

Introduction to E- Gov Project Costing



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Agenda

- **Project Costing**
- **Cost Components**
- **Classification of costs**
- **Cost Categories in e-Governance Projects**
- **Consultancy Services**
- **Software Design, Development and Maintenance**
- **IT infrastructure creation and maintenance**
- **Citizen Service Delivery**

Illustrative Templates

Margins in System Integrator Engagements

Project ?

- A project is “a temporary endeavor undertaken to create a unique product, service, or result” (PMBOK® Guide, 2017).
- Operations is work done to sustain the business.
- Projects end when their objectives have been reached or the project has been terminated

Project Attributes

- A project
 - has a unique purpose
 - is temporary
 - drives change and enable value creation
 - requires resources, often from various areas
 - should have a primary customer or sponsor
 - involves uncertainty
- The project sponsor usually provides the direction and funding for the project
- Project managers work with project sponsors, team, and other people involved in a project to achieve project goals

Project Management

- “Project management is “the application of knowledge, skills, tools and techniques to project activities to meet project requirements” (PMBOK® Guide, Sixth Edition, 2017).
- Project managers strive to meet the triple constraint (project scope, time, and cost goals) and also facilitate the entire process to meet the needs and expectations of project stakeholders

E-Gov Project Life Cycle

1. e-Governance
Strategy
Development

2. Current State
Assessment

3. Future State
Definition

4. Implementation
approach and
sourcing

5. Develop and
implement IT
system

6. Operate and
sustain

Project Management Office/Unit

Change Management and Communications

Project goals

