Transaction Processing System (TPS)

7.1 INTRODUCTION

Business transactions occur in every business activity whether a company produces a product or provides a service. Transactions are business events such as orders, requisitions, wages, invoices, reports and the like. Transactions represent 90% data of the organization, are of generally routine and repetitive nature. A major part of organization’s work involves data processing arising out of routine natured transactions, so common data processing activities are called Transaction Processing and the system that processes transactions to produce reports is known as transaction processing system.

7.2 MEANING

Transaction Processing Systems are a special class of information system designed to process business events and transactions. TPSs perform many of the functions originally associated with data processing. Transaction Processing Systems are the basic information systems that process transactions and produce reports. The goal of TPS is to automate repetitive information processing activities within the organization to increase speed, volume of data, accuracy and to lower the cost of processing each transaction, so it makes the organization more effective.

![Figure TPS-1. Transaction Processing System](image)

Taking the case of events happening in a small retail store dealing in daily needs, providing almost eight to ten thousand products. Throughout the day, the customers go on visiting the store, picking the required items, going for check out and paying for the items bought. Meanwhile, the helpers will keep a check as to which item is falling short, bringing the items from the storehouse and placing the items on the appropriate shelves. The store keeper will keep on recording the inventory levels and placing orders for new shipments to arrive so that the continuous flow of goods is maintained.
On the other hand, some may be enquiring about the exchange and still others about the warranty issues. All these events are called as transactions. It is a perfect example of a transaction processing systems where all the transactions are captured and processed, inventory levels are updated, bills are generated and payments are received side by side.

The procedure described above can be on line also, if a customer wants to do purchase online. The processes are same, with the exception that the TPS co-ordinates with the warehouse, distribution channel and financial institution (like a bank). Online Transaction Processing (OLTP) Systems/Applications are high throughput systems, available 24*7, and they are comparatively more insert/update intensive- directly linked with database and servers.
Examples in our day to day life are banking systems and Point of sale terminals.

TPS support the monitoring, collection, storage, processing and dissemination of the basic business transactions of the organization. TPS mainly includes finance and accounting transactions. TPS is the backbone of every organization because every transaction has to be processed by the transaction processing system. Reduction of clerical staff is offset by increase in data entry tasks for the system. Data is captured and processed immediately. TPS serves the operational level of the organization. Example: Inventory Control System

Figure TPS-4. Basic Transactions of TPS unit
7.3 GENERAL REQUIREMENT OF A GOOD TPS

1. Performance: Performance of TPS must be excellent; these must be rapidly responsive because the performance of TPS is measured by the number of transactions it can process in a given period of time.

2. Continuous availability: TPS systems must be available during the time period when the users are entering transactions.

3. Data Integrity: TPS must be able to handle hardware and software problems without corrupting data. Multiple concurrent users must be prevented from attempting to change the same data at the same time.

4. Ease of Use: TPS should be simple to understand and must provide provision for error correction.

5. Modular Growth: TPS should be capable of expansion/growth at incremental costs rather than complete replacement. It should be possible to add/replace/update hardware or software components.

7.4 FEATURES/ CHARACTERISTICS OF TPS

1. Automation of routine transactions: TPS is engaged in recording/performing routine transactions required for conducting day to day activities. TPS automates the storage and processing transactions. Report generation is also efficient and accurate which helps in decision making.

2. Acts as data source for other systems: TPS provides data to other types of Information systems- output of TPS (Operational Level) becomes the input for MIS (middle level).

3. Helps managers to take decisions on time: Managers take help from TPS to monitor the status of internal functioning of the organization and also improves relations of organization with outside environment. The decisions are taken on time, which actually benefits the organization.

4. Central for business tasks: Major activities or tasks of the organization revolve around processing the transactions. Since transactions handling is done by TPS-so TPS becomes central to the business. In case of TPS failure or break down, the functioning of the organization is badly hampered.

5. Manages large amount of data: Since 90% of the data is related to the transactions. TPS manages large amount of data on routine basis and TPSs are equipped with large storage capacities. Moreover, the data provided is accurate and reliable.
6. Improves Efficiency and Competitive Advantage: TPS reduces the workload of the people associated with the operational data, thus improves the efficiency. It gives competitive advantage to the firm as compared to those which are not using TPS.

