processing systems as organizational message systems as reflected through the variables and propositions developed by Huber [6] is clearly an area which merits empirical research. Of particular interest is the ways these systems reflect their organizational context. How do the characteristics of the system and the use of information technology interact with the organizational context?

Another potentially interesting area for research relates to the benefits that an organization may derive from initiating a formal message system which provides feedback from its customers. Under what circumstances do such systems provide a sustainable competitive advantage to organizations? If an organization fails to transmit messages about customer dissatisfaction to the appropriate management efficiently and accurately so that corrective action can be taken, is a likely result increased government regulation? To what extent does a single transaction or an initial exception signify a condition warranting management attention? When organizations develop message systems which structure incoming transactions and also rely heavily on information technology to perform the routing and summarizing functions, do they lose the early warning capabilities that may exist in a system which accepts semi-structured or unstructured inputs?
and as a result are forced to rely more heavily on human judgment? Given external environments which are increasingly turbulent, what is the appropriate configuration for transaction-based message systems in the intelligent organization?

References


