FINANCIAL AND ACCOUNTING SYSTEMS (Chart 2.58)

Integrated and Non- Integrated Systems

What is a System?

"a set of principles or procedures per which something is done; an organized scheme or method"

What is a Process?

It is a coordinated & standardized flow of activities performed by people or machines, which can traverse functional or departmental boundaries to achieve a business objective & creates value for internal or external customers.

Technical Concepts

A) Working of any software

i) Front End & Back End

- Front End -

It is part of the overall software which actually interacts with user who is using software

- Back End -

It is a part of overall software which does not directly interact with user, but interact with Front End only

ii) Application Software

- Application software performs many functions such as receiving inputs from user, interprets instructions & performs logical functions so a desired output is achieved

- There are three layers which together form application

B) Installed Applications V/s Cloud based Applications

a) Installed Applications

These are programs that are installed on hard disc of the user's computer.

b) Cloud Applications

These days many org. do not want to install Financial Applications on their own IT infrastructure. For many org., the thought process is that it is not their primary function to operate complex IT systems & to have a dedicated IT team & hardware which requires hiring highly skilled IT resources & to maintain the hardware & software to run daily operations. The costs may become prohibitive.

Non - Integrated System

Typical non-integrated environment where all departments are working independently & using their own set of data:-

i) Human Resource
ii) Accounting
iii) Marketing
iv) Production
v) Purchase
vi) Logistics
vii) Quality Control

Two major problems

i) Communication Gaps
ii) Mismatched Data

Integrated ERP

It is an overall business management system that caters need of all people connected with organization

Benefits of an ERP System

A) Information integration
B) Reduction of lead-time
C) On-time Shipment
D) Reduction in Cycle Time
E) Improved Resource utilization
F) Better Customer Satisfaction
G) Improved Supplier Performance
H) Increased Flexibility
I) Reduced Quality Costs
J) Better Analysis and Planning Capabilities
K) Improved information accuracy & decision-making capability
L) Use of Latest Technology

Features of an Ideal ERP System

i) Manufacturing
ii) Financials
iii) Human Resources
iv) Supply Chain Management
v) Projects
vi) Customer Relationship Management (CRM)
vii) Data Warehouse

(Continue on Chart 2.59)

FINANCIAL AND ACCOUNTING SYSTEMS (Chart 2.59)

Integrated and Non- Integrated Systems

Concepts in Computerized Accounting Systems

Types of Data

A) Master Data

It is relatively permanent data that is not expected to change again & again

Types of master data

1) Accounting Master Data
2) Inventory Master Data
3) Payroll Master Data
4) Statutory Master Data

B) Non-Master Data

It is a data which is expected to change frequently, again & again & not a permanent data

Voucher Types

It is a documentary evidence of a transaction

Types of vouchers used in accounting systems

1) Contra	9) Debit Note
2) Payment	10) Sales Order
3) Receipt	11) Stock Journal
4) Journal	12) Physical Stock
5) Sales	13) Delivery Note
6) Purchase	14) Receipt Note
7) Credit Note	15) Memorandum
8) Purchade Order	16) Attendance
	17) Payroll

Voucher Number

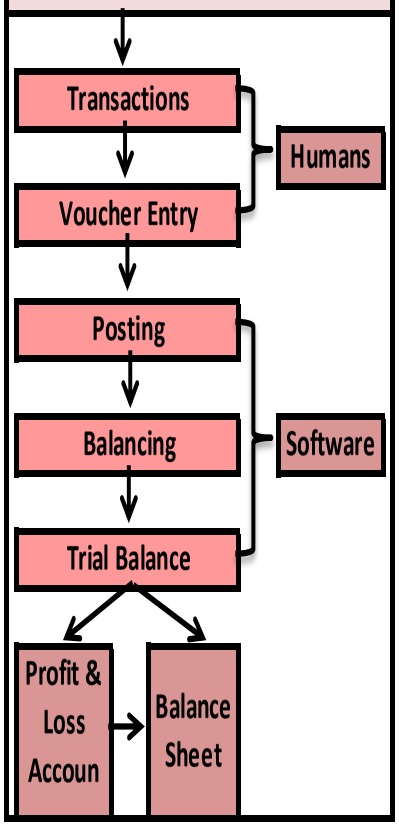
A Voucher No. or a Document Number is a unique identity of any voucher/ document

Peculiarities about voucher numbering

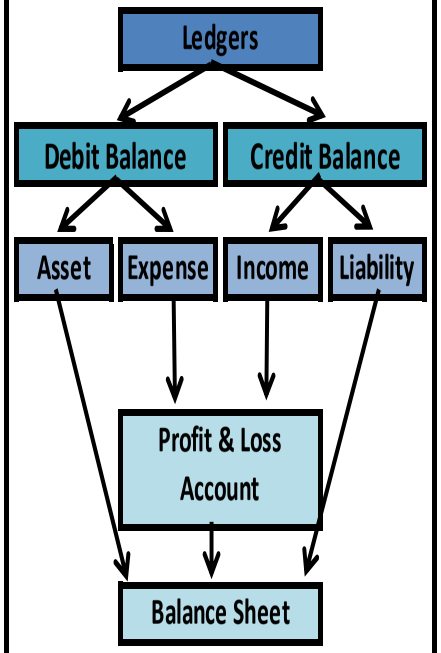
1) It must be unique
2) Separate numbering series
3) May have prefix or suffix or both
4) All vouchers must be numbered serially
5) All vouchers are recorded in chronological order & hence voucher recorded earlier must have an earlier number

Accounting Flow

Accounting flow from angle of software



Types of Ledgers



Grouping of Ledgers

At time of creation of any new ledger, it must be placed under a particular group

There are four basic groups in Accounting, i.e.
Income
Expense
Asset
Liability

FINANCIAL AND ACCOUNTING SYSTEMS (Chart 2.60)

Risks And Controls in an ERP Environment

A. ERP Implementation, its Risks and related Controls

1. People Issues
2. Process Risks
3. Technological Risks
4. Other Implementation Issues
5. Post Implementation issues

B. Role Based Access Control (RBAC)

i) It is an approach to restricting system access to authorized users.

ii) It is a policy neutral access control mechanism defined around roles & privileges

iii) RBAC can be used to facilitate administration of security in large org.

C. Types of Access

While assigning access to different users, following options are possible:-

i) Create – Allows to create data

ii) Alter – Allows to alter data

iii) View – Allows only to view data

iv) Print – Allows to print data

Audit of ERP Systems

i) Fundamental objectives of an audit of controls do not change in an environment. When evaluating controls over systems, decisions must be made regarding relevance of operational internal control procedures to IT controls

ii) ERP Systems should produce accurate, complete, & authorized information that is supportable & timely.

Applicable Regulatory & Compliance Requirements

i) Compliance means conforming to a rule, such as a specification, policy, standard or law.

ii) Regulatory Compliance describes goal that organizations aspire to achieve in their efforts to ensure that they are aware of & take steps to comply with relevant laws, policies & regulations

Types

i) General – Applicable to all irrespective of anything

ii) Specific - Applicable to specific type of businesses only

There may be two approaches for making compliances requiring accounting data

i) Using same software for accounting & tax compliance

ii) Using different software for accounting & tax compliance

FINANCIAL AND ACCOUNTING SYSTEMS (Chart 2.61)

Business Process Modules & Their Integration Financial & Accounting Systems

Different types of industries require different modules these are as follows:-

1) Financial Accounting Module

Features of this module:-

a) Tracking of flow for effective strategic decision making

b) Creation of Organizational Structure

c) Financial Accounting Global Settings

d) General ledger Accounting

e) Tax Configuration & Creation & Maintenance of house of Banks

h) Asset Accounting

f) Account payables

g) Account receivables

i) Integration with Sales & Distribution & Materials

2) Controlling Module

Features of this module:-

a) Cost element Accounting

b) Cost Center Accounting

c) Activity-Based-Accounting

d) Internal Orders

e) Product Cost Controlling

f) Profitability Analysis

g) Profit Center Accounting

3) Sales & Distribution Module

Features of this module:-

a) Setting up Organization Structure

b) Assigning Organizational Units

c) Defining pricing Components

d) Setting up sales document types, billing types, and tax-related components

e) Setting up Customer master data records & configuration

Sales & Distribution Process

a) Pre - Sales Activities

b) Sales Order

c) Inventory Sourcing

d) Material Delivery

e) Billing

f) Receipt from Customer

4) Human Resource Module

i) Enhances work process & data management within HR dept of enterprises.

ii) Most important objective of master data administration in Human Resources is to enter employee-related data for administrative, time-recording, & payroll purposes. payroll & personnel departments deal with Human Resource of org.

5) Quality Management Module

• Quality Planning • Quality Control
• Quality Assurance • Quality Improvement

Quality Management Process includes the following -

a) Master data & standards are set for quality management

b) Set Quality Targets to be met

c) Quality management plan is prepared

d) Define how those quality targets will be measured

e) Take actions needed to measure quality

f) Identify quality issues & improvements & changes to be made

g) Any change is needed in product, change requests are sent

h) Report on overall level of quality achieved

i) Quality is checked at multiple points

6) Material Management (MM) Module

a) Purchase Requisition from Production Dept.

b) Evaluation of Requisition

c) Asking for Quotation

d) Evaluation of quotations

e) Purchase Order

f) Material Receipt

g) Issue of material

h) Purchase Invoice

i) Payment to Vendor

(Continue on Chart 2.62)

FINANCIAL AND ACCOUNTING SYSTEMS (Chart 2.62)

Business Process Modules & Their Integration Financial & Accounting Systems

Different types of industries require different modules these are as follows:-

7) Project Systems Module

i) It is an integrated project management tool used for planning & managing projects

ii) It has several tools that enable project management process such as cost & planning budget, scheduling, requisitioning of materials and services

8) Production Planning (PP) Module

i) It is another important module that includes software designed specifically for production planning & management

ii) It also consists of master data, system configuration and transactions in order to accomplish plan procedure for production

- Master Data
- SOP (Sales & Operations Planning)
- DRP (Distribution Resource Planning)
- Production Planning
- MRP (Material Requirements planning)
- Capacity Planning
- Product Cost Planning

9) Supply Chain Module

It provides extensive functionality for logistics, manufacturing, planning, & analytics

10) Plant Maintenance Module

i) It is a functional module which handles maintaining of equipment & enables efficient planning of production & generation schedules

ii) PM application component provides you with a comprehensive software solution for all maintenance activities that are performed within a company

11) Customer Relationship Management (CRM)

Benefits of a CRM module :-

a) Improved customer relations

b) Increase customer revenues

c) Maximize up-selling & cross-selling

d) Better internal communication

e) Optimize marketing

Reporting System & Management Information System

A) Reporting System

i) It simply means presentation of information in proper & meaningful way.

ii) a system of regular reporting on pre-decided aspects.

B) Management Information System (MIS)

I) What is an MIS Report?

It is a tool that managers use to evaluate business processes & operations.

II) Who Uses MIS Reports?

i) MIS systems automatically collect data from various areas within a business

ii) These systems can produce daily reports that can be sent to key members throughout the organization

III) Type of Information in an MIS Report

i) Relevant	iii) Accurate
ii) Timely	iv) Structured

FINANCIAL AND ACCOUNTING SYSTEMS (Chart 2.63)

Business Process Modules & Their Integration Financial & Accounting Systems

What is a Business Process?

It consists of a set of activities that are performed in co-ordination in an organizational & technical environment.

Business Process Flow

Business Process is a prescribed sequence of work steps performed to produce a desired result for org.