7.5 COMPONENTS OF TRANSACTION PROCESSING SYSTEM
Like all other systems, Transactions Processing System also has certain components like input, storage, processing and output which perform their respective functions to achieve the goals of the organization. Let’s see how these components function:

7.5.1. INPUT
The input function of TPS accepts data from outside environment so that the system can process the data. TPS acquired data from primary sources as well as from secondary sources, this step of acquiring capturing data is called as Data Capturing.

Data Capturing: Data may be captured from the original/source documents or it may be captured on line as the transaction occurs. After capturing the data (if it is from some source document), it must be put into the system—this process is termed as Data Entry.

Data Entry: Here the data is recorded or coded or edited as per the requirements of the system. Source documents may be invoices, purchase orders, supply orders, catalogs etc. When data enters into the system, a program called as Data Validation.

Data Validation: Checks the validity if input data and also checks if some errors are there. Incorrect data must not enter the system for storage and processing, meaning thereby, data validation is testing of input data/records to determine that the data being entered into the system are correct and complete.

TPS may also use certain Validation Checks/Tests to check the validity of data items. These are:
1. Missing Data: Missing data check is conducted to check the existence of data items. If some data items are missing, an error condition is signaled.
2. Range: Range data test checks that the inputted values fall in some acceptable range and are reasonable for particular type of transaction. e.g. negative percentage of student is not reasonable.
3. Class/Composition: Here the composition of the data item is checked, e.g. only numeric values allowed for marks. If someone enters character type value, error arises.
4. Valid Size: Size of the data value is considered in this test and an error will be displayed if very few or very long character set is entered.
5. Comparison with stored data: The data being entered/recorded is compared with the stored data to check the validity of data.
So the data is validated for size, ensure and composition of characters. Check digit validation may also be incorporated as a permanent part of the number data. Check digit derivation procedure is repeated every time. In case of automated data entry, also called source data automation, automated methods to capture data are used. Automated data entry methods are developed to eliminate/reduce many activities, people and data media required by the traditional data entry processes. The data is captured as early as possible when a transaction occurs. e.g. at POS terminal.

- Sales person at POS terminal captures and edits data right on the floor by using machine readable media-bar coded tag, magnetic stripe, credit cards etc. instead of writing the source documents.
- Data is recorded on the machine readable media, and stored into the computer system
- Payment cycle comes into picture

These automated data capturing methods have been explained in Chapter 1.

7.5.2. STORAGE

Data inputted is stored in data files and database. Two types of data are most commonly stored: Master (main) data and Transaction (event) data. Master data is stored in master file; it is main data of the organization which generally remains fixed (permanent) as long as the system is in use. e.g. Item number, item description, unit cost, unit price etc. in the inventory master file. Transaction data is stored in transaction files. It is the data which changes as the transactions occur. e.g. Additions and removals from the stock as per the needs. Each record of transaction data contains the item number, units added or units issued from the stock. Transaction data remains with the system until the transactions are processed, after that; it is replaced with other transactional data (for new transactions). Both the master as well as transactional data is stored in the database in separate files, which are linked together and updated as per the policies of the system/organizations.

Master files are usually created once whereas transaction data is stored in the file or database when the transactions are to be processed. Transaction Processing System can retrieve the data from the file or from the database through a process called accessing the data, by applying conditions or clauses.

Database maintenance is one of the major activities of a TPS. Organizational databases maintained by TPS must always be correct and updated. Corporate database must reflect changes resulting from day to day transactions as the required data are to be accessed from the database only.

Transactions reports can be prepared/produced by using the data from inventory transaction file, whereas inventory value report can be prepared using the data from inventory master file.
7.5.3. PROCESSING

Processing converts raw data into information. Processing component involves manipulation of data. For producing output, TPS needs some computations/processing. Input data and store data are used to produce the results for output. You have already learnt about validation checks in input component, that the data is checked before being recorded into the system. A decision must be made by the system to determine that a particular data item needs to be recorded or not, before that item gets printed on the inventory order report. So, we see that another important processing function is that of decision making.

Batch Processing, as you are familiar, is used when immediate processing is not required or is not possible. Source documents are gathered into groups called batches; these documents are then recorded on some input medium; after that the transactions are stored in the same sequence as that of records, the records are processed, an updated master file comes into picture and the required reports are generated. The same type of transactions is accumulated into batches and processed together. Batch processing works fine with different types of processing jobs also, which are processed periodically, say, after a week or fortnight or month. The applications where capturing and storing of data occurs at remote sites and transferring the data to central computer for processing is after regular time intervals; are called as Remote Job Entry applications.

