Determining Executive Information Requirements: Better, Faster, and Cheaper

by

James C. Wetherbe
The University of Memphis and
The University of Minnesota

Executive Summary

Determining management’s information needs is historically one of the most time consuming and error-prone activities in designing and building information systems. Most managers spend half their time obtaining needed information, either informally through meetings, phone conversations, or reading; or formally through organizational computer-based information systems. During this process they have to sift through a great deal of useless information, resulting in “information overload.” The proliferating capabilities and plummeting cost of computers should signal relief for weary executives. Unfortunately, most information systems take too long to design and build, and then fail to meet executive needs. Indeed, most new systems require extensive revision (after they are supposedly completed) to even partially fulfill needs, resulting in a terrible loss. Most systems are very expensive to develop and even more expensive to revise. As the pace of business accelerates, decisions that used to be made over a period of weeks must now be made in days, hours, or even minutes. Failure to provide executives with the needed information in a timely manner can result in lost opportunities or in a problem not being solved expeditiously. Increasingly, executives have little reaction time to make decisions on pricing, product introduction, resource allocation, media inquiries, response to competition, and mergers. They need access to information quickly. They can not wait several weeks or months for completion of a computer project. Executives and systems designers need to work together to anticipate and determine information requirements more accurately. This article addresses four reasons for lengthy information requirements and provides a discussion of the failure to meet these requirements. Four straightforward solutions are offered to executives to solve this problem.¹

Introduction

The new vice president of engineering for an aerospace company noticed that he automatically received 32 computer-generated reports each month. He was having difficulty determining the purpose of most of them. Convinced his predecessor received these reports for a good reason and reluctant to admit his inability to find meaning for them, he had an idea. If he found out who the other managers were who also received copies of these reports, he could subtly inquire about their use and thereby determine what he was “missing.”

He asked his assistant to get distribution lists for all 32 reports. Within a week, the assistant returned with the distribution lists.

“So, who gets copies?” the vice president inquired.

“Two people—you and me,” the assistant replied.

Startled, the vice president asked, “What do you do with your copies?”

“They are just backup copies in case you lose one of yours.” replied the assistant.

By paying close attention during the next year, the vice president determined that he only needed four

¹ This article draws from earlier work by the author (Wetherbe, 1991).
of the 32 reports. He also determined there was some very important information he was not getting. He discontinued the unneeded 28 reports, which resulted in immense appreciation from those who had to provide data to generate them. He then began to focus on getting the information he really needed. Over the next year he became frustrated with the inability of the information systems department to meet his requirements. The information systems department, in turn, became frustrated with his inability to make up his mind about the information he needed. Because his requirements were in a constant state of flux, the department had to continually revise the systems, wasting time and money.

The preceding example is all too common and represents a major source of lost productivity among executives and the organization’s computer personnel.

The most important task of an executive is decision making. Outside of his or her intellect, the most important resource an executive uses is information. Yet time and again, executives complain they are overloaded with irrelevant, useless information, while they are unable to obtain the information they need in a timely manner.

The cost and time required to remedy a system that fails to meet management’s needs can often far exceed the cost and time required to develop the initial system. High as it might be, the revision cost might be only a fraction of the opportunity cost of management making a bad decision—lack of timely information for decision making might be a more significant issue. Consider the claims manager who cancelled the insurance of a teenager with a bad driving record. The teenager was the son of the president of a large corporate account, a fact unknown by the claims manager. You can guess the rest of the story.

Fortunately, executives can play a positive role in ensuring that a new system meets their information requirements and in reducing the time it takes for it to do so. By understanding why systems fail to meet requirements and the remedial actions required, an executive can work with systems analysts to get the correct system quickly.

This article covers the causes of and solutions for this problem. First, some fundamentals of information and decision making are discussed. Next, the four common mistakes made both by executives and system designers during design of information systems are reviewed. Finally, four techniques—cross-functional systems, joint application design, structured interviewing, and prototyping—are presented as pragmatic, easy-to-implement solutions for correctly determining executive information requirements.

Managers and Information

One of the most important revelations about managers and information from research and practice is that managers do not know what information they need. A study coordinated by the MIS Research Center at the University of Minnesota determined that 76 information systems developed in 26 organizations all required minor to major revisions after they were completed to even approximate management’s information requirements (Jenkins, et al., 1984). The systems development process can be broadly categorized into: (1) designing the right system and, (2) correctly implementing it. Given an appropriate design, most information systems departments can successfully implement a system. The big problem is correctly determining information requirements and designing the right system.