A typical life cycle of an accounting transaction may include :-

i) Source Document	v) Adjustments
ii) Journal	vi) Adjusted TB
iii) Ledger	vii) Closing Entries
iv) Trial Balance	viii) Financial statement

Business process cycles in a manufacturing industry are depicted as under:-

i) Purchase & payables	iv) Fixed Assets
ii) Production & Inventory	v) Payroll
iii) Revenue & Receivables	vi) Financial Statement

Integration with Other Modules

I) Integration Points

Some of points where integration with other modules is required are discussed here:-

i) Material Management Integration with Finance & Controlling (FICO)

ii) Human Resource Module Integration with Finance & Controlling

iii) Material Management Integration with Production Planning (PP)

iv) Material Management Integration with Sales & Distribution (SD)

v) Material Management Integration with Quality Management (QM)

vi) Material Management Integration with Plant Maintenance (PM)

II. Example of ERP Modules

i) Material Management Module

ii) Production Module

iii) Supply Chain Module

iv) Finance & Accounting

v) Human Resource Module

vi) Sales & Distribution

FINANCIAL AND ACCOUNTING SYSTEMS (Chart 2.64)

Business Reporting & Funadmentals of XBRL

Business Reporting

It is public reporting of operating & financial data by a business enterprise, or regular provision of information to decision-makers within an organization to support them in their work.

Why is Business Reporting Important?

i) Allows organizations to present a cohesive explanation of their business

ii) Helps stakeholders to assess organizational performance & make informed decisions

iii) Promote better internal decision-making

iv) Integral to successful management of business, & is one of major drivers of sustainable organizational success

Fundamentals of XBRL

I. What is XBRL

i) It is open international standard for digital business reporting, managed by a global not for profit consortium, XBRL International.

ii) XBRL provides a language in which reporting terms can be authoritatively defined.

iii) It is a standards-based way to communicate & exchange business information between business systems

II. What is XBRL tagging

It is process by which any financial data is tagged with most appropriate element in an accounting taxonomy that best represents data in addition to tags that facilitate identification/ classification

III. What does XBRL do?

It allows unique tags to be associated with reported facts, allowing:

i) People publishing reports to do so with confidence that information contained in them can be consumed & analyzed accurately

ii) People consuming reports to test them against a set of business & logical rules, to capture & avoid mistakes at their source

iii) People using information to do so in the way that best suits their needs, including by using different languages, alternative currencies & in their preferred style.

iv) People consuming information to do so confident that data provided to them conforms to a set of sophisticated pre-defined definitions

IV. Who uses it?

i) Regulators

ii) Companies

iii) Governments

iv) Data Providers

v) Analysts & Investors

vi) Accountants

V. Important features of XBRL

i) Clear Definitions

ii) Testable Business Rules

iii) Multi-lingual Support

iv) Strong Software Support

FINANCIAL AND ACCOUNTING SYSTEMS (Chart 2.65)

Data Analytics And Business Intelligence

Data Analytics

i) Data Analytics is process of examining data sets to draw conclusions about information they contain, increasingly with aid of specialized systems & software

ii) It's initiatives can help businesses increase revenues, improve operational efficiency, optimize marketing campaigns & customer service efforts, respond more quickly to emerging market trends & gain a competitive edge over rivals

Types of Data Analytics Applications

i) Data Analytics can also be separated into quantitative data analysis & qualitative data analysis

ii) More advanced types of data analytics include data mining, which involves sorting through large data sets to identify trends, patterns & relationships

Inside Data Analytics Process

Data Analytics applications involve more than just analysing data

Data Collection - in which data scientists identify information they need for an analytics application & then work on their own or with data engineers & IT staffers to assemble it for use.

Find & Fix Data Quality Problem - Once the data that's needed is in place, the next step is to find & fix data quality problems that could affect accuracy of analytics applications

Building Analytical Model: In some cases, analytics applications can be set to automatically trigger business actions

Business Intelligence (BI)

i) It is a technology-driven process for analyzing data & presenting actionable information to help corporate executives, business managers & other end users make more informed business decisions

ii) Potential benefits of business intelligence programs include:-

a) Accelerating & improving decision making

b) Optimizing internal business processes

c) Increasing operational efficiency

d) Driving new revenues

e) Gaining competitive advantages over business rivals

iii) BI data can include historical information, as well as new data gathered from source systems as it is generated, enabling BI analysis to support both strategic & tactical decision-making processes

E-COMMERCE, M-COMMERCE AND EMERGING TECHNOLOGY (Chart 4.85)

E-Commerce

Introduction

"Sale / Purchase of goods / services through electronic mode is e-commerce." This could include use of technology in form of Computers, Desktops, Mobile Applications, etc.

Difference between Traditional commerce & E-Commerce

Base for Comparison	Traditional Commerce	E - Commerce
Definition	Includes all those activities which encourage exchange, of goods / services which are manual & non-electronic.	E-Commerce means carrying out commercial transactions or exchange of information, electronically on the internet.
Location	It requires a marketplace to operate.	It requires market-space.
Size	Type of items, size of items, & the number of customers influence the size of the store.	Size of business model is also influenced by products and customers.
Marketing	Stores have a physical presence & are known to potential customers.	Have to invest more money, time & effort to acquire a new customer.
Transaction Processing	Manual	Electronically
Availability for commercial transactions	For limited time.	24×7×365
Nature of purchase	Goods can be inspected physically before purchase.	Goods cannot be inspected physically before purchase.

Base for Comparison	Traditional Commerce	E - Commerce
Customer interaction	Face-to-face	Screen-to-face
Business Scope	Limited to particular area	Worldwide reach
Information exchange	No uniform platform for exchange of information.	Provides a uniform platform for information exchange.
Resource focus	Supply side	Demand side
Payment	Cash, cheque, credit card, etc.	Credit card, fund transfer, Cash in Delivery, Payment Wallets, UPCI application etc.
Delivery of goods	Instantly	Takes time
Fraud	Relatively lesser as there is personal interaction between the buyer & seller.	Lack of physical presence in markets & unclear legal issues give loopholes for frauds.
Process	Because of manual processing of business transactions; chances of clerical errors are high.	Automated processing of business transactions minimizes the clerical errors.
Profit Impact	The cost incurred on the middlemen, overhead, inventory & limited sales reduces the profit of organization.	By increasing sales, cutting cost and streamlining operating processes

E-COMMERCE, M-COMMERCE AND EMERGING TECHNOLOGY (Chart 4.86)

E-Commerce

Benefits

To Customer/ Indivisual/ User

- Convenience
- Time saving
- Various Options
- Easy to find reviews
- Coupon & Deals

To Business / Sellers

- Increased Customer Base
- Recurring payments made easy
- Instant Transaction
- Provides a dynamic market
- Reduction in costs:
- Efficiency improvement
- Creation of new markets
- Easier entry into new markets
- Better quality of goods
- Elimination of Time Delays

To Government

- Instrument to fight corruption
- Reduction in use of ecologically damaging materials

Disadvantage of E-Business

- Internet Connection
- High start-up costs
- Legal issues
- Some business processes may never lend themselves to e-commerce
- Cultural impediments to e-business
- Security Concerns

Components

1) User

2) Internet / Network

3) Web portal

4) Payment Gateway

5) Technology Infrastructure
- Computers, Servers & Database
- Mobile Apps
- Digital Libraries
- Data Interchange

6) E-commerce Vendors

a) Suppliers & Supply Chain Management
b) Warehouse Operations
c) Shipping & returns
d) E - Commerce catalogue & product display
e) Marketing & loyalty
f) Showroom & offline purchase programs
g) Different Ordering Methods
h) Guarantees
i) Privacy Policy
j) Security

Various e- Market models

- e - Shops (e-tailers)
- e -Malls
- e -auctions
- Portals
- Buyer Aggregators
- Virtual Community
- e -marketing
- e-procurement
- e -distribution

Trends in E- commerce

- Content
- Social Commerce
- Mobile Commerce
- Biometrics
- Artificial Intelligence
- Predictive Analysis

Business Models for E-Commerce

- Business-to-Consumer (B2C)
- Business-to-Business (B2B)
- Consumer- to-Consumer (C2C)
- Consumer to Business (C2B)
- Consumer to Government (C2G)
- Government to Consumer (G2C)
- Business to Government (B2G)

E-COMMERCE, M-COMMERCE AND EMERGING TECHNOLOGY (Chart 4.87)

Types of Architecture

Two Tier

1) Presentation Tier- allows user to interact with e-commerce / m-commerce vendor
2) Database Tier- Product data /price data / customer data & other related data are kept here.

Advantages	Disadvantages
• System performance is higher because business logic & database are physically close	• Performance deteriorates if number of users' increases.
• Since processing is shared between client & server, more users could interact with system	• There is restricted flexibility and choice of DBMS, since data language used in server is proprietary to each vendor
• By having simple structure, it is easy to setup & maintain entire system smoothly	

Three Tier

1) Presentation Tier- Occupies top level & displays information related to services available on a website.
2) Application Tier- It controls application functionality by performing detailed processing. 3) Database Tier- Information is stored & retrieved. Data in this tier is kept independent of application servers or business logic

Advantages	Disadvantages
• Clear separation of user-interface-control & data presentation from application-logic	• Creates an increased need for network traffic management, server load balancing & fault tolerance
• Dynamic load balancing	• Current tools are relatively immature & are more complex
• Change management	• Maintenance tools are currently inadequate for maintaining server libraries.

E-Commerce Architecture Vide Internet

Layer	Includes	Purpose
1) Client / User Interface	1) User 2) Web Browser 3) Web Server	This Layer helps the e-commerce customer connect to e-commerce merchant
2) Application Layer	1) E-merchant 2) Reseller 3) Logistics partner	Customer logs to merchant systems. allows customer to check products available on merchant's website
3) Database Layer	Information store house, where all data relating to products, price it kept	This layer is accessible to user through application layer

E-COMMERCE, M-COMMERCE AND EMERGING TECHNOLOGY (Chart 4.88)

E-Commerce Architecture Vide M-Commerce

Layer	Includes	Purpose
1) Client /	1) Mobile APP (Application) 2) User	Helps e-commerce customer
2) Application Layer	1) E-merchant 2) Reseller 3) Logistics partner 4) Payment Gateway	Through these application's customer logs to merchant systems. This layer allows customer to check products available on merchant's website
3) Database Layer	Information store house, where all data relating to products, price it kept	This layer is accessible to user through application layer

Steps of E-Commerce Work Flow Digram

1) Customers login 2) Product / Service Selection 3) Customer Places Order
4) Payment Gateway
5) Dispatch & Shipping Process
6) Delivery Tracking
7) COD tracking

Guidelines & Laws Governing E-Commerce

Guidelines for E-Commerce

1) Billing
2) Product guarantee / warranty
3) Shipping
4) Delivery
5) Return
6) Payment

Special Laws governing E-Commerce

1) Information Technology Act, 2000
2) Reserve Bank of India, 1934

Commercial Laws Governing E-Commerce

1) Income Tax Act, 1961
2) Companies Act, 2013
3) Foreign Trade (Development and Regulation) Act, 1992
4) The Factories Act, 1948
5) The Custom Act, 1962
6) The Goods and Services Tax Act, 2017 (GST)
7) The Competition Act, 2002
8) Foreign Exchange Management Act (FEMA 1999)
9) Consumer Protection Act, 1986

E-COMMERCE, M-COMMERCE AND EMERGING TECHNOLOGY (Chart 4.89)

Risks & Controls

Risks

1) Privacy & Security
2) Quality issues
3) Delay in goods & Hidden Costs
4) Needs Access to internet & lack of personal touch
5) Security & credit card issues
6) Infrastructure
7) Problem of anonymity
8) Repudiation of contract
9) Lack of authenticity of transactions
10) Data Loss or theft or duplication
11) Attack from hackers
12) Denial of Service
13) Non-recognition of electronic transactions
14) Lack of audit trails
15) Problem of piracy

Controls

E-business environment, controls are necessary for all persons in chain, including

1) Users
2) Sellers / Buyers / Merchants
3) Government
4) Network Service Providers
5) Technology Service Providers
6) Logistics Service Providers
7) Payment Gateways

Ways to protect risk

1) Educating participant about nature of risks
2) Communication of organizational policies to its customers
3) Ensure Compliance with Industry Body
4) Protect your e-Commerce business from intrusion-
   - Viruses
   - Hackers
   - Passwords
   - Regular software updates
   - Sensitive data

Cyber Security Risk Considerations

There could be cyber security risks with Direct as well as Indirect impact.
- A Direct Financial Impact could be if Application at Company's Retailers which contains financial information has weak passwords at all OSI layers resulting in harming integrity of data.
- An Indirect Operational Impact could be if sensitive customer information

Digital Payments

way of payment which is made through digital modes. Payer & payee both use digital modes to send & receive money. Also called electronic payment. No hard cash is involved. All transactions are completed online. Instant & convenient way to make payments.