Transaction data is processed as soon as they are originated or recorded in case of On-Line Transaction Processing, data need not wait to accumulate in batches. Data are fed from the on-line terminals into the computer systems, stored on line in direct access files. Files/Database are always updated fast, since the data resides on direct access devices, can be retrieved fast, so the response to user queries is always immediate.
Real Time Processing is a variation of on-line processing which involves wide area and local area networks to provide communication links between workstations and other computers. Real time integration of on-line files and databases is required to answer the user queries in real time. Real time processing provides immediate updating of files and user responses instantaneously, suited for applications where frequency of change is very high and the file needs to be updated very fast. e.g. Railway/ Airline Reservation System.

It must be noted that because of its real time nature, special measures must be taken to protect the contents of database. Software and processing controls have to be built in the system to protect the important data from unauthorized users. However, most organizations are willing to pay price for speed, efficiency and better services for getting the advantages of real time processing.

7.5.4 OUTPUT
The fourth component of TPS-Output obtains three types of results- updated master file, operational reports and special reports. After processing of transactions takes place, master file has to be updated and must be stored in the series of master files with date and time stamp at one or more places as per the policy of the organization. The output for direct results for transactions also takes place. e.g. delivery list from an order processing system or salary cheque from a payroll program. These types of transactional results are known as operational reports/ results. Third type of results is special results- which may include detail report or summary report or exception reports.

Details reports have all the information for all the transactions e.g. payroll register report of the organization. Summary reports have the summaries of transactions for one particular type e.g. Maintenance charges paid by the company in one particular year. Exception reports are prepared as per the need, these reports are not of routine structured nature and are not predefined.

So, in general, TPS produces:
(a) Informational Reports/ Control Reports- to give information, to confirm the status of a particular transaction and can be used as proofs.
(b) Action Reports- Reports to initiate some action on the part of the recipient.
(c) Edit Reports- Reports to describe the errors detected
(d) Accounts Reports- to legally document the financial status of the organization.

7.5.5 BACKUP AND RECOVERY
Last but not the least is the component for backup and recovery. This component ensures security against lost data and recovers that in case of malfunctioning. Back up component copies the stored data to some other storage media. The frequency of data backup depends on the frequency of changes made on the data. If a system failure occurs, say, some hardware or software has started malfunctioning or some other factor from the environment has played havoc, back up copy of the data can be used to recreate the original
stored data by means of recovery procedure. Backup copies of the data must be stored away from the primary location to ensure its safety in case of physical disaster or file. Multifunctional companies these days keep their back up data at geographically far away multiple locations to keep the data safe, because if adequate backup and recovery procedures are not followed, there is high risk of losing the data.

7.6 MANUFACTURING FIRM’S TRANSACTION PROCESSING CYCLE
All the transactions which occur in any organization have multifold effect. A transaction that initiates an action and recorded in some away being the TPS cycle. Whenever a transaction begins it is recorded in the transaction file, some business documents are generated and ultimately master file is updated. Data entry may be on-line or off-line. Transaction Processing Cycle organizes the transactions according to the business processes of the organization, the nature and type of processes vary considerably depending upon the transactions, processing and information requirements of the firm.

<table>
<thead>
<tr>
<th>Purchasing</th>
<th>Manufacturing</th>
<th>Accounts Receivable</th>
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</thead>
<tbody>
<tr>
<td>Purchase orders</td>
<td>Schedules</td>
<td>Dispatch of goods</td>
</tr>
<tr>
<td>Receipt of Materials</td>
<td>Production Reports</td>
<td>Sales returns</td>
</tr>
<tr>
<td>Accounts Payable</td>
<td>Quality Control Reports</td>
<td>Accounting/ Finance</td>
</tr>
<tr>
<td>Inventory</td>
<td>Sales</td>
<td>Financial Statements</td>
</tr>
<tr>
<td>Inventory levels</td>
<td>Sales Records</td>
<td>Expenses Accounts</td>
</tr>
<tr>
<td>Consumption</td>
<td>Invoices/ billing</td>
<td>Tax records</td>
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<td></td>
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<td>Payroll</td>
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<td></td>
<td>Attendance</td>
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<td></td>
<td>Record Pay &amp; Deduction</td>
</tr>
</tbody>
</table>

A typical transaction processing system is composed of the following:
(1) Data Entry and Recording Activity
(2) File and Database Processing Activity
(3) Document and Report Generation Activity
(4) Query Processing Activity

Data Entry and Recording activity is explained under input component. File and Database processing activity relates to processing and storage component. Document and Report generation activity is explained under output component. Query Processing Activity is also associated with processing component.