How do most systems analysts go about determining what information managers want from their computer system? They do the obvious and the logical. They ask, “What information do you want from the new order processing (or whatever) system?”

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2 The inability of managers to recognize information needs was described by Russell Ackoff in 1967.
Unfortunately, managers usually do not know what information they need. They give it their best attempt, assuming these brilliant computer wizards will sort things out. Several months and millions of dollars later when the system is delivered, managers quickly and frequently discover the system does not give them the needed information.

Managers ask for changes, and the system analyst goes into shock. Costs and time to change the design of a system after it is complete are 50 to 100 times higher than making those same changes during the systems design stage. This sounds like an exaggeration, but it is not. If you, or someone you know, has had a house custom-built, you may be familiar with these dynamics. For example, consider the cost of adding a bathroom after the house is complete versus the cost of adding a bathroom during the blueprint or design stage. The cost factor explains why so many needed revisions are never implemented. Consequently, the resulting systems are a disappointment. A disappointing system can range from a system that partially fulfills management’s requirements (with or without expensive revisions) to one that is totally abandoned, resulting in a multimillion dollar write-off.

For example, a major bank recently completed a multimillion dollar project that tracked all of its customers’ financial relationships with the institution. The system was demonstrated to various management teams who asked if the system would be able to provide information it was not designed to provide. In other words, managers wanted information that had not been requested when the system was designed the previous year. Though it would not have been difficult to add the requested capabilities had they been identified before systems development, adding them now would delay the project more than a year and double the cost of the system. Management was so furious that it cancelled the project, which represented a $40 million investment up to that point, and many information systems people lost their jobs.

Having been victims of management’s inability to properly define information requirements, most systems analysts go to Plan B—the “user sign-off.” This approach involves asking managers what information they want from a system and then requiring them to sign a document aimed at contractually obligating them to accept the resulting system. User sign-offs have marginal political value when systems analysts are battling with management over system revisions. They, however, do not solve the functional problem, which is that managers do not know what information they need.

For example, in the banking illustration discussed above, the managers signed off on the design. However, once they realized the system would not satisfy their needs, they blamed the systems analysts for misleading them. Top management claimed: “You technical people should have protected us from our lack of expertise in this area.” A user sign-off is a powerless piece of paper when matched against the fury of top management.

Plan C, commonly used by systems analysts, is to use the “catalog” approach to information requirements determination. This involves showing a manager a wide variety of reports, perhaps requested by other managers or available from a commercial software package. The manager reviews these reports, selecting the ones believed to be needed. This may seem like a good idea, but it does not work. Offering managers many reports usually results in requests for them whether needed or not.
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Research has found that decision makers who are offered cosmetically impressive, but useless reports, have a high propensity to take them (Benbasat, et al., 1977; Judd, et al., 1981). For example, in one study production managers were offered 20 different reports, eight of which were deemed useful by a panel of production experts. The remaining 12 were useless and were provided solely to see if anyone would take them. Uncertain if the information was useful, they played it safe and requested it. In practice, although the manager requesting the information does not use it, the manager who replaces him or her years later may assume the information has some value. Consequently, he or she may often be found staying late at work, sifting through the useless reports, wasting time, and asking the compelling question: “What am I missing from this information used by my predecessor?” Years of this phenomenon result in information overload episodes similar to the one described in the beginning of this article.

Four fundamental mistakes historically have been made in the process of determining executive information needs: (1) viewing systems as functional instead of cross-functional, (2) interviewing managers individually instead of jointly, (3) asking the wrong questions during the interview, and (4) not allowing trial-and-error in the detail design process.

**Cross-Functional Systems**

The first mistake in determining information requirements for information systems is viewing the systems as functional as opposed to cross-functional (Wetherbe and Vitalari, 1995), a perspective that is too narrow and time consuming. Indeed, cross-functioning is a key principle of cycle time reduction (Wetherbe, 1995). For example, when developing a new budgeting system, we tend to focus on the information needed by the budget managers or budgeting staff members, rather than all personnel who will use budget information.

Virtually all managers need access to budget information. Unfortunately, if the budget department is responsible for design, the system carries a very strong control orientation as opposed to a general management reporting orientation, resulting in budgeting systems that end up much like a bank statement. Most people use a bank statement simply to reconcile their personal finances, whether on paper or a personal computer. Similarly, many managers keep their departmental budgets on a departmental computer and simply reconcile them with the control statement they receive from the budget department. Due to this phenomenon, up to 60 percent of the data entered into personal computers are keyed from reports generated from other computers in the same organization.