Types

A) New Methods

1) UPI Apps
2) Immediate Payment Service (IMPS)
3) Mobile Apps
4) Mobile Wallets
5) Aadhar Enabled Payment Service(AEPS)
6) Unstructure Supplementary Service Data(USSD)
7) Mobile Banking
8) Cryptocurrency

B) Traditional Methods

i) Cards
- Credit Cards
- Debits Cards
- Smart Card

ii) Internet Banking

Advantages

1) Easy and convenient
2) Pay or send money from anywhere
3) Discounts from taxes
4) Written record
5) Less Risk
6) Competitive advantage to business
7) Environment Friendly

Drawbacks

1) Difficult for a Non-technical person
2) The risk of data theft
3) Overspending
4) Disputed transactions
5) Increased business costs
6) The necessity of internet access

E-COMMERCE, M-COMMERCE AND EMERGING TECHNOLOGY (Chart 4.90)

Computing Technologies

Virtualization

Concept

Core concept of Virtualization lies in Partitioning, which divides a single physical server into multiple logical servers. Once physical server is divided, each logical server can run an operating system & applications independently

Application Areas

1) Server Consolidation
2) Disaster Recovery
3) Testing & Training
4) Portable Applications
5) Portable Workspaces

Types

1) Hardware Virtualization
2) Network Virtualization
3) Storage Virtualization

Grid Computing

Concept

It is a special kind of distributed computing. In ideal grid computing system, every resource is shared, turning a computer network into a powerful supercomputer. Every authorized computer would have access to enormous processing power & storage capacity

Benefits

1) Making use of Underutilized Resources
2) Resource Balancing
3) Parallel CPU Capacity
4) Virtual resources & virtual organizations for collaboration.
5) Access to additional resources
6) Reliability
7) Management

Types of Resources

1) Computation
2) Storage
3) Communications
4) Software & Licenses
5) Special equipment, capacities, architectures, & policies

Grid Computing Security

- Secured Single Sign-on
- Resource Management
- Data Management
- Management and Protection of Credentials
- Interoperability with local security solutions
- Standardization
- Exportability
- Support for secure group communication
- Support for multiple implementations

Machine Learning

Definition: It is a type of AI that provides computers with ability to learn without being explicitly programmed. It focuses on development of computer programs that can change when exposed to new data

Applications

1) Autonomous vehicles
2) Medical diagnosis, in cancer research
3) Search engines
4) Playing games
5) Online assistants
6) Detecting unusual credit card transactions to prevent frauds

Risks

It being an application based on AI, the nature of risk to it remain similar to those posed by AI systems

E-COMMERCE, M-COMMERCE AND EMERGING TECHNOLOGY (Chart 4.91)

Cloud Computing

Cloud computing, means use of computing resources as a service through networks, typically Internet. It provides facility to access shared resources & common infrastructure offering services on demand over network to perform operations that meet changing business needs

Cloud Computing Environment

Private

Resides within boundaries of an organisation & used exclusively for the organisation's benefits

Characteristics

1) Secure
2) Central Control
3) Weak Service Level Agreements

Advantages

1) Improves average server utilization, higher efficiencies in low cost
2) High level of security & privacy to user
3) small , controlled & maintained by organization

limitation

IT teams in organization may have to invest in buying, building & managing clouds independently. Budget is a constraint in private clouds & they also have loose SLAs

Public

IT is provisioned for open use by general public. It may be owned, managed, & operated by a business, academic, or government org., or some combination of them. Services are offered on pay-per-use basis.

Characteristics

1) Highly Scalable
2) Affordable
3) Less Secure
4) Highly Available
5) Stringent SLAs

Advantages

1) Used in development, deployment & management of enterprise applications, at affordable costs.
2) Deliver highly scalable & reliable applications rapidly
3) No need for establishing infrastructure for setting up & maintaining cloud
4) Strict SLAs are followed
5) There is no limit for number of users

limitation

Security assurance & thereby building trust among clients is far from desired but slowly liable to happen. Further, privacy & organizational autonomy are not possible

Hybrid

It is a combination of both at least one private (internal) & at least one public (external).

Characteristics

1) Scalable
2) Partially Secure
3) Stringent SLAs
4) Complex Cloud Management

Advantages

1) Highly scalable
2) Provides better security than public cloud

limitation

Security features are not as good as private cloud & complex to manage

Community

It is provisioned for exclusive use by a specific community of consumers from organizations that have shared concerns

Characteristics

1) Collaborative & Distributive Maintenance
2) Partially Secure
3) Cost Effective

Advantages

1) Establishing a low-cost private cloud
2) Collaborative work
3) Sharing of responsibilities
4) Better security than public cloud

limitation

autonomy of organization is lost & some of security features are not.

E-COMMERCE, M-COMMERCE AND EMERGING TECHNOLOGY (Chart 4.92)

Computing Technologies

Cloud Computing

Characteristics

1) Elasticity & Scalability
2) Pay-per-Use
3) On-demand
4) Resiliency
5) Multi Tenancy
6) Workload Movement
7) Wide Range of Network Access Capacities

Advantages

1) Achieve economies of scale
2) Reduce spending on technology infrastructure
3) Globalize workforce
4) Streamline business processes
5) Reduce capital costs
6) Pervasive accessibility
7) Monitor projects more effectively
8) Less personnel training is needed
9) Minimize maintenance & licensing software
10) Improved flexibility
11) Easy access to information/ applications
12) Load balancing
13) Backup and Recovery

Drawbacks

1) If Internet connection is lost, link to cloud & thereby to data & applications is lost.
2) Security is a major concern as entire working with data & applications depend on other cloud vendors or providers.
3) Does not permit control on these resources as these are not owned by the user or customer.
4) Customers may have to face restrictions on availability of applications , operating systems & infrastructure options.
5) Applications may not reside with a single cloud vendor & two vendors may have applications that do not cooperate with each other.

Service Models

a) IAAS

Characteristics

1) Web access to resources
2) Centralized Management
3) Elasticity & Dynamic
4) Shared infrastructure
5) Metered Services

Instances

1) NAAS	4) DTAAS
2) STAAS	5) BAAS
3) DBAAS	

b) PAAS

c) SAAS

Instances

1) TAAS	3) EAAS
2) APIAAS	

d) Other

1) CASS	3) SECAAS
2) DAAS	4) IDAAS

Pertinent Issues Related to Cloud Computing

- Threshold Policy
- Interoperability
- Hidden Costs
- Unexpected Behaviour
- Security Issues
- Legal Issues
- Software Development in Cloud
- Bugs in Large-Scale Distributed Systems

Internet of Things

It is a system of interrelated computing devices, mechanical & digital machines, objects, animals or people that are provided with unique identifiers & ability to transfer data over a network without requiring human-to-human or human-to-computer interaction

Application

1) Home appliances
2) Office machines
3) Governments can keep track of resource utilisations
4) Wearables
5) Smart City
6) Smart Grids
7) Industrial Internet of Things
8) Connected Car
9) Connected Health
10) Smart Retail
11) Smart Supply Chain

Risks

1) Risk to Product manufacturer
2) Risk to user of these products
   a) Security
   b) Privacy, autonomy & control
   c) Intentional obsolescence of devices
3) Technology Risk
4) Environmental Risk due to Technology

Aritificial Intelligence

Defination- Ability to use memory, knowledge, experience, understanding, reasoning, imagination & judgement to solve problems & adapt to new situations

Applications

1) Autonomous vehicles
2) Medical diagnosis, in cancer research
3) Proving mathematical theorems
4) Online assistants
5) Creating art
6) Playing games & predicting outcomes.
7) Search engines

Risks

1) AI relies heavily of data it gets. Incorrect data can lead to incorrect conclusions
2) AI carries a security threats
3) AI in long term may kill human skills of thinking the unthinkable

E-COMMERCE, M-COMMERCE AND EMERGING TECHNOLOGY (Chart 4.93)

Computing Technologies

Mobile Computing

It refers to the technology that allows transmission of data via a computer without having to be connected to a fixed physical link. Mobile data communication has become a very important & rapidly evolving technology as it allows users to transmit data from remote locations to other remote or fixed locations

Components

1) Mobile Communication
2) Mobile Hardware
3) Mobile Software

Limitations

1) Insufficient Bandwidth
2) Security Standards
3) Power consumption
4) Transmission interferences
5) Potential health hazards
6) Human interface with device

Benefits

1) Remote access to work order details
2) Update work order status in real-time, facilitating excellent communication
3) Access to corporate services & information at any time, from anywhere
4) Improve management effectiveness by enhancing information quality
5) Remote access to corporate knowledge base job location

Green Computing

It is study & practice of establishing/ using computers & IT resources in a more efficient & environmentally friendly & responsible way.

Green Computing Best Practices

1) Develop a sustainable Green Computing plan
2) Recycle
3) Make environmentally sound purchase decisions
4) Reduce Paper Consumption
5) Conserve Energy

Challenges

a) Evaluate the actual security mechanisms in order to assess their energy consumption

b) Building new security mechanisms by considering the energy costs from the design phase.

BYOD

BYOD refers to business policy that allows employees to use their preferred computing devices, like smart phones & laptops for business purposes

Advantages

1) Happy Employees
2) Lower IT budgets
3) IT reduces support requirement
4) Early adoption of new Technologies
5) Increased employee efficiency

Emerging BYOD Threats

1) Network Risks
2) Device Risks
3) Application Risks
4) Implementation Risks

Web 3.0

also known as Semantic Web, describes sites wherein computers will be generated raw data on their own without direct user interaction

Components

1) Semantic Web
2) Web Services

AUTOMATED BUSINESS PROCESS (Chart 1.71)

Categories of Business Processes

Operational Processes

Order to Cash Cycle (Eg)-

It is a set of business processes that involves receiving & fulilling customer requests for goods or services

An order to cash cycle consists of multiple sub-processes:-

i) Customer Order
ii) Order Fulfillment
iii) Delivery Note
iv) Invoicing
v) Collections
vi) Accounting

Supporting Processes

Human Resource Management (Eg.)-

Main HR Process Areas are grouped into logical functional areas & they are as follows-

i) Recruitment & Stafing
ii) Goal Setting
iii) Training & Development
iv) Compensation & Benefits
v) Performance Management
vi) Leadership Development
vii) Career Development

Management Processes

Budgeting (Eg.)-

Having a formal & structured budgeting process is foundation for good business management, growth & development

Budgeting Process-

i) Vision
ii) Strategic Plan
iii) Business Goals
iv) Revenue Projections
v) Cost Projection
vi) Profit Projection
vii) Board Approval
viii) Budget Review

Business Process Automation (BPA)

It is technology-enabled automation of activities or services that accomplish a speciic function & can be implemented for many different functions of company activities. BPA is tactic a business uses to automate processes to operate eficiently & effectively. BPA is tradition of analyzing, documenting, optimizing & then automating business processes.