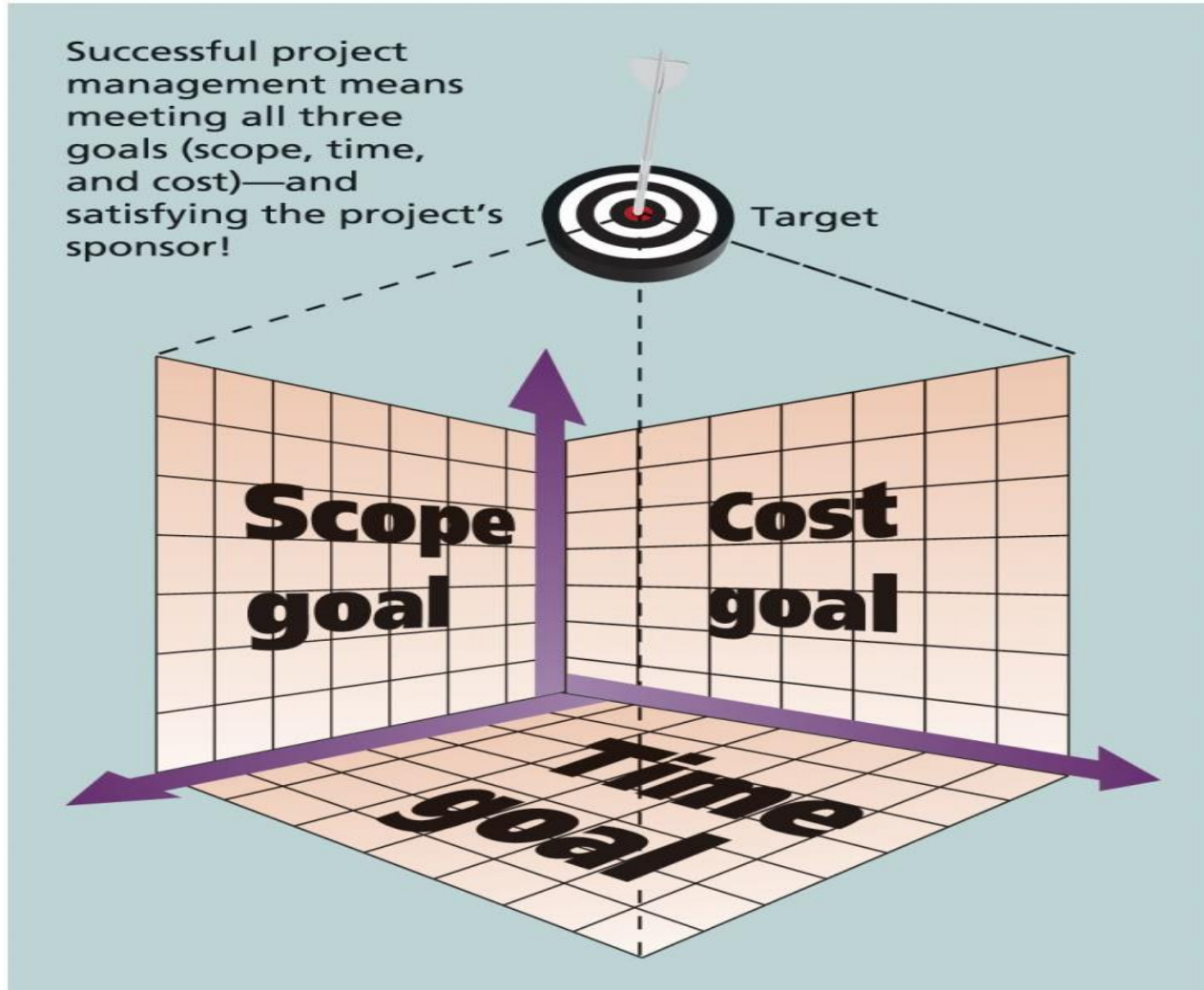


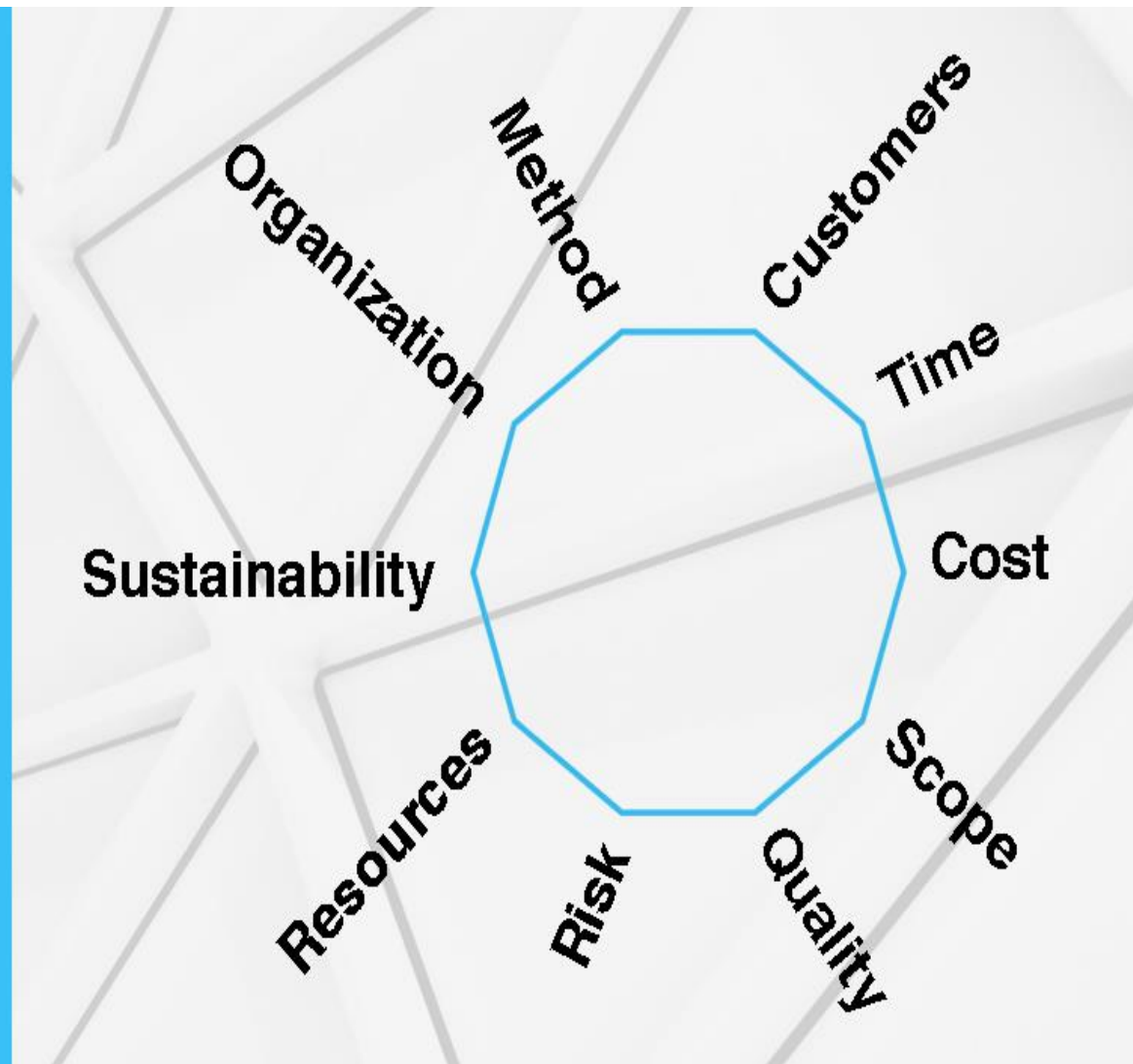
FIGURE 1-1 Project constraints

Project constraints



Beyond Triple Constraint

10 Constraints of Project Management



Project Management

- A 2011 study published in the Harvard Business Review examined IT change initiatives in almost 1,500 projects and reported an average cost overrun of 27 percent.
- One in six of all projects studied contained a “black swan”: a high-impact event that is rare and unpredictable, but not improbable in retrospect

Disasters

- The United Kingdom's National Health Service (NHS) IT modernization program was called "the greatest IT disaster in history" by one London columnist.
- This 10-year program, which started in 2002, was created to provide an electronic patient records system, appointment booking, and a prescription drug system in England and Wales.
- Britain's Labor government estimates that the program will eventually cost more than \$55 billion, a \$26 billion overrun.
- The program has been plagued by technical problems due to incompatible systems, resistance from physicians who say they were not adequately consulted about system features, and arguments among contractors about who's responsible for what.
- A government audit in June 2006 found that the program, one of the largest civilian IT projects undertaken worldwide, was progressing despite high-profile problems.
- In an effort to reduce cost overruns, the NHS program would no longer pay for products until delivery, shifting some financial responsibility to prime contractors, including BT Group, Accenture, and Fujitsu Services.
- On September 22, 2011, government officials in the United Kingdom announced that they were scrapping the National Programme for Health IT. Health Secretary Andrew Lansley said that the program "let down the NHS and wasted taxpayers' money."