For example, a marketing vice president for a manufacturing company wanted to categorize costs and revenue by salesperson, customer, and product. The budgeting system only allocated costs by project account number. A project could involve more than one salesperson, more than one customer, and more than one product. Only through extensive data collecting from the sales force and the use of spreadsheet software could the needed information be obtained.

Some would argue that the budgeting department should incorporate the reporting needs of functional managers into the development of a new budgeting system, but the common argument against this would be increased costs. The flaw in this logic is that the increase in costs exists anyway because these functional managers have to develop their own system, resulting in higher costs than if an integrated system was developed and used across functions.

As this marketing vice president said, “The accounting department adds so much overhead to marketing by wanting more and more data categorized in ways that allow them to control and audit us. I need information categorized in ways to help us market our products effectively and efficiently. The systems designed by budgeting are not responsive to my needs. Have you ever heard of a manufacturing company that was successful because it had the best accounting practices in the world?”
To illustrate the need to develop systems cross-functionally, consider a business process such as customer order processing. To process orders, salespeople have to decide on which customers to call and what is available to sell them. Credit departments must decide which customers can have credit and how much, which customers need past-due notices, and which customers' credit should be discontinued. Distribution centers must decide inventory stocking levels and reorder points, when to unload slow-moving inventory, and to which customers limited inventory should be allocated. Shipping must decide such things as what merchandise to send to which customers, how orders can be shipped together to save delivery costs, vehicle routing, and vehicle scheduling. These decisions are summarized in Table 1. In developing a new system, information should be provided to improve all decisions.

For example, consider the last decision listed for the distribution center in Table 1— which customers should receive available inventory. If the distribution center has five orders but only enough inventory to fill three, a resource allocation decision must be made. Typically, this decision would be made on a first-in/first-out (FIFO) basis, which would seem equitable and fair given the available information.

Consider the following scenario. Orders for limited stock arrive in this manner. Customer A orders infrequently, does not need the stock urgently, does not pay bills promptly, yields a low profit margin,

<table>
<thead>
<tr>
<th>Decision Center</th>
<th>Activity</th>
<th>Examples of Major Decisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salespeople</td>
<td>Selling Merchandise</td>
<td>• Which major customers to call</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• What to sell customers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• What is available to sell</td>
</tr>
<tr>
<td>Credit Department</td>
<td>Accounts Receivable Management</td>
<td>• Which customers should receive credit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• How much credit to allow</td>
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<tr>
<td></td>
<td></td>
<td>• Which customers need past-due notices</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Which customers' credit should be discontinued</td>
</tr>
<tr>
<td>Distribution Center</td>
<td>Inventory Management</td>
<td>• What inventory to stock</td>
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<tr>
<td></td>
<td></td>
<td>• How much inventory to stock</td>
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<tr>
<td></td>
<td></td>
<td>• When to reorder stock</td>
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<td></td>
<td></td>
<td>• When to unload slow-moving inventory</td>
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<tr>
<td></td>
<td></td>
<td>• Which customers to allocate available inventory</td>
</tr>
<tr>
<td>Shipping Department</td>
<td>Packing and Shipping Orders</td>
<td>• What merchandise is included in the customer's order</td>
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<tr>
<td></td>
<td></td>
<td>• What orders can be shipped together to save delivery costs</td>
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<tr>
<td></td>
<td></td>
<td>• Vehicle routing to minimize transportation costs</td>
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<tr>
<td></td>
<td></td>
<td>• When vehicle should depart</td>
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</tbody>
</table>
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and is on a three-week trucking route cycle. Customer B, a high volume buyer, recently complained of late delivery. He needs the shipment urgently, pays bills promptly, yields a high profit margin, and is located on a frequently used trucking route. In this instance, a shipment made to customer A on a FIFO basis could have disastrous results.

In trying to improve the quality of the decision, factors that should be considered include:

• How important is each customer to the business?
• How soon does each customer need delivery of the order?
• What is the profitability of each order?
• What is the credit status of each customer?
• What is the shipping schedule for delivery to each customer?
• Has the customer recently been upset because previous order was late?

Note that the information needed to improve the decision making in the distribution center is generated outside the distribution center. For example, customer need, importance, and profitability are determined by sales, credit worthiness by the credit department, and shipping schedule by the shipping department.

A very important concept of information management, therefore, is that most of the information needed to improve functional decision making is generated outside of the function. Sharing information within an organization is important in improving productivity. When an organization learns to share information cross-functionally, employees are empowered to make better and more productive decisions for the organization.