Objectives of BPA

1) Confidentiality
2) Integrity
3) Availability
4) Timeliness

Benefits

1) Quality & Consistency
2) Time Saving
3) Visibility
4) Improved Operational
5) Governance &
6) Reduced Turnaround
7) Reduced Costs

Implementation of BPA

1) Step 1: Define why we plan to implement a BPA?
2) Step 2: Understand rules / regulation under which enterprise needs to comply with?
3) Step 3: Document process, we wish to automate
4) Step 4: Define the objectives/goals to be achieved by implementing BPA
5) Step 5: Engage business process consultant
6) Step 6: Calculate the RoI for project
7) Step 7: Developing the BPA
8) Step 8: Testing the BPA

Enterprise Risk Management (ERM)

It may be defined as a process, effected by an entity's Board of Directors, management & other personnel, applied in strategy setting.

Benefits of Enterprise Risk Management

1) Align risk appetite & strategy
2) Link growth, risk and return
3) Enhance risk response decisions
4) Minimize operational surprises & losses
5) Identify & manage cross-enterprise risks
6) Provide integrated responses to multiple risks
7) Seize opportunities
8) Rationalize capital

Components of Enterprise Risk Management

1) Internal Environment
2) Objective Setting
3) Event Identification
4) Risk Assessment
5) Risk Response
6) Control Activities
7) Information & Communication
8) Monitoring

Which Business Processes should be automated

1) Processes involving high-volume of tasks or repetitive tasks
2) Processes requiring multiple people to execute tasks
3) Time-sensitive processes
4) Processes involving need for compliance & audit trail
5) Processes having significant impact on other processes and systems

Challenges involved in Business Process Automation

1) Automating Redundant Processes
2) Defining Complex Processes
3) Staff Resistance
4) Implementation Cost

AUTOMATED BUSINESS PROCESS (Chart 1.72)

Risks & Its Management

Risk is any event that may result in a significant deviation from a planned objective resulting in an unwanted negative consequence

Types of Risks

A) Business Risks

- i) Strategic Risk
- ii) Financial Risk
- iii) Regulatory (Compliance) Risk
- iv) Operational Risk
- v) Hazard Risk
- vi) Residual Risk

B) Technology Risk

- i) Frequent changes or obsolescence of technology
- ii) Multiplicity and complexity of systems
- iii) Different types of controls for different types of technologies/systems
- iv) Proper alignment with business objectives and legal/regulatory requirements
- v) Dependence on vendors due to outsourcing of IT services
- vi) Vendor related concentration risk
- vii) Segregation of Duties (SOD)
- viii) External threats leading to cyber frauds/ crime
- ix) Higher impact due to intentional or unintentional acts of internal employees
- x) New social engineering techniques employed to acquire confidential credentials
- xi) Need for governance processes to adequately manage technology & information security
- xii) Need to ensure continuity of business processes in the event of major exigencies
- xiii) Downtime due to technology failure

Risk Management & Related Terms

- A) Risk Management
- B) Asset
- C) Vulnerability
- D) Threat
- E) Exposure
- F) Likelihood
- G) Attack
- H) Counter Measure

Risk Management Strategies

- A) Tolerate/Accept the risk
- B) Terminate/Eliminate the risk
- C) Transfer/Share the risk
- D) Treat/mitigate the risk
- E) Turn back

Controls

SA-315 defines system of internal control as plan of enterprise & all methods & procedures adopted by management of an entity to assist in achieving management's objective of ensuring, as far as practicable, orderly & efficient conduct of its business, including adherence to management policies, safeguarding of assets, prevention & detection of fraud and error, accuracy & completeness of accounting records, & timely preparation of reliable financial information.

Based on mode of implementation, these controls can be:-

1) Manual Control
2) Automated Control
3) Semi-Automated Control

An Internal Control System

1) Facilitates effectiveness & eficiency of operations
2) Helps ensure reliability of internal & external financial reporting
3) Assists compliance with applicable laws & regulations
4) Helps safeguarding assets of entity

Components of Internal Control

1) Control Environment
2) Risk Assessment
3) Control Activities
   - i) General Controls
   - ii) Application Controls
4) Information & Communication
5) Monitoring of Controls

Applying IT Controls

(a) Information Technology General Controls (ITGC)

- Information Security Policy
- Administration, Access, & Authentication
- Separation of key IT functions
- Management of Systems Acquisition and Implementation
- Change Management
- Backup, Recovery & Business Continuity
- Proper Development and
- Confidentiality, Integrity and Availability of Software and data files
- Incident response and management
- Monitoring of Applications and supporting Servers
- Value Add areas of Service Level Agreements (SLA)
- User training and qualification of Operations personnel

(b) Application Controls

Limitations of Internal Control System

1) Management's consideration that cost of an internal control does not exceed expected benefits to be derived
2) Most internal controls do not tend to be directed at transactions of unusual nature
3) Collusion with employees or with parties outside the entity
4) Person responsible for exercising an internal control could abuse that responsibility
5) Manipulations by management with respect to transactions or estimates & judgements required in preparation of financial statements

AUTOMATED BUSINESS PROCESS (Chart 1.73)

Risks And Controls For Specific Business Process

Business Processes - Risks & Controls

Suitable controls should be implemented to meet requirements of control objectives.

Levels of Computer controls:

1) Configuration
2) Masters
3) Transactions

Procure to Pay – Risks & Controls

It is process of obtaining & managing raw materials needed for manufacturing a product or providing a service

Order to Cash (O2C) – Risks & Controls

It is a set of business processes that involve receiving & fulfilling customer requests for goods or services

It consists of multiple sub-processes including:

1) Customer order is documented
2) Order is fulfilled or service is scheduled
3) Order is shipped to customer or service is performed
4) Invoice is created & sent to customer
5) Customer sends payment /Collection
6) Payment is recorded in general ledger

Inventory Cycle – Risks & Controls

It is a process of accurately tracking on-hand inventory levels for an enterprise

Phases of Inventory Cycle for Manufacturers:

1) The ordering phase
2) The production phase
3) The finished goods & delivery phase

Human Resources – Risks & Controls

Stage of HR cycle includes following:

1) Recruiting & On boarding
2) Orientation & Career Planning
3) Career Development
4) Termination or Transition

General Ledger – Risks & Controls

Steps in general ledger process flow are as follows:

1) Entering inancial transactions into system
2) Reviewing Transactions
3) Approving Transactions
4) Posting of Transactions
5) Generating Financial

Fixed Assets – Risks & Controls

Steps of fixed assets process are as follows:

1) Procuring an asset
2) Registering or Adding an asset
3) Adjusting the Assets
4) Transferring the Assets
5) Depreciating the Assets
6) Disposing the Assets

AUTOMATED BUSINESS PROCESS (Chart 1.74)

Diagramatic Representation of Business Process

Flowcharts

Flowcharts are used in designing & documenting simple processes or programs

Advantages of Flowcharts

1) Quicker grasp of relationships
2) Effective Analysis
3) Communication
4) Documentation
5) Efficient coding
6) Program Debugging
7) Efficient program maintenance
8) Identifying Responsibilities
9) Establishing Controls

Limitations of Flowchart

1) Complex logic
2) Modification
3) Reproduction
4) Link between conditions &
5) Standardization

Data Flow Diagrams

Processes are identiied to functional departments. Data Flow Diagrams (DFD) show flow of data or information from one place to another

DFD basically provides an overview of:

1) What data a system processes
2) What transformations are performed
3) What data are stored
4) What results are produced and where they flow

Diagrammatic Representation of Specific Business

1) Customer Order Fulfilment
2) Order to Cash
   i) Sales & Marketing (SM)
   ii) Order Fulfilment
   iii) Manufacturing
   iv) Receivables
3) Procure to Pay
   i) User Department
   ii) Procurement Department
   iii) Vendor
   iv) Stores
   v) Accounts Payable

Regulatory & Compliance Requirements

The Companies Act, 2013

1) Section 134- Financial statement, Board's report, etc
2) Section 143- Powers & duties of auditors & auditing standards
3) Guidance Note on Audit of Internal Financial Controls over Financial Reporting
   a) Management's Responsibility
   b) Auditors' Responsibility
   c) Corporate Governance Requirements

Information Technology Act (IT Act)

Cyber Crime

- Traditional Theft
- Hacking

Key Provisions of IT Act

Sec 43 - Penalty & compensation for damage to computer, computer system, etc.
Sec 43A - Compensation for failure to protect data
Sec 65 - Tampering with Computer Source Documents
Sec 66 - Computer Related Offences
Sec 66B - Punishment for dishonestly receiving stolen computer resource or communication device
Sec 66C - Punishment for identity theft
Sec 66D - Punishment for cheating by personation by using computer resource
Sec 66E - Punishment for violation of privacy
Sec 66F - Punishment for cyber terrorism
Sec 67 - Punishment for publishing or transmitting obscene material in electronic form
Sec 67A - Punishment for publishing or transmitting of material containing sexually explicit act, etc. in electronic form
Sec 67B - Punishment for publishing or transmitting of material depicting children in sexually explicit act, etc. in electronic form

Computer Related Offences

- Harassment via fake public profile on social networking site
- Email Account Hacking
- Credit Card Fraud
- Web Defacement
- Introducing Viruses, Worms, Backdoors, Rootkits, Trojans, & Bugs
- Cyber Terrorism
- Online sale of illegal Articles
- Cyber Pornography
- Phishing and Email Scams
- Theft of Confidential Information
- Source Code Theft

Advantages of Cyber Laws

Privacy of Online Data

Sensitive Personal Data Information (SPDI)

INFORMATION SYSTEMS AND ITS COMPONENTS (Chart 3.94)

Information

i) Data is a raw fact & can take form of a number or statement such as a date or a measurement.
ii) Information involves collecting data & then subjecting them to a transformation process in order to create information

System

A group of mutually related, cooperating elements with a defined boundary; working on reaching a common goal by taking inputs & producing outputs in organized transformation process.

Information System

IS is a combination of people, hardware, software, communication devices, network & data resources that processes (can be storing, retrieving, transforming information data & information for a specific purpose.

Steps of IS Model

1) Input 2) Process 3) Output

Components of Information Systems

Networking & Communication Systems

Computer Network

It is a collection of computers & other hardware interconnected by communication channels that allow sharing of resources & information.

Network & Communication System

These consist of both physical devices & software, links various pieces of hardware & transfers data from one physical location to another.

Issues

1) Routing
2) Bandwidth
3) Resilience
4) Contention

Benefits

1) Distributed nature of info
2) Resource Sharing
3) Computational Power
4) Reliability
5) User communication

Impacts

1) Time compression
2) Overcoming geographical dispersion
3) Restructuring business relationships

Types of Network

1) Connection Oriented networks
2) Connectionless Networks

Hardware & Software

Hardware

It is tangible portion of our computer systems; something we can touch & see.