Taking the case of a manufacturing firm, various transactions occurring in the organization can be put together in four major cycles.
7.7 TRANSACTION PROCESSING SYSTEM CYCLES
Production Cycle, Finance Cycle, Revenue Cycle and Expenditure Cycle

7.7.1. PRODUCTION CYCLE
It involves transactions relating to conversion of purchased inventory into finished product, also includes material, labour and overheads consumed in the production process. Production cycle converts raw material into finished goods and also account for the work in progress status.

![Production Cycle Diagram]

Figure TPS-5. Production Cycle

7.7.2. FINANCE CYCLE
This cycle takes into consideration the accounting transactions that record the acquisition of capital from owners and creditors and the use of capital to acquire assets that are required for generating funds and reporting to owners and creditors regarding how it has been issued.

![Finance Cycle Diagram]

Figure TPS-6. Finance cycle
7.7.3 Revenue Cycle
It involves accounting transactions which result from economic events and generate revenue.

Receiving order from customer, delivering goods and service to the customer, requesting payment from the customer and receiving the payment are the major events that take place in revenue cycle.
When company sells goods or services on credit, each of these events produce a transaction which may occur at separate times but when the things sold on cash basis, ordering, delivering, billing and receiving occur at the same time.

4. Expenditure Cycle: It involves accounting transactions caused by events necessary to acquire material and supplies. This cycle processes transactions representing any of the events like: requesting the item, receiving item, recording the details to pay for items and actually paying.
Most organization uses a purchase department to obtain requisitions and ultimately obtaining material and supplies. Purchase managers order material and select supplier who dispatches the material and provide bills.
Thus, the basic transactions relate to raising of capital and using capital for acquiring property and equipment. This cycle provides accounting/financial reports like Balance Sheet, Income Statement and Cash Flow.
7.8 CASE STUDY OF ATM

An Automated Teller Machine (ATM) allows the bank customers or users to perform basic financial transactions like viewing their account balance, withdraw cash, deposit funds and transfer funds etc. An ATM is also called Automatic Banking machine (ABM), it is a computerized telecommunications device that provides the clients with access to financial transactions in a public space without the need for a cashier, human clerk or bank teller. Each user can have only one account at the bank. The transactions are handled easily and efficiently.

ATM Session Display a welcome message and prompt the user to enter an account number. The user enters a five-digit account number, using the keypad. The screen prompts the user to enter the PIN the user enters a four-digit PIN, using the keypad. If the user enters a valid account number and the correct PIN for that account, the screen displays the main menu. If the user enters an invalid account number or an incorrect PIN, the screen displays an appropriate message, and then the ATM restarts the authentication process. ATMs keep your personal identification number (PIN) and other information safe by using encryption software such as Triple DES (Data Encryption Standard).

Various options displayed by ATM main Menu are:

1. **View /Query Balance**: Displays the user’s account balance. ATM retrieves the balance from the bank’s database and prints it on the receipt.
2. **Withdraw Cash**: Displays withdrawal menu, user’s account number and pin is authenticated, then the user enters the amount to be withdrawn.
3. **Deposit Funds**: Prompts the user to enter deposit amount or 0 (zero) to cancel the transaction.
4. **Transfer of funds from one account to another**: The user is asked to specify the account to which funds are to be deposited. ATM program checks if the account transferring the amount is having the required amount or not. If the amount specified is exist in the account, then the transfer is made.

Figure TPS-9. Working of ATM - Courtesy: @2001HowStuffWorks
ATM is known as Automated Teller Machine which basically deals with transactions between a bank and its account holder.

An Automated teller machine or automatic banking machine is a computerized telecommunication device that provides the clients of a financial institution with access to financial transactions in a public space without the need for a cashier human clerk or bank teller. By inserting a plastic ATM card with a magnetic stripe or a plastic smart card with a chip, that contains a unique card number and in some cases, some security information such as an expiration date or CVVC (CVV). Authentication is provided by the customer entering a personal identification number (PIN).

The transactions are made easily and efficiently.

Bank is given a distinct pass code to access that particular ATM machine. ATM process works faster than a normal bank transaction which gives a lot of overhead. Transactions are much more secure than the normal transaction.