The bottom line is that in order to develop a new information system, it is necessary to be aware of all functions that are impacted by the information system and to be sensitive to their decision making requirements. Then a system can be developed that allows information to flow cross-functionally to improve decision making.

As straightforward as the concept of cross-functional systems is, most system analysts attempting to develop these systems complain that employees are very proprietary about their functional information and are often unwilling to participate in a system that will share information. Recognizing that information is power, employees are not interested in sharing power.

For example, sales representatives for a manufacturing company were not allowed to access customer credit status. Consequently, they would occasionally invest substantial effort into obtaining a large order from a client only to have it rejected because of credit/financing conditions. Customer relations were damaged and morale suffered as the sales force began to refer to credit as the “sales prevention department.” This attitude is totally dysfunctional. Since information is power, the idea is to empower decision makers by giving them the best information to make these critical decisions. An organization that does not share information cross-functionally ends up with a situation of the left hand not knowing what the right hand is doing.

To solve the problem, top management needs to use its leadership and influence to achieve cross-functional design. New systems which transcend functions must have management participation in their design.

Joint Application Design

The second mistake commonly made in the determination of information requirements is that the systems design team usually interviews managers individually instead of using a group process known as joint application design (JAD). As a cycle time principle, this process is referred to as co-locating (Wetherbe, 1995). The individual interviewing process places cognitive stress on a manager that hin-
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Consider this scenario: A group of strangers come into your office and ask you to tell 10 jokes. Even though you probably know 10 good jokes, you might have difficulty recalling them; most people would. Now, let us change this scenario: A group of you and your fellow managers are put together in a room and asked to generate some good jokes. It is likely you and your colleagues could generate 80, 90 maybe 100 jokes. Each manager would be familiar with perhaps 80-90 percent of them. In other words, each manager really knew many jokes, but had difficulty recalling them on an individual rather than group basis. The moral is that group or collective experiences and memory are essential in recalling information. When people are asked to tell a joke, they generally tell ones they have heard recently. On their own, they can not remember many from the past. Similarly, when managers are asked what information they need, they generally mention only recent needs, not every-thing they need. Therefore, requirements determination should be done as a group or joint process so the memory of each manager can be pooled for a more thorough job of recalling key information requirements.

A second reason for a joint application design is that different functional areas of an organization have different agendas for developing a new information system. For example, in the order processing system shown in Table 1, each decision center would likely emphasize different design criteria. Sales may view the primary importance of order processing as ensuring prompt and correct delivery of orders to customers. Credit, on the other hand, may view the agenda as primarily ensuring that the company gets full payment for all orders. Those responsible for inventory management are interested, of course, in facilitating good inventory management and reducing inventory costs, while those responsible for shipping are interested in ensuring good routing of trucks to minimize delivery costs. Viewing the purpose of order processing from a group perspective would likely result in a design criteria that would focus on achieving prompt, correct delivery of orders to customers while ensuring credit integrity and facilitating good inventory management, as well as good routing and scheduling of shipments.

It is difficult to achieve this overall perspective if each manager is interviewed individually. A case study illustrates the need for joint application design from a cross-functional perspective. A direct mail catalogue company was revising its information systems. Prior to the cross-functional design, the credit department viewed its primary goal as ensuring payment from customers. Ideal performance would be for all customers to make all payments—that is, no credit losses. In an effort to increase its performance in this area, the credit department had continually requested more and more information about customers, i.e., credit references, credit bureau checks, etc., to the point that credit costs were becoming excessive.

Two mistakes can be committed in making a credit decision: (1) giving credit to people who will not pay their bills and (2) not giving credit to people who would pay their bills. After looking at the problem cross-functionally with joint application design, the organization determined that it was better off not doing any credit checks at all. This rather counter-intuitive conclusion was based upon two key understandings that were generated from the joint application design. First, the company could send catalogues of only low-priced items to first-time customers. Customers who paid for what they ordered could be upgraded to receive more expensive cata-
logues. Those customers who did not pay would be dropped from any future mailings.

In this way, the company was not inferring whether customers would pay from credit reference material; based on their own experience they knew which customers would and would not pay. Their losses from not receiving payment were less than the costs for all the credit checks. In other words, the cost of unpaid merchandise was the cost of determining whether someone would pay. This information was not only more accurate but also less costly than doing the traditional credit reference checking. If credit information requirements had been determined without considering the context of sales management, this insight would not have been achieved.