Input Devices

Through which we interact with systems & include devices like Keyboard, Mouse & other pointing devices, Scanners

Processing Devices

Include computer chips that contain Central Processing Unit & main memory

It consists of three functional units

1) Control Unit (CU)
2) Arithmetic & Logical Unit (ALU)
3) Registers
   i) Accumulators
   ii) Address Registers
   iii) Storage Registers
   iv) Miscellaneous

Data Storage Devices

Memory where data & programs are stored

Types of memory

1) Internal Memory
   i) Internal Memory
   ii) Cache Memory
2) Primary Memory/ Main Memory
   i) Random Access Memory
   ii) Read Only Memory
3) Secondary Memory
4) Virtual Memory

Output Devices

Output devices are devices through which system responds

Types of output

1) Textual output
2) Graphical outputs
3) Tactile output
4) Audio output
5) Video output

Software

Operating Systems Software

It is a set of computer programs that manages computer hardware resources & acts as an interface with computer applications programs.

Activities are executed by OS

1) Performing hardware functions
2) User Interfaces
3) Hardware Independence
4) Memory Management
5) Task Management
6) Networking Capability
7) Logical Access Security
8) File management

Application Software

It includes all that computer software that cause a computer to perform useful tasks beyond running of computer itself

INFORMATION SYSTEMS AND ITS COMPONENTS (Chart 3.95)

Components of Information Systems

People Resources

People are most important element in most computer-based information systems.

People involved include users of system & information systems personnel, including all people who manage, run, program, & maintain system.

Data Resources

Data

Data are raw bits & pieces of information with no context. it can be quantitative or qualitative. Quantitative data is numeric, result of a measurement , count, or some other mathematical calculation. Qualitative data is descriptive.

Database

It is an organized collection of related information. In a database all data is described & associated with other data.

Database Models

It is a type of data model that determines logical structure of a database & fundamentally determines in which manner data can be stored, organized & manipulated.

Hierarchy of database

1) Database
2) File
3) Record
4) Field
5) Characters

Database models

1) Hierarchical Database Model
2) Network Database Model
3) Relational Database Model
4) Object Oriented Database Model

Related Concepts of Database

1) Big Data
2) Data Warehouse
3) Data Mining

Database Management Systems (DBMS)

It is a software that aid in organizing, controlling & using data needed by application programme.

Operations Performed by DBMS

1) Adding new files to database
2) Deleting existing files from database
3) Inserting data in existing files
4) Modifying data in existing files
5) Deleting data in existing files
6) Retrieving or querying data from existing files

Advantages of DBMS

1) Permitting Data Sharing
2) Minimizing Data Redundancy
3) Integrity can be maintained
4) Program & File consistency
5) User-friendly
6) Improved security
7) Achieving program/data independence
8) Faster Application Development

Disadvantages of a DBMS

1) Cost
2) Security

Information System's Control

Need for Controls in IS

1) Information integrity, reliability & validity for timely flow of accurate information throughout org.
2) To reduce probability of organizational costs of data loss, computer loss, computer abuse, incorrect decision making & to maintain privacy
3) Safeguarding assets to maintain accurate data readily available

Objectives of Controls

Categories of Exposures

1) Errors or omissions in data, procedure, processing, judgment & comparison
2) Improper authorizations & improper accountability
3) Inefficient activity in procedures, processing & comparison

Critical control lacking in a computerized environment

1) Lack of management understanding of IS risks & related controls.
2) Absence or inadequate IS control framework
3) Absence of weak general controls & IS controls
4) Lack of awareness & knowledge of IS risks & controls amongst business users & even IT staff
5) Complexity of implementation
6) Lack of control features or their implementation in highly technology driven environments
7) Inappropriate technology implementations or inadequate security functionality in technologies implemented

Purpose Served by Control Objectives

1) Outline policies of org. as laid down by management
2) Benchmark for evaluating whether control objectives are met

INFORMATION SYSTEMS AND ITS COMPONENTS (Chart 3.96)

Classification of Information System's Controls

Objective of Controls

1) Preventive Controls

These controls prevent errors, omissions, or security incidents from occurring

2) Detective Controls

These controls are designed to detect errors, omissions or malicious acts that occur & report occurrence.

Characteristics

i) Clear understanding of lawful activities

ii) Established mechanism to refer reported unlawful activities to appropriate person or group.

iii) Interaction with preventive control to prevent such acts from occurring

iv) Surprise checks by supervisor

3) Corrective Controls

It is desirable to correct errors, omissions, or incidents once they have been detected

Characteristics

i) Minimizing impact of threat.

ii) Identifying cause of problem

iii) Providing remedy to problems discovered by detective controls

iv) Getting feedback from preventive & detective controls.

v) Correcting error arising from a problem

vi) Modifying processing systems to minimize future occurrences of incidents.

Nature of Information System Resources

1) Environmental Controls

Controls relating to IT environment

Controls for Environmental Exposures

1) Fire Damage

2) Electrical Exposure

3) Water Damage

4) Pollution Damage & others

2) Physical Access Controls

This includes abuse of data processing resources

Controls for Physical Exposures

i) Locks on Doors

ii) Physical Identiication Medium

iii) Logging on Facilities

iv) Other means of Controlling Physical Access

a) Video Cameras

b) Security Guards

c) Controlled Visitor Access

d) Bonded Personnel

e) Dead Man Doors

f) Non–exposure of Sensitive Facilities

g) Computer Terminal Locks

h) Controlled Single Entry Point

i) Alarm System

j) Perimeter Fencing

k) Control of out of hours of employee-employees

l) Secured Report/Document Distribution Cart

3) Logical Access Controls

These are controls relating to logical access to information resources

Technical Exposures

1) Data Diddling

2) Bomb

3) Christmas Card

4) Worm

5) Rounding Down

6) Salami Techniques

7) Trap Doors

8) Spooing

Asynchronous Attacks

1) Data Leakage

2) Subversive Attacks

3) Wire tapping

4) Piggybacking

Logical Access Violators

1) Hackers

2) Employees

3) IS Personnel

4) Former Employees

5) End Users

Some of Logical Access Controls

1) User Access Management

i) User Registration

ii) Privilege management

iii) User password management

iv) Review of user access rights

2) User Responsibilities

i) Password use

ii) Unattended user equipment

3) Network Access Control

i) Policy on use of network services

ii) Enforced path

iii) Segregation of networks

iv) Network connection & routing control

v) Security of network services

vi) Firewall

viii) Encryption

ix) Call Back Devices

4) Application & Monitoring System Access Control

i) Information access restriction

ii) Sensitive system isolation

iii) Event logging

iv) Monitor system use

v) Clock synchronization

5) Mobile Computing

6) Operating System Access Control

i) Automated terminal identiication

ii) Terminal log-in procedures

iii) Access Token

iv) Access Control List

v) Discretionary Access Control

vi) User identiication & authentication

vii) Password management system

viii) Use of system utilities

ix) Duress alarm to safeguard users

x) Terminal time out

xi) Limitation of connection time

(Continue on Chart 3.97)

INFORMATION SYSTEMS AND ITS COMPONENTS (Chart 3.97)

Classification of Information System's Controls

Audit Functions

A) Managerial Controls

I) Top Management & Information Systems Management Controls

- a) Planning
- b) Organizing
  - i) Resourcing Info Systems Function
  - ii) Stafing Info systems Function
- c) Leading
  - i) Motivating & Leading Information Systems Personnel
  - ii) Communicating with IS Personnel
- d) Controlling
  - i) Overall Control of IS Function
  - ii) Control of Info. System Activities
  - iii) Control over Info System Services

II) Quality Assurance Management Controls

VII) BCP (Business Continutity Planning) Controls

III) Programming Management Controls

a) Phases of Program Development Life Cycle

- i) Planning
- ii) Control
- iii) Design
- iv) Coding
- v) Testing
- vi) Operation & Maintenance

IV) Data Resource Management Controls

control activities involved in maintaining integrity of database

V) Security Management Controls

VI) Operations Management Controls

- a) Computer Operations
  - i) Operation Controls
  - ii) Scheduling Controls
  - iii) Maintenance Controls
- b) Network Operations
- c) Data Preparation & Entry
- d) Production Control
- e) File Library
- f) Documentation & Program Library
- g) Help Desk/ Technical support
- h) Capacity Planning & Performance
- i) Management of Outsourced Operations

VII) Systems Development Management Controls

- a) System Authorization Activities
- b) User Speciication Activities
- c) Technical Design Activities
- d) Internal Auditor's Participation
- e) Program Testing
- f) User Test & Acceptance Procedures

(Continue on Chart 3.98)

INFORMATION SYSTEMS AND ITS COMPONENTS (Chart 3.98)

Classification of Information System's Controls

Audit Functions

B) Application Controls & their Categories

I) Boundary Controls

- b) Cryptography
- c) Passwords
- d) Personal Identiication Numbers (PIN)
- e) Identiication Cards
- f) Biometric Devices

II) Input Controls

a) Source Document Controls

b) Data Coding Controls

i) Transcription Errors
- Addition errors
- Truncation errors
- Substitution errors

ii) Transposition Errors
- Single transposition
- Multiple transposition

c) Batch Controls

ii) Types of control
- Financial totals
- Hash totals
- Document/Record Counts

d) Validation Controls

i) Field Interrogation
- Limit Check
- Picture Checks
- Valid Code Checks
- Check Digit
- Arithmetic Checks
- Cross Checks

ii) Record Interrogation
- Reasonableness Check
- Valid Sign
- Sequence Check

iii) File Interrogation
- Version Usage
- Internal & External Labeling
- Data File Security
- Before & after Image & Logging
- File Updating & Maintenance
- Parity Check

III) Communication Controls

- i) Physical Component Controls
- ii) Line Error Control
- iii) Flow Controls
- iv) Link Controls
- vi) Channel Access Controls

IV) Processing Controls

i) Processor Controls
- Error Detection & Correction
- Multiple Execution States
- Timing Controls
- Component Replication

ii) Real Memory Controls

iii) Virtual Memory Controls

iv) Data Processing Controls

V) Database Controls

i) Major Update Controls
- Sequence Check between Transaction & Master Files
- Ensure All Records on Files are processed
- Process multiple transactions for a single record in correct order
- Maintain a suspense account

ii) Major Report Controls
- Standing Data
- Print-Run-to Run control Totals
- Print Suspense Account Entries
- Existence/Recovery Controls

VI) Output Controls

- Storage & Logging of sensitive, critical forms
- Logging of output program executions
- Spooling/ Queuing
- Controls over printing
- Report Distribution & Collection Controls
- Retention Controls

INFORMATION SYSTEMS AND ITS COMPONENTS (Chart 3.99)

Information System Auditing

Objectives
1) Asset Safeguarding Objectives
2) Data Integrity Objectives
3) System Effectiveness Objectives
4) System Eficiency Objectives

Need for Audit of IS
1) Organisational Costs of Data Loss
2) Cost of Incorrect Decision Making
3) Costs of Computer Abuse
4) Value of Computer Hardware, Software & Personnel
5) High Costs of Computer Error
6) Maintenance of Privacy
7) Controlled evolution of computer Use

Types of Audit Tools
1) Snapshots
2) Integrated Test Facility (ITF)
3) System Control Audit Review File (SCARF)
4) Continuous & Intermittent Simulation (CIS)
5) Audit Hooks

IS Audit & Audit Evidence
1) Means of controlling current audit work
2) Evidence of audit work performed
3) Schedules supporting or additional item in accounts
4) Information about business being audited, including recent history

Segregation of Duties

It ensures that single individuals do not possess excess privileges that could result in unauthorized activities such as fraud or manipulation or exposure of sensitive data

Examples of Segregation of Duties Controls
1) Transaction Authorization
2) Split custody of high-value
3) Worklow
4) Periodic reviews