Cost and Project Cost Management

- **Cost** is a resource sacrificed or foregone to achieve a specific objective or something given up in exchange.
- **Project Cost Management**, is primarily concerned with the cost of the resources needed to complete project activities.
- And should consider the effect of project decisions on the subsequent recurring cost of using, maintaining, and supporting the product, service, or result of the project

Classification of Costs

Based on Whether or not Asset is created <ul style="list-style-type: none">•Capital Costs [Capex]•Operating Costs [Opex]	Based on Variability <ul style="list-style-type: none">•Fixed Costs•Variable Costs•Semi-Variable costs
Based on Directness <ul style="list-style-type: none">•Direct Costs•Indirect Costs	From Economics perspective <ul style="list-style-type: none">•Production Costs•Transaction Costs
Cost concepts for decision making <ul style="list-style-type: none">•Incremental costs•Sunk Costs	Opportunity Costs
There are other classifications too...	

Classification by nature of Costs



Direct costs are expenses that are billed directly to the project. Examples of direct costs are team travel expenses, team wages, costs incurred for recognition and awards for employees, etc.

Indirect costs are costs that are shared and allocated among several or all projects. Examples include fringe benefits and taxes. Another example of indirect costs would be the salary of an architect or a project manager who is partially allocated across many projects. Their team members' salaries would be direct costs since each of them is directly working on a particular project and their salary is a direct cost to the project. But since the project manager is allocated to several projects, the costs incurred on his salary are indirect costs to the project.