Furthermore, people who would be categorized generally as higher credit risks have a greater propensity to purchase from this company’s catalogues. Conversely, people who would be considered excellent credit risks tend not to buy anything from their catalogues. This means the company could send out many catalogues to people with excellent credit ratings but seldom make a sale. Therefore, it would be losing money by shipping catalogues that never generate any revenue. The company would be better off marketing to those people who would be higher credit risks but not letting them buy anything expensive until it was established that the customer would, in fact, pay for their orders.

Without the perspective provided by a joint application design, it would have been difficult for credit to accept that credit checks were not essential to the overall process of making sales and processing orders. Therefore, when determining information requirements, all affected functions should be represented in the same room at the same time.

**Structured Interviewing**

The third mistake made in determining information requirements is that the designers usually ask the wrong question: “What information do you need from the new system?” Though this is the obvious question, it is not at all helpful to managers attempting to determine what information they need. Systems analysts assume managers surely know what information they need. The executive assumes the systems analyst knows what he or she is doing. The problem is that this technique is akin to a psychoanalyst talking to a patient and asking, “What type of therapy do you need?” Or a salesperson acting as an order taker rather than a problem solver, who asks, “What features do you want?” If patients or customers do not know how to look out for themselves, they are unlikely to get satisfactory solutions.

A personal story illustrates this point. When I moved to Minnesota, I purchased a home in the country with sufficient land to require a tractor mower. I set out to purchase a tractor mower, not knowing much about tractor mowers, other than that I wanted a Toro (The dean of our business school was the former chief executive officer of Toro, and I wanted a Toro in my garage just in case he stopped by for a visit). Consider me a manager who needed to solve a problem without knowing specific requirements.

When I went into a dealership to purchase a tractor mower, the salesperson would ask me what I was looking for. I would say I was looking for a Toro tractor mower. After that I would find myself in trouble. The next question I would typically be asked was what blade width I wanted. This was not a question I was really prepared to answer. When I told the salesperson this, I could see him roll his eyes as if to say, “I hate these idiots who do not know what they are doing.”

Next he would ask how much horsepower I wanted. “How much can I get?” I would respond. He would say “five to 18,” as he rolled his eyes again. Then he would ask such questions as, “Do you want wide tires, narrow tires, a rear bagger, a side bagger, manual start or electric start?” It turned out the tractor mower would cost between $800 and $2,800, depending on how it was configured. Ideally, I would not like to over-buy or under-buy. Once the salesperson realized I did not know what I was doing, he would immediately start pushing the $2,800 unit, suggesting I should go first class. Mowing my yard and first class are not two concepts I associate
with one another. Suspecting that I was being over-sold, I would go to another dealership. Unfortunately, I encountered the same experience at each dealership.

Finally, I went into a dealership where the salesperson was not an order taker but a problem solver. He did not ask what features I wanted on the lawn mower. He asked other types of questions such as, “How big is your yard?” My yard was about an acre. Next he asked, “How steep is your yard?” I told him it had a gradual slope. He next asked, “What is the terrain like?” I told him it was natural, lumpy in spots. He wanted to know if I had fences or trees. I replied, Yes, a fence and about 80 trees.” Next he wanted to know if I wanted my wife to use the tractor mower. I said, “Are you kidding? This is her anniversary present!”

With that information, he walked over to a tractor mower unit and said, “This is the one you need.” I said, “How much?” He said, “Eighteen hundred dollars.” Well, that was better than $2,800. I asked him why this particular unit. He said, “You have a large yard so you want the widest blade. You need 12 horsepower to drive the widest blade, but you do not need 18 horsepower unless your yard is both big and steep. You want wide tires to keep them from slipping into a rut, tilting the blade deck and scalping the yard; you want a rear bagger so you can mow around the trees and mow by your fences one way one time and the other way the next time so you do not pack the grass; and you want electric start because you have delusions that you are going to get your wife to use it!”

Notice that what he did was extremely simple. He asked indirect questions that backed into my requirements. He never specifically asked what features I wanted.

Using indirect questions is the creative skill of the problem solver in sales versus the order taker. Problem solvers creatively determine requirements through less obvious, indirect questions. Those designing information systems need to do the same, and executives should request that they do so.

### Determining Executive Information Requirements

A straightforward, useful approach to interviewing executives (instead of simply saying “what information do you need?”) to determine information requirements has been developed through research conducted at the MIS Research Center at the University of Minnesota (Wetherbe, 1988). The technique is based upon three different requirement/determination methodologies, defined in Table 2. By combining questions from these three different methodologies, a comprehensive, reliable determination of conceptual information requirements can be achieved.