The choices for mitigating a SOD issue include
1) Reduce access privileges
2) Introduce a new mitigating control

Organizations Structure & Responsibility

1) Short & long-term objectives
i) Market conditions
ii) Regulation
iii) Available talent

2) Roles & Responsibilities
It defines specific job titles & duties, & it denotes generic expectations & responsibilities regarding use & protection of assets

3) Individual Roles & Responsibilities
i) Executive management
ii) Owner
iii) Manager
iv) User

4) Job Titles & Job Descriptions
i) Job titles in IT have matured & are quite consistent across organizations. This consistency helps organizations in several ways

- Recruiting
- Career advancement
- Compensation baselining

ii) Additional titles such as district manager, group manager, or area manager

a) Executive Management
- CIO
- CTO
- CSO
- CISO
- CPO

b) Software Development
- Systems Architect
- Systems Analyst
- Software Developer, Programmer
- Software Tester

c) Data Management
- Database Architect
- Database Administrator (DBA)
- Database Analyst

d) Network Management
- Network Architect
- Network Engineer
- Network Administrator
- Telecom Engineer

e) Systems Management
- Systems Architect
- Systems Engineer
- Storage Engineer
- Systems Administrator

f) General Operations
- Operations Manager
- Operations Analyst
- Controls Analyst
- Systems Operator
- Data Entry
- Media Librarian

g) Security Operations
- Security Architect
- Security Engineer
- Security Analyst
- User Account Management
- Security Auditor

INFORMATION SYSTEMS AND ITS COMPONENTS (Chart 3.100)

Audit Trail

1) Audit Trail Objectives

i) Detecting Unauthorized Access

ii) Reconstructing Events

iii) Personal Accountability

Auditing Environmental Controls

1) Role of Auditor in Auditing Environmental Controls

2) Audit of Environmental Controls

i) Power conditioning

ii) Backup power

iii) Heating, Ventilation, & Air Conditioning (HVAC)

iv) Water detection

v) Fire detection & suppression

vi) Cleanliness

Auditing Physical Security Controls

1) Role of IS Auditor in Auditing Physical Access Controls

i) Risk Assessment

ii) Controls Assessment

iii) Review of Documents

2) Audit of Physical Access Controls

i) Siting & Marking

- Proximity to hazards
- Marking

ii) Physical barriers

iii) Surveillance

iv) Guards & dogs

v) Key-Card systems

Auditing Logical Access Controls

1) Role of IS Auditor in Auditing Logical Access Controls

i) Network Access Paths

ii) Documentation

2) Audit of Logical Access Controls

i) User Access Controls

a) Auditing User Access Controls

- Authentication
- Access violations
- User account lockout
- Intrusion detection & prevention
- Dormant accounts
- Shared accounts
- System accounts

b) Auditing Password Management

- Password standards

c) Auditing User Access Provisioning

- Access request processes
- Access approvals
- New employee provisioning
- Segregation of Duties (SOD)
- Access reviews

d) Auditing Employee Terminations

- Termination process
- Access reviews
- Contractor access & terminations

ii) User Access Logs

- Centralized access logs
- Access log protection
- Access log review
- Access log retention

iii) Investigative Procedures

- Investigation policies & procedures
- Computer crime investigations
- Computer forensics

iv) Internet Points of Presence

- Search engines
- Social networking sites
- Online sales sites
- Domain names
- Justiication of Online Presence

Managerial Controls & their Audit Trails

1) Top Management & Information Systems Management Controls

- Planning
- Organizing
- Leading
- Controlling

2) System Development Management Controls

i) Different types of Audit during System Development Process

- Concurrent Audit
- Post -imple- mentation Audit
- General Audit

3) Data Resource Management Controls

4) Programming Management Controls

i) Audit Trails under Programming Management Controls

- Planning
- Control
- Design
- Coding
- Testing
- Operation & Maintenance

5) Security Management Controls

6) Operations Management Controls

7) Quality Assurance Management Controls

Application Controls & their Audit Trails

1) Boundary Controls

2) Input Controls

3) Communication Controls

4) Processing Controls

5) Database Controls

6) Output Controls

CORE BANKING SYSTEMS (Chart 5.56)

Overview of Banking Services

Overview of Banking Services

Key features of a banking business are as follows:

i) Custody of large volumes of monetary items

ii) Dealing in large volume of transactions

iii) Wide network of branches & departments, which are geographically dispersed

iv) Banks provide multi-point authentication checks & highest level of information security

Core banking services:-

i) Acceptance of Deposits

ii) Granting of Advances

iii) Remittances

iv) Collections

v) Clearing

vi) Letters of Credit & Guarantees

vii) Credit Cards

viii) Debit Cards

ix) Other Banking Services

- a) Back operations
- b) Retail Banking
- c) High Net-worth Individuals
- d) Risk Management
- e) Specialized Services

Overview of Core Banking Systems

The characteristics of CBS are -

i) There is a common database in a central server located at a Data Center, which gives a consolidated view of the bank's operations

ii) Branches function as delivery channels providing services to its customers

iii) It is centralized Banking Application software that has several components which have been designed to meet the demands of the banking industry

iv) It is supported by advanced technology infrastructure & has high standards of business functionality

v) Core Banking Solution brings significant benefits such as a customer is a customer of the bank & not only of branch

vi) It is modular in structure & is capable of being implemented in stages as per requirements of the bank.

vii) A CBS software also enables integration of all 3rd party applications, including in-house banking software, to facilitate simple & complex business processes.

Key Modules of CBS

A) Back End Applications

i) Back Office	iii) Credit Card System
ii) Data Warehouse	iv) ATM Switch

B) Central Server

C) Front End Applications

• Mobile Banking	• Phone Banking
• Internet Banking	• Branch Banking

Core features of CBS

i) On-line real-time processing.

ii) Transactions are posted immediately.

iii) All databases updated simultaneously.

iv) Centralized Operations

v) Separate hierarchy for business & operations

vi) Business & Services are productized

vii) Remote interaction with customers

viii) Reliance on transaction balancing

ix) Highly dependent system-based controls

x) Authorizations occur within the application

xi) Increased access by staff at various levels based on authorization

xii) Daily, half yearly & annual closing

xiii) Automatic processing of standing instructions

xiv) Centralized interest applications for all accounts & account types

xv) Anytime, anywhere access to customers & vendors

Components & Architecture of CBS

Technology Components of CBS

A) Key technology components of CBS

i) Database Environment

ii) Application Environment

iii) Connectivity to the Corporate Network & the Internet

iv) Data Centre & Disaster Recovery Centre

v) Enterprise Security architecture

vi) Online Transaction monitoring for fraud risk management

B) Some key aspects in-built into architecture of a CBS

i) Information flow

ii) Customer centric

iii) Regulatory compliance

iv) Resource optimization

CBS IT Environment

i) Application Server

ii) Database Server

iii) Automated Teller Machines (ATM) Channel Server

iv) Internet Banking Channel Server (IBCS)

v) Internet Banking Application Server

vi) Web Server

vii) Proxy Server

viii) Anti-Virus Software Server

Implementation of CBS

- Planning
- Approval
- Selection
- Design and develop or procured
- Testing
- Implementation
- Maintenance
- Support
- Updation
- Audit

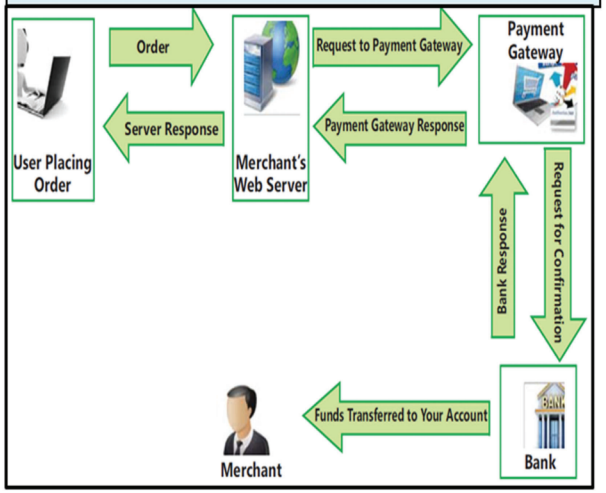
CORE BANKING SYSTEMS (Chart 5.57)

Components & Architecture of CBS

E-Commerce Transaction processing

a) Most of e-Commerce transactions involve advance payment either through a credit or debit card issued by a bank

b) flow of transaction when a customer buys online from vendor's e-commerce website.:-



Implementation of CBS

• Planning	• Implementation
• Approval	• Maintenance
• Selection	• Support
• Design & develop or procured	• Updation
• Testing	• Audit

CBS Risks, Security Policy & Controls

Risks associated with CBS

i) Operational Risk
ii) Credit Risk
iii) Market Risk
iv) Strategic Risk
v) Compliance Risk
vi) IT Risk
a) Ownership of Data/ process
b) Authorization process
c) Authentication procedures
d) Several software interfaces across diverse networks
e) Maintaining response time
f) User Identity Management
g) Access Controls
h) Incident handling procedures
i) Change Management

Security Policy

i) Information Security Policies,
ii) Procedures & practices
iii) User Security Administration
iv) Application Security
v) Database Security
vi) Operating System Security
vii) Network Security
viii) Physical Security

Internal Control System in Banks

i) Internal Controls in Banks

a) Work of 1 staff member is invariably supervised/ checked by another staff member, irrespective of nature of work

b) A system of job rotation among staff exists

c) Financial & administrative powers of each official/ position is fixed & communicated to all persons concerned

d) Branch managers must send periodic confirmation to their controlling authority on compliance of laid down systems & procedures

e) All books are to be balanced periodically. Balancing is to be confirmed by an authorized official

f) Details of lost security forms are immediately advised to controlling so that they can exercise caution

g) Fraud prone items like currency, valuables, draft forms, term deposit receipts, traveler's cheques & other such security forms are in the custody of at least 2 officials of the branch

ii) IT Controls in Banks

a) System maintains a record of all log-ins & log-outs.

b) transaction is sought to be posted to a dormant account, processing is halted & can be proceeded with only with a supervisory password

c) system checks whether amt. to be withdrawn is within drawing power.

d) system flashes a msg if balance in a lien account would fall below lien amt after processing of transaction

e) Access to system is available only between stipulated hrs & specified days only

f) Individual users can access only specified directories & files. Users should be given access only on a 'need-to-know basis' based on their role in bank

g) Exception situations such as limit excess, reactivating dormant accounts, etc. can be handled only with a valid supervisory level password

h) A user timeout is prescribed

i) Once end-of-the-day process is over, the ledgers cannot be opened without a supervisory level password.

iii) Application Software

a) Configuration

- Defining access rules from various devices/terminals.
- Creation of User Types
- Creation of Customer Type, Deposit Type, year-end process
- User Access & privileges - Configuration & its management
- Password Management

b) Masters

- Customer Master
- Employee Master
- Income Tax Master

c) Transactions

- Deposit transactions
- Advances transactions
- ECS transactions
- General Ledger