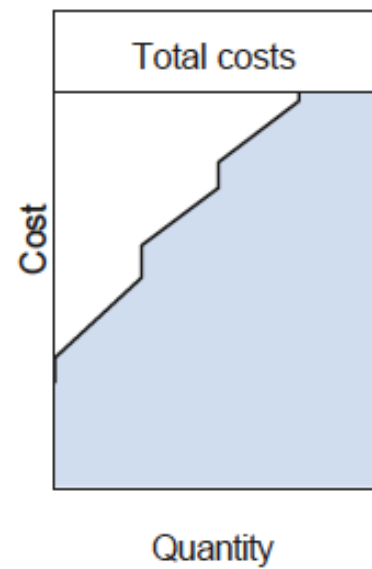
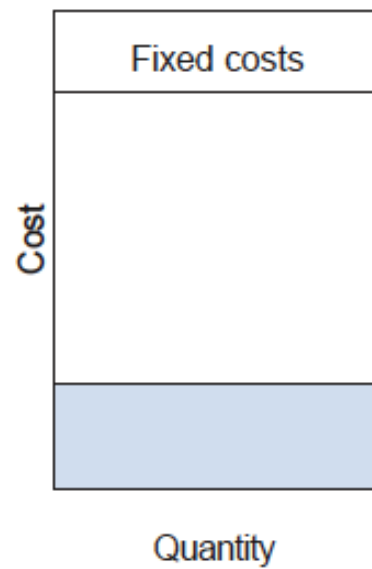
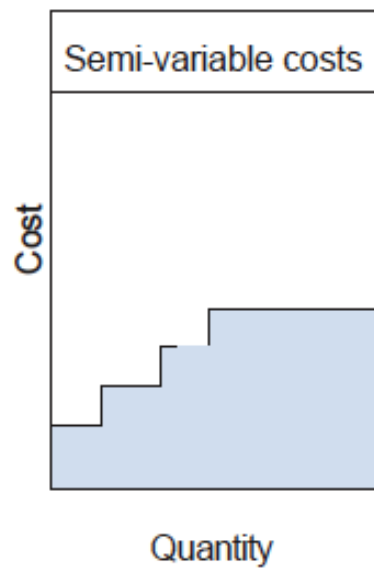
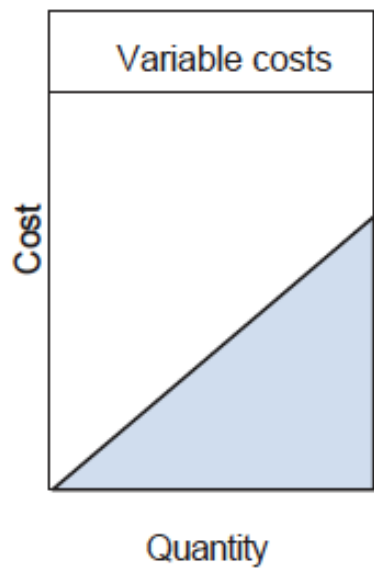
Cost classification by Behaviour?



Fixed Cost: Fixed cost is the cost which does not vary with the change in the volume of activity in the short run. These costs are not affected by temporary fluctuation in activity of an enterprise. Example: Rent, Depreciation...etc.

Variable Cost: Variable cost is the cost of elements which tends to directly vary with the volume of activity. Variable cost has two parts (i) Variable direct cost (ii) Variable indirect costs. Variable indirect costs are termed as variable overheads. Example: Direct labour, Outward Freight...etc.

Semi-Variable Costs: Semi-variable costs contain both fixed and variable elements. They are partly affected by fluctuation in the level of activity. These are partly fixed and partly variable costs and vice versa. Example: Factory supervision, Maintenance...etc.



Project Costs - Types

CAPEX focuses on the long term. CAPEX is an expense a project/business incurs to create a benefit in the future.

OPEX covers the short term. OPEX is an expense required for the day-to-day functioning of a project/business.

Capital expenditure or capital expense (CAPEX) is the money a project/company spends to buy, maintain or improve fixed assets. Fixed assets are buildings, vehicles, equipment, or land