An ATM is simply a data terminal with two input- Card reader and keypad and four output devices- speaker, display screen, receipt printer and cash dispenser. Like any other data terminal, the ATM has to connect to, and communicate through, a host processor. The host processor is analogous to an Internet service provider (ISP) in that it is the gateway through which all the various ATM networks become available to the cardholder (the person wanting the cash).

![Figure 7.10 Components of ATM Machine - Courtesy: @2001HowStuffWorks](image-url)
INPUT DEVICES

- **Card reader** - The card reader captures the account information stored on the magnetic stripe on the back of an ATM/debit card. The host processor uses this information to route the transaction to the cardholder's bank.
- **Keypad** - The keypad lets the cardholder tell the bank what kind of transaction is required and for what amount. Also, the bank requires the cardholder's personal identification number (PIN) for verification.

OUTPUT DEVICES

- **Speaker** - The speaker provides the cardholder with auditory feedback when a key is pressed.
- **Display screen** - The display screen prompts the cardholder through each step of the transaction process. Leased-line machines commonly use a monochrome or color CRT display. Dial-up machines commonly use a monochrome or colour LCD.
- **Receipt printer** - The receipt printer provides the cardholder with a paper receipt of the transaction.
- **Cash dispenser** – Dispenses the cash amount.

The cash-dispensing mechanism has an electric eye that counts each bill as it exits the dispenser. The bill counts and all of the information pertaining to a particular transaction is recorded in a journal. The journal information is printed out periodically and a hard copy is maintained by the machine owner for two years. The cash-dispensing mechanism also has a sensor that evaluates the thickness of each bill. If two bills are stuck together, then instead of being dispensed to the cardholder they are diverted to a reject bin. The same thing happens with a bill that is excessively worn, torn, or folded.

All transactions are carried out cooperatively between bank and ATM machine. All the transactions executed at ATM are executed at the bank system as well.

7.9 ADVANTAGES OF TPS

I. **Process data regularly:** Processing orders, purchasing materials, controlling inventory and generating bills for customers and paying suppliers etc. all such business activities result from customer orders which produce transaction data to be stored and processed by TPS.

II. **High degree of accuracy and integrity:** In case of manual systems, human are responsible for inspecting all the documents and reports required by the company business processes. If the transactions are inaccurate, it results in wasted time and effort and ultimately less profits or in worst case lost profits and customers.
Automated TPSs—data entry, validation, generation of reports ensures high degree of accuracy and integrity at every step.

III. **Produces routine reports:** Manual transaction processing can take days to produce routine reports. Automated TPS ensure fast generation of reports with high degree of accuracy. Electronic recording and transmission of sales information, processing transactions in seconds improves company’s cash flow which helps to produce routines reports instantaneously/daily.

IV. **Helps in maintaining customer loyalty:** Customer interaction with TPS keeps customers satisfied and returning, thus their loyalty is maintained and is retained.

V. **Gains Competitive advantage:** Depending on the nature and specific goals of the business, TPS can help provide some or all of the following: customer loyalty, superior service provided to a customer, better relationship with suppliers, superior information gathering, costs dramatically reduced, all these factors give the company a competitive edge/advantage.

### 7.10 DISADVANTAGES OF TPS

I. **Performing multiple Operations at once:** The transaction processing system must simultaneously co-ordinate thousands of purchases, take consumer’s bank accounts details and ship out or process the order to the consumer. If the system does not integrate all sub modules, it will not work well.

II. **Central to the business:** Major organizational work revolves around processing activities that are handled by TPS. So TPS becomes central to the business that even its failure for few hours can badly affect the firm and all others linked to it.

III. **Problems related to security and hardware:** Transaction processing systems are a combination of software and hardware used to handle immense quantities of consumer and business data. Security breaches may occur in this system, especially since consumers’ private information is held within the database. Also, any hardware malfunction, could damage a well-integrated system that serves millions of consumers. If a business has the resources, the business can invest in high-quality computer security to ensure consumer protection and have hardware to back up data or generators for electricity.

IV. **Too much consolidated:** A transaction processing system requires a lot from a firm. Business requires technical people to perform maintenance of the system 24 hours a day, seven days’ week. The business also needs flawless integration with other departments. Even the failure of one module disturbs the entire working.

You notice that almost every organization works with transaction processing systems—TPSs whether manual or automated, which processes the detailed data necessary to update records about the fundamental business operations of the organization. TPS includes transactions relating to order entry, inventory control, payroll, accounts payable, accounts receivable and general ledger etc.