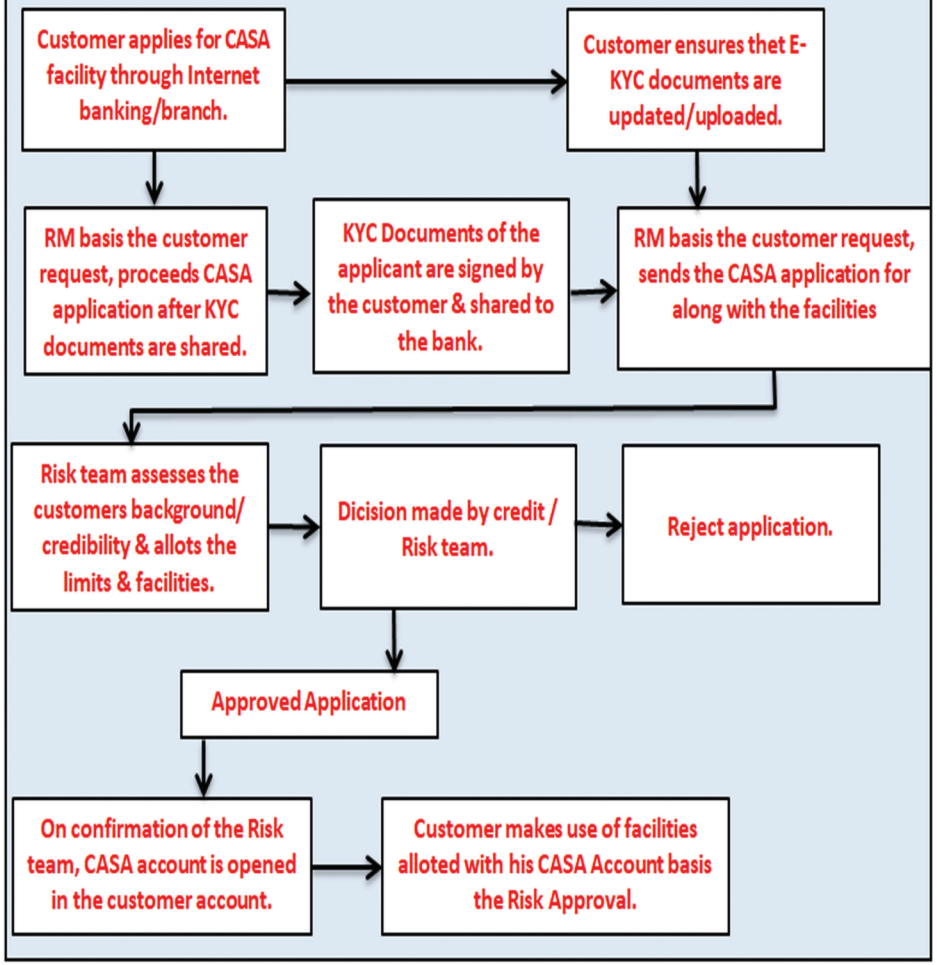
d) Reports

- Summary of transactions of day
- Daily General Ledger of day
- Activity Logging & reviewing
- MIS report for each product or service
- Reports covering performance/compliance;
- Reports of exceptions,

CORE BANKING SYSTEMS (Chart 5.58)

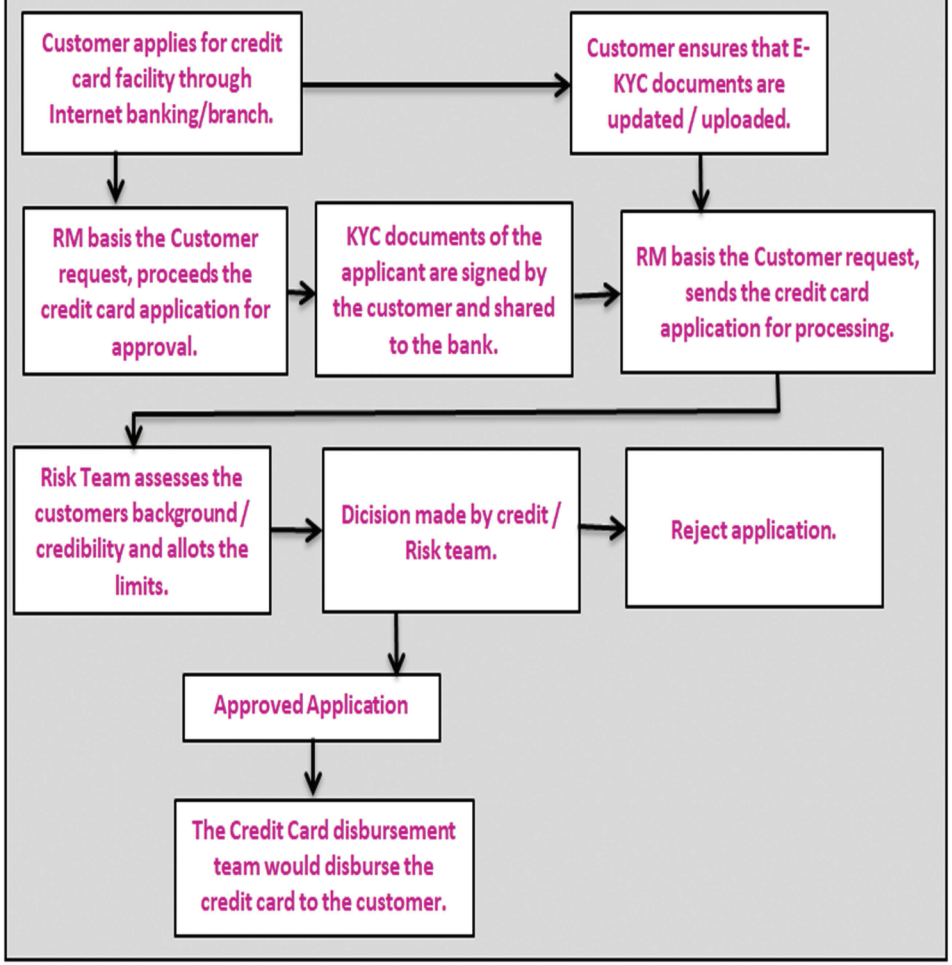
Core Business Flow & Relevant Risks and Controls

I) Business process low of Current & Savings Accounts (CASA)



II) Business Process low of Credit Cards

a) Process Flow of Issuance of Credit Card Facility

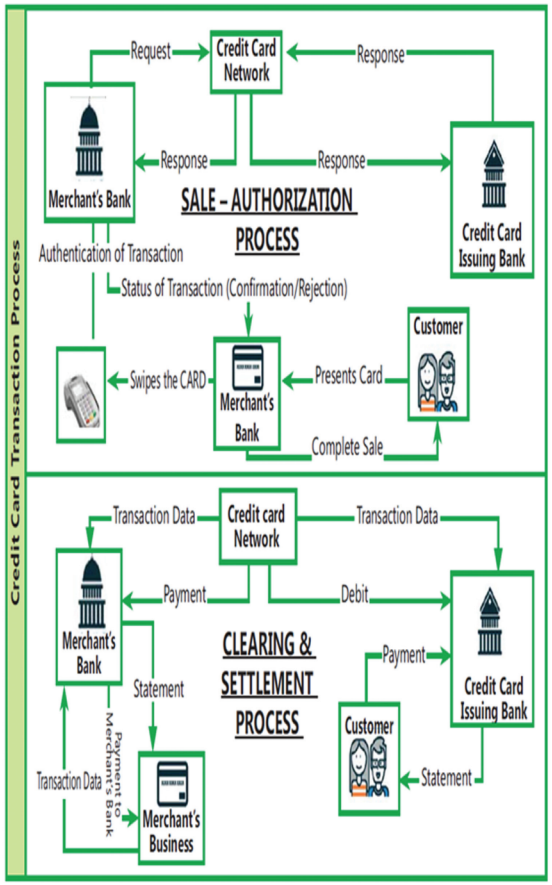


CORE BANKING SYSTEMS (Chart 5.59)

Core Business Flow & Relevant Risks and Controls

II) Business Process low of Credit Cards

b) Process Flow of Sale - Authorization process of Credit Card Facility



III) Business Process Flow of Mortgages

i) Types of Mortgage Loan

a) Home loan	b) Top up loan
c) Loans for Under Construction Property	

ii) Process Description

a) Loans are provided by lender which is a financial institution. There are 2 types of loan widely offered to customer first is fixed rate mortgage second is variable/ floating rate mortgage.

b) Borrower/Customer approaches bank for a mortgage & relationship manager/ loan officer explains customer about home loan . Customer to fill loan application & provide requisite KYC documents.

c) Loan officer reviews loan application & sends it to Credit risk team who will calculate financial obligation income ratio . along with customer documents details are sent to underwriting team for approval.

d) Underwriter will ensure that loan provided is within lending guidelines & at this stage provide conditional approval along with list of documents required

e) As per property selected by customer, loan officer will provide property details along with requisite documents to the legal & valuation team.

f) Further verification of property to determine whether property is built as per approved plan, builder has received requisite certificates, age of building to determine whether it will withstand loan tenure, construction quality

g) Legal & valuation team will send their report to operations team, which entails all details of loan

h) Customer will agree to loan agreement which is offered by signing offer letter. Loan officer will notarize all loan documents & are send back to lender operations team

i) Once signed offer letter is received operations team release or disburse fund & prepare a cashier order

j) Post disbursement of loan customer can carry out various loan servicing activity by visiting the branch or via online mode amendments

IV) Treasury Process

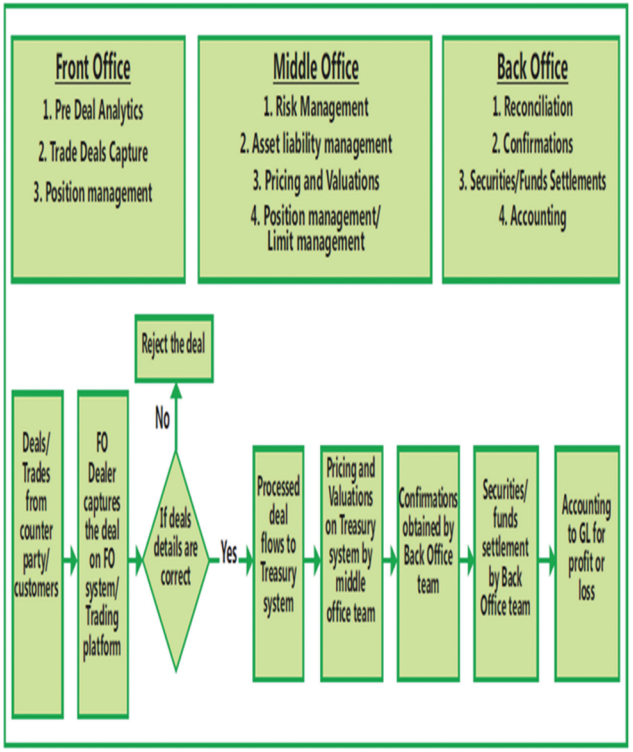
i) Core areas of Treasury Operations

a) Dealing Room Operations (Front office operations)

b) Middle Office (Market Risk department / Product Control Group)

c) Back office.

ii) Process flow for Bank Treasury Operations



CORE BANKING SYSTEMS (Chart 5.60)