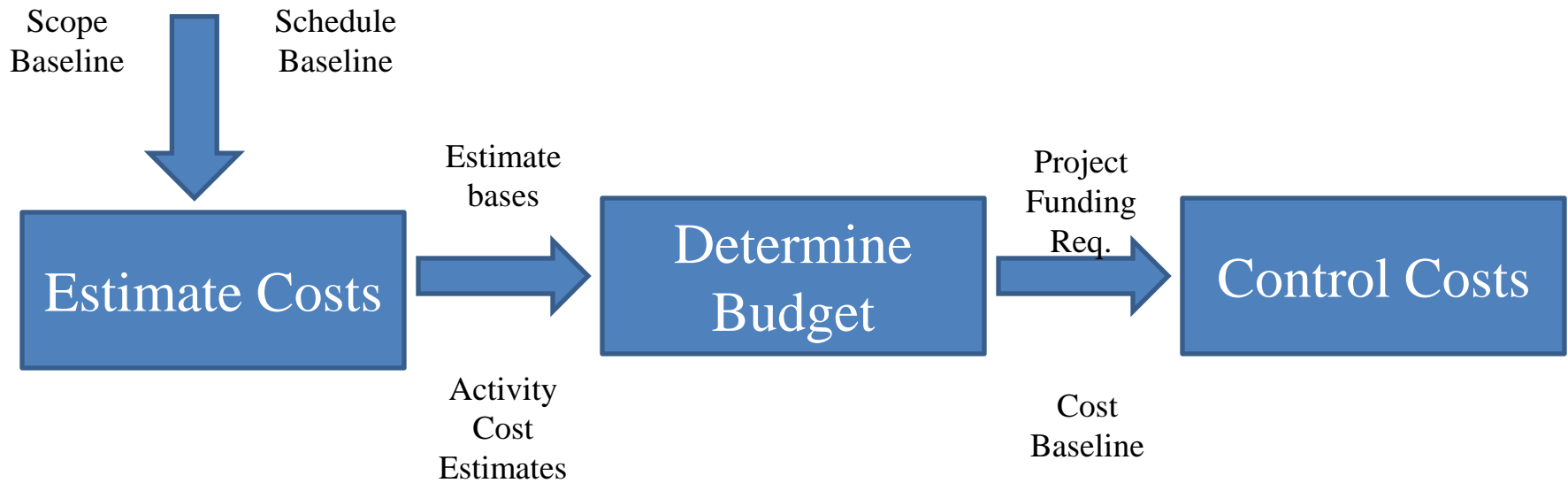
CAPEX is the capital the project/company invested in hardware (concrete structures, wells, pumps, pipes, toilets) and in the software (preparation costs with stakeholders before construction or implementation, such as planning, community mobilisation or hygiene education).

Acquisition efforts may be largely CapEx while development efforts may be largely OpEx.