Before conducting the interview, an agreement of the overall purpose of the business activity must be established in a joint application design fashion. For example, the objective of the order processing system discussed earlier could be to ensure prompt, correct delivery of orders to customers, maintain credit integrity, facilitate inventory management, and ensure good shipment routing and scheduling. Once this has been established, questions can be asked that determine the information needed to ensure those objectives are accomplished. A basic model for the information requirements interview is portrayed in Figure 1.

The notion is to focus on issues that “back into” information requirements. The specific questions asked are as follows.

**Business Systems Planning (BSP)**  
(Source: IBM Corporation, 1984)

**Problem/Solution/Information Format**

1. What are the major problems encountered in accomplishing the purposes of the organizational unit you manage?

For example, in an order processing system, problems include frequent stock-outs, allocation of limited inventory to the wrong customers, and truck departurescheduling.

1b. What are good solutions to those problems?
Table 2: Comprehensive Interview Approaches, Implementations, and Developers

<table>
<thead>
<tr>
<th>Comprehensive Approach</th>
<th>Information System Implementation</th>
<th>Developer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specify problems and decisions</td>
<td>The executive interview portion of Business Systems Planning (BSP)</td>
<td>IBM</td>
</tr>
<tr>
<td>Specify critical factors</td>
<td>Critical Success Factors (CSF)</td>
<td>Rockart</td>
</tr>
<tr>
<td>Specify effectiveness criteria for outputs and efficiency criteria for processes used to generate outputs</td>
<td>Ends/Means Analysis (E/M Analysis)</td>
<td>Wetherbe and Davis</td>
</tr>
</tbody>
</table>

Figure 1: Framework for Information Requirements Interview
Better inventory management would solve the problem of frequent stock-outs. Communicating the relative importance of customers and the importance of orders to specific customers to the distribution center would solve incorrect allocation of orders. It would also be helpful to know customer credit status. Solving the truck departure scheduling problems requires advising shipping personnel of the destination of orders that are being processed but have not yet arrived at the shipping dock.

1c. How can information play a role in any of those solutions?

Out-of-stock and below-minimum reporting could be provided electronically to improve inventory management. Also, an automatic reordering system could be implemented. Electronic access to customer importance, importance of order, and credit status could allow the distribution center to make appropriate allocation decisions when inventory is limited. Better decisions concerning routing and scheduling trucks can be made if the shipping department has access to orders received and in process.

Table 3a provides an illustration of a structured interview using the problem/solution/information interview format.

**Decision/Information Format**

2a. What are the major decisions associated with your management responsibilities?

Major decisions for order processing include: which customers to call on and what to sell to them; credit for whom; how much; when to discontinue credit; what and how much inventory to stock; when to re-

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**Table 3a: Requirements Interview for Order-Processing System — BSP**

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Out-of-stock too often</td>
<td>Better inventory management</td>
<td>Out-of-stock, below-minimum report; automatic reordering of inventory</td>
</tr>
<tr>
<td>Distribution center often allocates limited inventory to the least important customers and/or customers who have credit problems</td>
<td>Let distribution center know relative importance and credit status of different customers</td>
<td>Customer-importance rating and credit rating</td>
</tr>
<tr>
<td>Shipping department often sends off a truck, unaware that another order going to the same destination will be coming to the dock within an hour</td>
<td>Let shipping department know the destination of orders that are being processed through credit and distribution center</td>
<td>Shipping destination of orders provided when orders received from customers</td>
</tr>
</tbody>
</table>

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order; how to allocate limited inventory; and how to schedule and route trucks.

2b. What improvements in information could result in better decisions?

Table 3b provides an illustration of a structured interview using the decision/information interview format.

Critical Success Factors (CSF)
(Source: Rockart, 1979)

3a. What are the critical success factors of the organizational unit you manage? Most managers have four to eight of these.

For example, critical success factors for order processing include: adequate inventory to fill customer orders, prompt shipment of orders, high percentage of customer payments made, and vendors (suppliers) promptly filling reorders.

3b. What information is needed to ensure that critical success factors are under control?