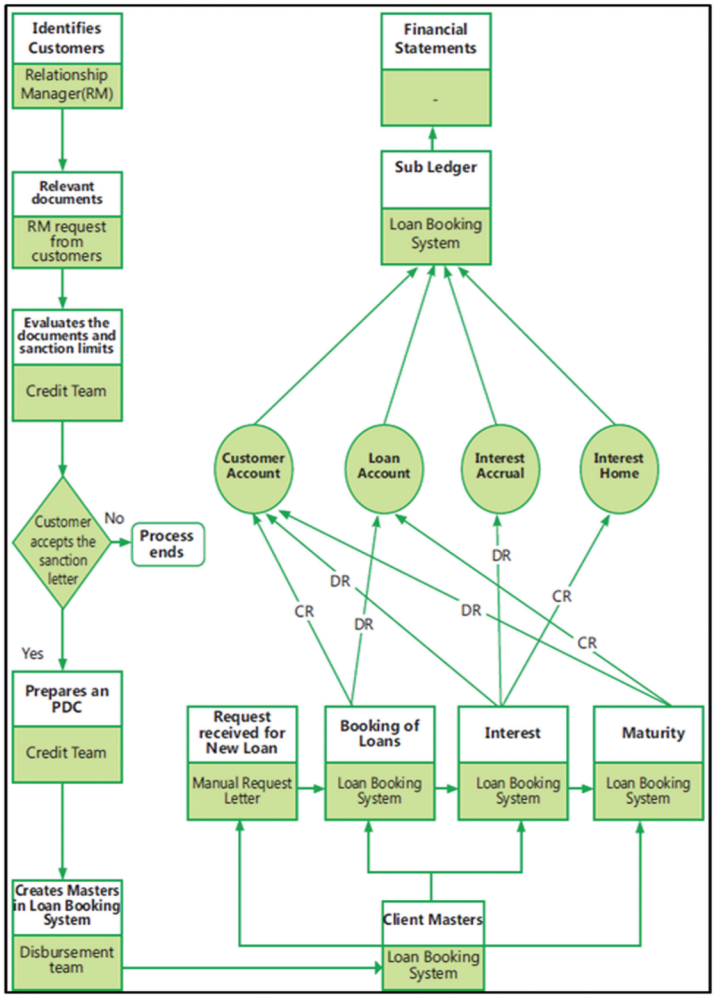
Core Business Flow & Relevant Risks and Controls

Reporting Systems & MIS, Data Analytics & Business Intelligence

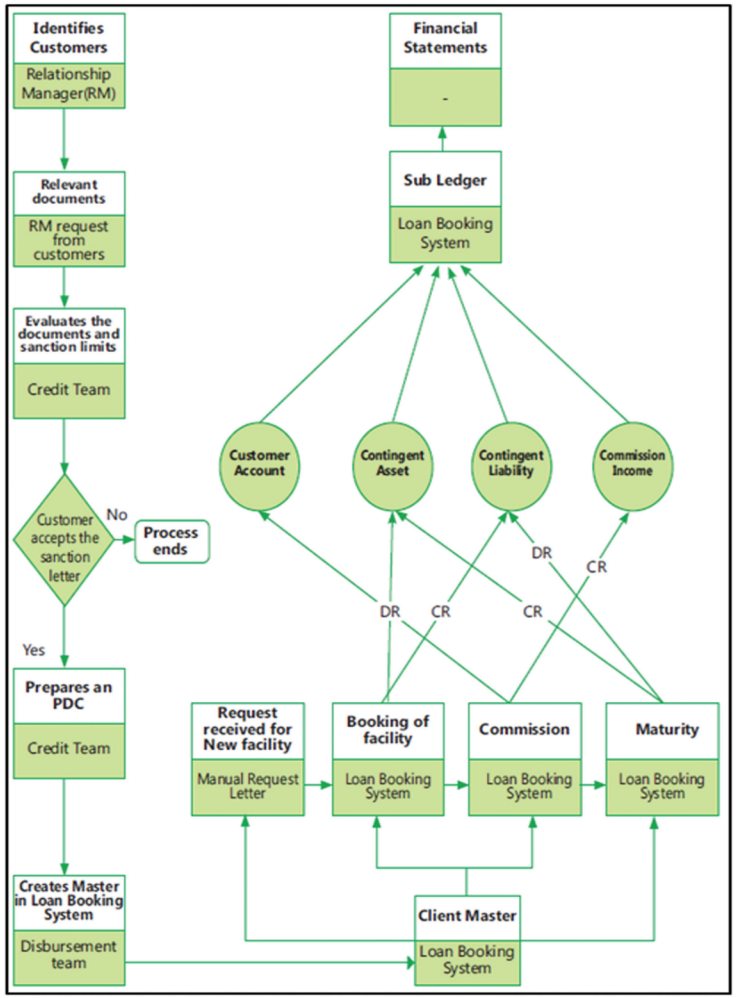
V) Loans & Trade Finance Process

Classification of Credit Facilities:

a) Fund Based Credit Facilities



b) Non-Fund Based Credit Facilities



Risk Prediction for Basel III, based on Artificial Intelligence

- Basel III is a comprehensive set of reform measures, developed by the Basel Committee on Banking Supervision, to strengthen the regulation, supervision & risk management of banking sector
- These measures aim to improve banking sector's ability to absorb shocks arising from financial & economic stress, whatever source & to improve risk management & governance
- One of the dimensions of Basel III is determining capital adequacy based on risk assessment.

CORE BANKING SYSTEMS (Chart 5.61)

Applicable Regulatory & Compliance Requirement

Impact of Technology in Banking

key components of banking business with controls pervading all 4 areas of business process, policies & procedures, regulatory requirements & organization structure. However, in the CBS environment, technology is the encompasses all the 4 critical components which are business processes, policies & procedures, regulatory requirements & organization structure

Money Laundering

i) Stages of Money Laundering

a) Placement

b) Layering

c) Integration

ii) Anti-Money laundering (AML) using Technology

iii) Financing of Terrorism

Cyber Crimes

It is defined as: 'Offences that are committed against individuals or groups of individuals with a criminal motive to intentionally harm reputation of victim or cause physical or mental harm, or loss, to victim directly or indirectly, using modern telecommunication networks such as Internet (Chat rooms, emails, notice boards & groups) & mobile phones.

Classification of Crimes

i) Committing of a fraud by manipulation of the input, output, or throughput of a computer based system

ii) Computer forgery, which involves changing images or data stored in computers

iii) Deliberate damage caused to computer data or programs through virus programs or logic bombs

iv) Unauthorized access to computers by 'hacking' into systems or stealing passwords, &

v) Unauthorized reproduction of computer programs or software piracy

vi) Cybercrimes have grown big with some countries promoting it to attack another country's security and financial health

Banking Regulation Acts

Act provides a framework using which commercial banking in India is supervised & regulated

I) Negotiable Instruments Act-1881 (NI Act)

a) Under NI Act, Cheque includes electronic image of truncated cheque & a cheque in electronic form.

b) A cheque in the electronic form has been defined as 'a mirror image' of a paper cheque

II) RBI Regulations

Some of the key functions of RBI:-

a) Monetary Authority

b) Regulator & supervisor of financial system

c) Issuer of currency

III) Prevention of Money Laundering Act (PMLA)

i) CHAPTER II - Offence of Money Laundering

a) Section 3. Offence of money-laundering

ii) CHAPTER IV - Oblication of Banking Companies, Financial Institutions & Intermediaries

a) Section 12. Reporting entity to maintain records.

b) Section 13. Powers of Director to impose fine.

iii) CHAPTER X - Miscellaneous

a) Section 63. Punishment for false information or failure to give information, etc.

b) Section 70. Offences by companies.

Information Technology Act

Key Provisions of IT Act

i) Section 43 - Penalty & compensation for damage to computer, computer system, etc.

ii) Section 43A - Compensation for failure to protect data.

iii) Section 65 - Tampering with Computer Source Documents

iv) Section 66 - Computer Related Offences

v) Section 66-B - Punishment for dishonestly receiving stolen computer resource or communication device

vi) Section 66-C - Punishment for identity theft

vii) Section 66-D - Punishment for cheating by personation by using computer resource

viii) Section 66-E - Punishment for violation of privacy

Prevention of Money Laundering Act (PMLA)

CHAPTER II OFFENCE OF MONEY-LAUNDERING

Sec 3. Offence of money-laundering

CHAPTER IV OBLIGATIONS OF BANKING COMPANIES, FINANCIAL INSTITUTIONS AND INTERMEDIARIES

Sec 12. Reporting entity to maintain records.

Sec 13. Powers of Director to impose fine

CHAPTER X MISCELLANEOUS

Section 63. Punishment for false information or failure to give information, etc.

Section 70. Offences by companies

Sensitive Personal Data Information (SPDI)

Privacy Policy

CORE BANKING SYSTEMS (Chart 5.61)

I) Risk around CASA Process	II) Risks around Credit Card Process	III) Risk around Mortgage Process	IV) Risk around Treasury Process	V) Risk in Loans & Advances Process
a) Credit Line setup is unauthorized & not in line with banks policy.	a) Credit Line setup is unauthorized & not in line with banks policy	a) Incorrect customer & loan details are captured which will affect overall downstream process.	a) Unauthorized securities setup in systems such as Front office/Back office	a) Credit Line setup is unauthorized & not in line with banks policy.
b) Customer Master defined in CBS is not in accordance with Pre- Disbursement Certificate.	b) Credit Line setup is unauthorized & not in line with banks policy.	b) Incorrect loan amount disbursed.	b) Inaccurate trade is processed.	b) Credit Line setup is unauthorized & not in line with banks policy.
c) Inaccurate interest / charge being calculated in CBS.	c) Masters defined for customer are not in accordance with Pre-Disbursement Certificate.	c) Interest amount is incorrectly calculated & charged.	c) Unauthorized confirmations are processed.	c) Masters defined for customer are not in accordance with Pre-Disbursement Certificate.
d) Unauthorized personnel approving CA-SAS transaction in CBS.	d) Credit Line setup can be breached.	d) Unauthorized changes made to loan master data or customer data.	d) Insufficient Securities available for Settlement	d) Credit Line setup can be breached in Loan disbursement system/CBS.
e) Inaccurate accounting entries generated in CBS.	e) Inaccurate interest / charge being calculated in Credit Card system.		e) Incomplete & inaccurate data flow between systems.	e) Lower rate of interest/ Comm may be charged to customer.
	f) Inaccurate reconciliations performed.		f) Insufficien funds are available for settlements.	f) Facilities/Loan's granted may be unauthorized/inappropriate
			g) Incorrect Nostro payments processed.	g) Inaccurate interest / charge being calculated in Loan disbursal system

VII) Risks & Controls w.r.t Information Security			VIII) Risks w.r.t Application Controls		
a) Significant information resources may be modified inappropriately, disclosed without authorization, and/ or unavailable when needed.	d) Potential Loss of confidenti-ality, availability & integrity of data & system.	g) Potential loss of confidentiality, availability & integrity of data & system	a) Interest may be incorrectly computed leading to incorrect recording of income/ expenditure.	f) Multiple liens in excess of deposit value may result in inability recover outstanding in event of a default.	j) Failure to levy appropriate charges resulting in loss of revenue. Inappropriate levy of charges, resulting in customer disputes.
b) Lack of management direc-tion & commitment to protect information assets.	e) It is easier for unauthorized users to guess password of an authorized user & access system and/ or data. This may result in loss of confidentiality, availability & integrity of data & system.	h) Inadequate preventive measure for key server & IT system in case of environ-mental threat like heat, humidity, fire, flood etc.	b) Inappropriate assignment of rate codes resulting in violation of business rules &/ or loss of revenue.	g) Inappropriate security or controls over system parameter settings resulting in unauthorized or incorrect changes to settings.	k) Incorrect classification & provisioning of NPAs, resulting in financial misstatement.
c) User accountability is not established.			c) Absence of appropriate system validations may result in violation of business rules.	h) Inappropriate set up of accounts resulting in violation of business rules	
d) Unauthorized system or data access, loss & modification due to virus	f) Unauthorized viewing, mod-ification or copying of data and/ or unauthorized use, modification or denial of service in system.	d) Security breaches may go undetected.	d) Inappropriate reversal of charges resulting in loss of revenue.	i) Failure to automate closure of NRE/ NRO accounts on change in residence status may result in regulatory non-compliance & undue benefits to customers.	
			e) Failure to levy appropriate charges resulting in loss of revenue.		