INFORMATION PROCESSING FOR A STORE - AN OVERVIEW – A Small Case Example

In what follows we will present a broad overview of how data is processed to meet the functional requirements of a store. The presentation below will be an overview.

The important functions of a store are:

- to keep an up to date ledger containing stock positions,
- cater to requisitions for issue of items from the store,
- initiate reorder of items whose stock is below a specified limit,
- update stock register when items are received, and
- answer enquiries regarding availability of items in stores.

In a computer based system the stock ledger is organized in a suitable form for easy updating and retrieval and recorded on a magnetic disk. Magnetic disk storage is the primary storage medium for storing large data bases. This is due to the fact that any record can be directly accessed. Magnetic tapes are used primarily as a back-up storage unit for keeping copies of data on disk. Tapes are also useful for storing old files and for interchanging files between different computers.

In order to create a stock ledger for a computer-based system it is necessary to first assign unique codes for each item in the store. The unique code assigned to each item is known as the *key* of the item record and identifies the record. After that it is necessary to find out what data fields are needed for each item in the stock. The fields are determined by working backwards, that is, first asking what outputs are needed and based on that

determining the data needed. The fields are organized as a record and stored in a data base. This data base is the primary or *master file* for the store. (It is the computer readable version of a stock ledger used in a store). Once the record format for each item in the store is determined, one record is created for each item in the store. These records are entered manually by a data entry operator who enters the records using a keyboard of a terminal connected to the computer. This is called *on-line* data entry. Data may also be entered on a separate computer such as Personal Computer (PC) and stored on a floppy disk. This is called *off-line* data entry.

In off-line data entry the data entry machine is a low cost machine. If the volume of data to be entered is very large, then a number of machines can be used and data prepared, checked and corrected. As opposed to this, an on-line data entry method uses terminals connected to the computer. In such a case the computer should be timeshared. On-line data entry is appropriate for inserting, deleting or correcting some records in fields.

The data on floppy disk can then be transferred to the disk connected to the computer. Off-line entry is used when the data base is very large and the computer used is a server or a mainframe computer. If the data base is small, the PC itself may be used for data entry and for data processing.

Before data is stored in the disk-file it must be ensured that any errors made during data entry is detected and corrected. This is done by a program called an *edit program* and a

control total checking program. Such programs are essential to ensure the validity of data in a master file.

A procedure similar to the one used to create the master file is also used to keep the data in the master file up-to-date when new items are received or new stock of items already in the ledger are received. Table 1 summarizes the operations performed for other functions. The format of a record for entering requests uses the same item codes assigned in creating the master file. Other fields are determined based on what outputs are needed. In this case a reasonable format for requests is:

(item code, item name, quantity requested)

Table 1 Operations Performed in Stores Information Processing

1. Create stock ledger
   - Codify items
   - Determine data fields needed for each item
   - Create a record for each item
   - Organize the records as a data base
2. Issues/Reorder
   - Codify items
   - Determine data fields required in each request
   - Determine data fields required for each issue
   - Create record format for requests and issues
   - Create record format for reorder
3. Receipts
   - Codify items
   - Determine data fields required in each receipt
   - Create record format for receipts
4. Enquiry
   - Codify items
   - Record format for enquiry
   - Record format for response

The record format for a reorder request would be: item code, item name)

(The quantity to be reordered is normally stored in the file maintained by the Purchase department)

The record format for issues would be : (item code, item name, quantity requested, quantity issued)

The request record is entered through a keyboard by a requester. It is checked for validity by a program. A valid request is forwarded to a retrieval program which retrieves the data on the requested item from the Master file on disk. The item code in the request is used as the *key* for retrieval. If the requested number of items is available, then an issue slip is printed; otherwise a reorder request is printed. Care must, however, be taken to ensure that once a reorder is requested it is not requested again till the item reordered is taken into stock. Each request slip processed by the computer is called a *transaction*. If each request is processed as and when it arrives and the terminal on which the request is entered is connected to the computer, then the processing method is called *On-Line Transaction Processing* (OLTP).