For example, to determine if adequate inventory is available, management would need summary and exception reports on percentage of orders filled on time. In addition to overall reports, reports should also be categorized by customer and product. To determine if orders are being shipped promptly, management would need to have summary and exception reports on delivery time—both overall reports and reports categorized by customers. Table 4 pro-

Table 3b: Requirements Interview for Order-Processing System — BSP
Decision/Information Format

<table>
<thead>
<tr>
<th>Decision</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Which customers to call on and what to sell them?</td>
<td>Customer order history; inventory available</td>
</tr>
<tr>
<td>Credit for whom? How much? When to discontinue?</td>
<td>Credit rating; current status of account; payment history</td>
</tr>
<tr>
<td>What and how much inventory to stock? When to reorder?</td>
<td>Inventory on hand; sales trends on inventory items; market forecasts</td>
</tr>
<tr>
<td>How to allocate limited inventory?</td>
<td>Priority of order; importance of customer; credit status of customer; shipping schedule</td>
</tr>
<tr>
<td>When to unload slow-moving inventory?</td>
<td>Sales trends</td>
</tr>
<tr>
<td>Destination of ordered inventory?</td>
<td>Customers’ addresses</td>
</tr>
<tr>
<td>What orders can be shipped together to save delivery costs?</td>
<td>Shipping schedule and customers' destination for orders awaiting shipment</td>
</tr>
</tbody>
</table>
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Critical Success Factor

<table>
<thead>
<tr>
<th>Critical Success Factor</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adequate inventory to fill customer orders</td>
<td>Percentage of orders filled on time—overall and also categorized by customer and product</td>
</tr>
<tr>
<td>Prompt shipment of orders</td>
<td>Delivery time—overall and also categorized by customer</td>
</tr>
<tr>
<td>High percentage of customer payments</td>
<td>Delinquency report on non-paying customers</td>
</tr>
<tr>
<td>Vendors (suppliers) promptly fill reorders</td>
<td>Exception report of vendor reorders not filled on time</td>
</tr>
</tbody>
</table>

Table 4: Requirements Interview for Order-Processing System — CSF

Ends/Means (E/M) Analysis
(Source: Wetherbe and Vitalari, 1995)

Ends/Effectiveness/Information Format

4a. What is the end good or service provided by the business process?

4b. What makes this good or service effective to recipients or customers?

4c. What information is needed to evaluate that effectiveness?

Table 5a provides an illustration of the ends/effectiveness/information interview format.

Means/Efficiency/Information Format

5a. What are the key means or processes used to generate or provide goods or services?

For example, means for order processing include processing orders, processing credit requests, and making shipments.

5b. What constitutes efficiency in the provision of these goods or services?

For example, efficiency for order processing concerns achieving low transaction costs for orders and credit checks as well as minimizing shipment costs.

5c. What information is needed to evaluate that efficiency?

Examples of information needed to assess efficiency include cost per transaction with historical trends, cost per credit transaction with historical trends, and shipment cost categorized by order, customer, region, and revenue generated. Table 5b provides an illustration of the means/efficiency/information format.

The approach of using these three methodologies as a basis for indirect questions to obtain a reasonably correct and complete set of information requirements is both simple and powerful. It is simple because it consists of simple components that can be learned by an analyst and a manager in a relatively short time. It is powerful because it is based on fundamental theories of human information processing and recognizes human strengths and limitations.
**Table 5a: Requirements Interview for Order-Processing System — E/M Analysis**

<table>
<thead>
<tr>
<th>Ends</th>
<th>Effectiveness</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fill customer orders</td>
<td>Customer orders delivered as ordered, when expected, and as soon or sooner than competition</td>
<td>Summary and exception reports on customer deliveries; number of order corrections made; comparative statistics on delivery service vs. competition's</td>
</tr>
<tr>
<td>Provide customer service</td>
<td>Promptly provide credit to qualified customers</td>
<td>Customer credit status and payment history</td>
</tr>
<tr>
<td></td>
<td>Quick response to and reduction of customer complaints</td>
<td>Report of number and type of complaints by customers and average time to resolve complaint</td>
</tr>
<tr>
<td></td>
<td>Customers are satisfied</td>
<td>Customer attitudes toward services perhaps determined by customer surveys</td>
</tr>
</tbody>
</table>

**Table 5b: Requirements Interview for Order-Processing System — E/M Analysis**

<table>
<thead>
<tr>
<th>Means</th>
<th>Efficiency</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process orders</td>
<td>Low transaction cost</td>
<td>Cost per transaction with historical trends</td>
</tr>
<tr>
<td>Process credit requests</td>
<td>Low transaction cost</td>
<td>Cost per transaction with historical trends</td>
</tr>
<tr>
<td>Make shipments</td>
<td>Minimize shipment costs</td>
<td>Shipping cost categorized by order, customer, region, and revenue generated</td>
</tr>
</tbody>
</table>

It provides a comprehensive set of approaches that are additive in their results.