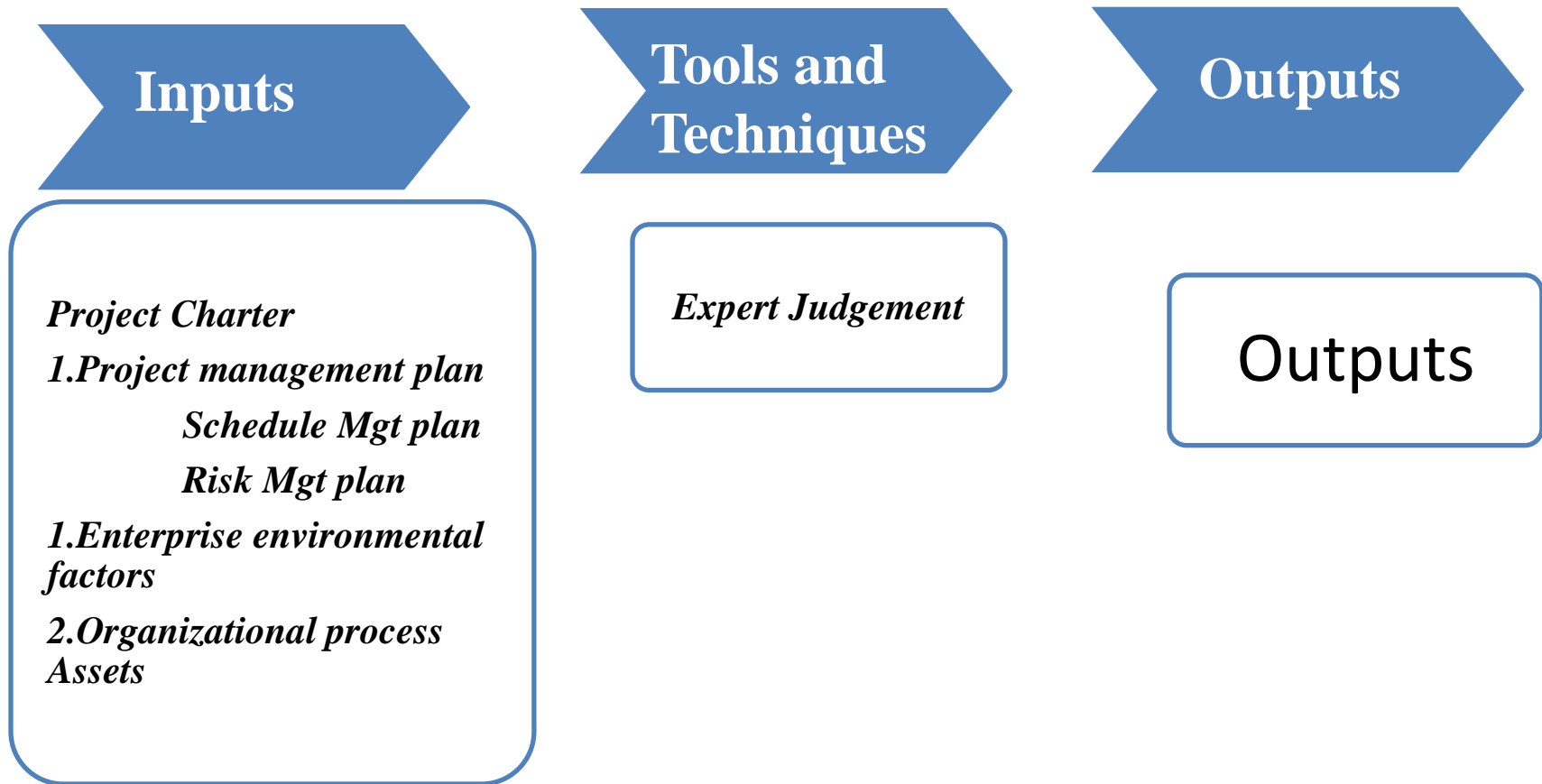
Project Cost Management

- **Plan Cost Management:** The process of defining how the project costs will be *estimated, budgeted, managed, monitored, and controlled.*
- **Estimate Costs:** The process of developing an approximation of the monetary resources needed to complete project work.
- **Determine Budget:** The process of aggregating the estimated costs of individual activities or work packages to establish an authorized cost baseline.
- **Control Costs:** The process of monitoring the status of the project to update the project costs and manage changes to the cost baseline.

Project Cost Management Processes



Tools and Techniques ?



Basic rules of Estimation.

- *Assume that resources will only be productive for, say, 80 percent of their time.*
- *Resources working on multiple projects take longer to complete tasks because of time lost switching between them.*
- *People are generally optimistic and often underestimate how long tasks will take.*
- *Make use of other people's experiences and your own.*
- *Ensure that the person responsible for creating the product is also responsible for creating the effort estimates.*
- *Always make provision for problem-solving, meetings and other unexpected events.*
- *Cost each activity rather than trying to cost the plan as a whole.*
- *Communicate any assumptions, exclusions or constraints you have to the user(s).*

Estimating cannot guarantee accuracy but, when applied, provides a view of the overall cost and time required to complete the plan.

Estimates will inevitably change as more is discovered about the project

Costs

- Because projects cost money and consume resources that could be used elsewhere, it is very important for project managers to understand project cost management.
- Many of the original cost estimates for IT projects are low or based on unclear project requirements, so naturally, there will be cost overruns.
- Another perceived reason for cost overruns is that many IT projects involve new technology or business processes. Any new technology or business process is untested and has inherent risks. Thus, costs grow and failures are to be expected

E-Gov Project Life Cycle

For determining the right business model, it is important to understand the project costs right...across the project lifecycle...

Let us understand the project costs/investments needed in e-Governance Projects....

Sample Revenues Options

- Commerce revenues
- Content revenues
- Community revenues
- Infrastructure revenues