There is another method of processing requests. A number of requests arriving during a day (for example) are collected and formed into a batch. The data in such a batch can be keyed-in off-line and a floppy disk created. This floppy disk can then be used to enter requests on the computer which has the Master file. The entire batch is processed and outputs are printed. This mode of processing is called *batch processing.* Batch processing is usually more efficient. It, however, is not as timely as on-line processing. In operations such as payroll processing which is done periodically, batch processing is more appropriate.

Enquiry system is normally an on-line transaction processing system as it is the most natural way of answering users' queries. In an enquiry system also, a user's query is first checked for validity of item code, etc. before it is processed.

A variety of information systems used in practice are primarily on-line transaction processing systems. Common examples are airlines and railway ticket reservation systems. Designing such systems require special care to ensure that response to enquiries are fast and that the system has a "hot standby" if there is a failure. High reliability is required as failures can be catastrophic (imagine many persons getting the same berth reserved on a train). Similarly reliability and availability is essential in on-line banking systems.

MIS and DSS for Stores

The processing methods presented in the last para are for *routine data processing*. The information they provide is operational information. The system required to obtain tactical information require further processing. Such systems are known as *Management Information Systems* (MIS). In the stores processing case study, some tactical decisions would be: at what stock level should reorder be initiated? How much should be reordered? These are determined based on data such as rate of issue of each item, time needed for delivery from date of order, transport cost, storage cost, shelf life, and loss incurred if an item is out-of-stock. These data have to be collected separately over a period of time, often as a byproduct of a routine data processing system. In the stores case daily issues of some critical items can be abstracted and the average issue can be computed. Data on delivery times, transport cost etc. can be separately collected. Well

known methods of operations research can then be used to compute stock level for initiating reorder and the optimal quantity to be reordered.

Operational data collected over a period of time is called *data archives* and the process of collecting it is called *data archiving*. With the availability of massive disks in which terabytes (10^{12} bytes) of data can be stored, it has become feasible to analyse the archived data. Analyzing archived data to observe patterns which assist in management decision making is called *data mining*. A stores manager may, based on his experience, think that in the months of October, December and April the sale of sugar is very high compared to other months. This conjecture maybe verified by data mining. In data mining a rule is formulated which may say that in October sugar sale is 1.5 times the average, in December it is 1.3 times normal and in April it is 1.4 times normal. This rule may be verified within a specified margin of error by examing the data archive. If the rule turns out to be correct, a manager will be able to decide how much sugar is to be stocked in these months. This is a simple example of the use of archival data and data mining to assist in tactical management.

As another example of tactical information requirement, let us consider the question of fixing credit limits for customers. In order to arrive at this, the following inputs would be useful:

- Customer details such as income, occupation etc.
    - Customer payment history
    - Volume of purchase by customer
    - Outstanding dues (if any) from the customer.

Using these one may formulate some rules to arrive at the credit limits and also predict their possible effect such as:

- anticipated effect on sales caused by varying credit limits
- anticipated loss/profit due to credit limits.

By analyzing the impact of credit limits as specified above, a decision may be arrived at to fix credit limits.

The primary point to note is that one has to formulate a model and sometimes simulate a system to obtain tactical information. The operational information from routine processing becomes an input to obtain tactical information.

Strategic information is obtained through what are known as *Decision Support Systems (DSS)*. In the stores example a strategic decision would be to reduce variety in inventory by discontinuing some items in store, deciding what new items to introduce in the store, and when to open a new branch. Decisions such as these require provisions for a variety of data transformations and representations.

Strategic information is often unstructured. Strategic decisions are made after trying to answer questions such as "What will be the profit if I take a decision and what will be the long range loss if I don't take it?". In a complex decision many parameters will be involved. Identifying these and predicting their impact on a decision needs judgements coupled with analysis. For example, taking a strategic decision of whether to open a new branch or not would require the following information:

- Projected demands in the new branch
- Impact on current branch
- Pricing in new branch

- Competition in new location
- Profitability of new branch

These have to be provided using analytical and simulation model known as decision support models. These models are more difficult to evolve than those needed in tactical information development. Decision support systems should also provide aids to the manager for conceptualization such as charts, graphs, etc. They should also provide facilities to ask a variety of queries on the data base. A variety of summary reports should be made available on request. The overall purpose of decision support systems is to aid in strategic, unstructured decision making. Developing such systems is much more difficult than developing operational systems. They, however, are the ones required by the top management of organizations.