The interview has a redundant safety net. For example, a problem identified in the first set of questions in the example pertains to poor allocation of limited inventory to customers (see Table 3a). The need to allocate limited inventory was also identified as a decision that must be made (see Table 3b).

In other words, if the concept of allocating limited inventory was not recalled as a problem, it can still be identified as a decision, and vice versa. This “safety net” effect greatly increases the reliability of the structured interview.

A profile of conceptual types of information necessary to support an order processing system is generated from the interview. For example, the first
Determining Executive Information Requirements

Prototyping

The fourth mistake typically made in requirements determination is that managers are not allowed to determine and refine their conceptual requirements into detail information requirements through trial and error. Detail requirements refer to the specific screens or reports that are generated by a system, as illustrated in Figure 2.

Figure 2: From Conceptual Design to Detail Reporting Specification
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Trial and error, or experiential learning, is an important part of problem solving. For example, people are using trial and error when they:

- Try on clothes before they purchase them
- Test-drive cars
- Change their college major after a few courses
- Have several relationships before marriage
- Rearrange furniture several times when decorating a room
- Put more than one nail hole in a wall when hanging a picture

Trial and error is also a part of determining detail information requirements. It can be incorporated into the systems design process through the use of a prototype or mock-up of the system. Using state-of-the-art technology, a prototype of a new system usually can be constructed in a day to a couple of weeks, depending on the complexity of the system (Wetherbe and Vitalari, 1995). As in manufacturing, much can be learned about final requirements through a prototype before “building the new factory.” As such, prototyping is another key principle of cycle time reduction (Wetherbe, 1995). A model of prototyping is provided in Figure 3.

Conceptual analysis through a structured interview prior to the trial-and-error process can substantially reduce the amount of time expended to resolve the

Figure 3: Model of Prototyping

Based upon information requirements interview, develop initial database with reporting capabilities using high-level languages and relational database. System should have fixed and ad hoc reporting capabilities

Demonstrate prototype to users and have them use it

Is Prototype Satisfactory?

Yes

Develop Production System

No

Revise prototype by:
- Adding data
- Changing data structure
- Enhancing input and output capabilities
- Enhance software tools
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problem. For example, in the five preceding situations, the following analysis undertaken prior to trial and error could save time:

1. A fashion consultant could narrow the trial-and-error search for a new wardrobe by asking questions about career, lifestyle, budget, and taste, and by observing physical characteristics. Stores and designs could be suggested based upon the answers to these questions, thereby saving search time.

2. A well-trained car salesperson could ask qualifying questions (similar to those of the fashion designer) to better suggest automotive alternatives.

3. A career counselor, based upon interviewing, could suggest majors for students.

4. A marriage counselor could use personality and interest profiles to assist in determining the compatibility of potential marriage partners.

5. Interior decorators could use their analysis techniques to suggest a decorating solution that could be refined by trial and error.

As in these examples, the structured interview prior to a trial-and-error process reduces the time necessary to determine detail requirements.

Unfortunately, over the years, systems analysts have not incorporated a learning, trial-and-error process into systems design. Equally as troublesome is that they either naively agree to or have imposed upon them by management a budget and schedule for a new system before there is a prototype. If the schedule and budget are set, the only thing left to maneuver around is the content of the deliverable. Accordingly, systems analysts often leave useful or even critical functionality out of a system in an effort to stay within budget and on schedule.

Management should not let systems analysts disappear after the initial concept for the system is established. Management should be able to observe and experience a prototype within two to five days after being interviewed. This prototype can then be shaped into a final design within a few weeks.

Once management accepts the prototype, a realistic schedule and budget can be established for building the system. Although systems must evolve over time and should be built with evolution in mind, a system that is initially right will not need substantial immediate modifications. Evolutionary change of such a system is much more manageable.

Conclusion

Determining information requirements rapidly and accurately is a key productivity issue, both for systems development and for managers who need better information for decision making. Failure to get the requirements right the first time wastes human and economic resources. Management can greatly enhance the speed and accuracy of information requirements determination by encouraging their systems designers to use a cross-functional, joint application design that involves input from all key decision makers involved in the business process. The conceptual requirements for a new system can be determined by a structured interview. Detail requirements can then be identified through prototyping. Then the best source of information—be it formal or informal—can be determined.

References