Cost Categories in e-Gov Projects

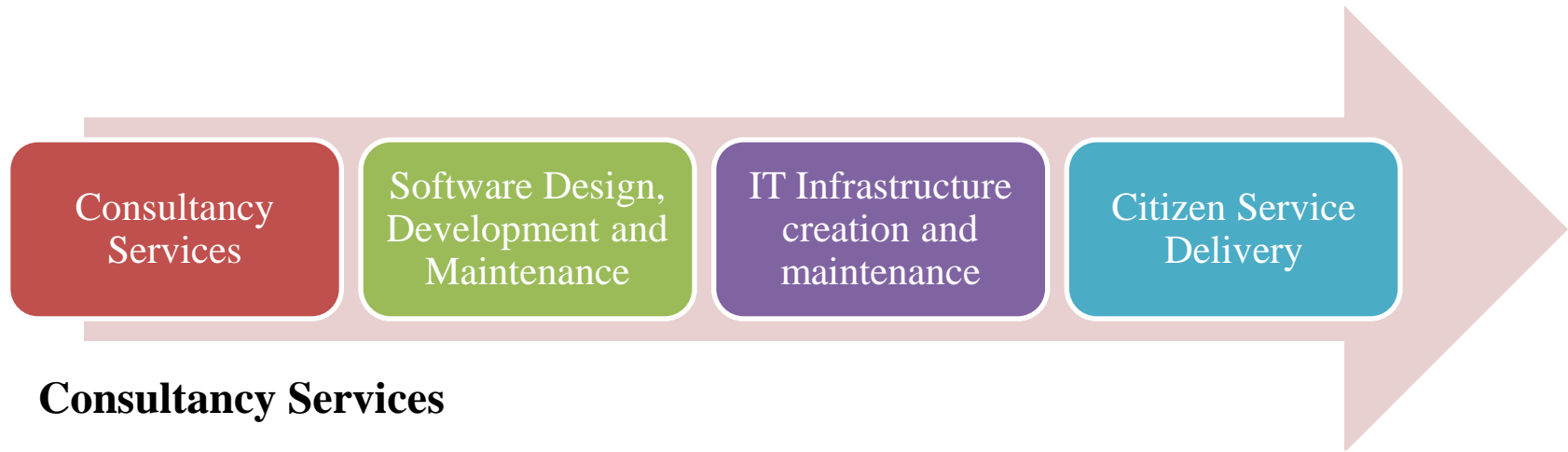
1. Consultancy Services

2. Software Design, Development and Maintenance

3. IT Infrastructure creation and maintenance

4. Citizen Service Delivery

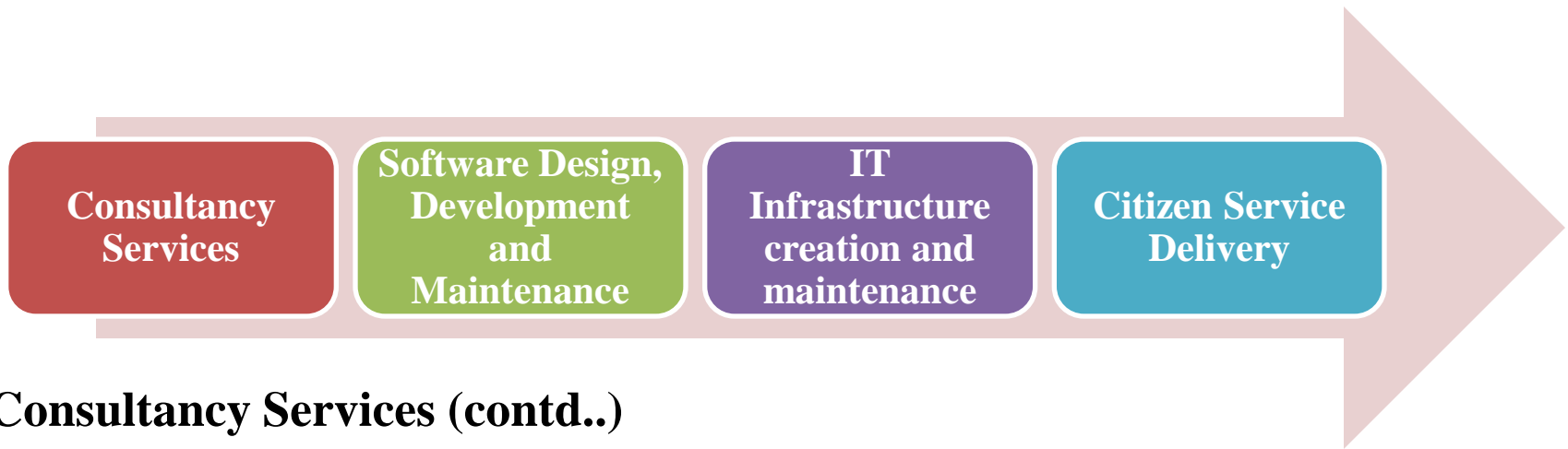
Cost Categories in e-Gov Projects



Consultancy Services

1. e-Governance Vision and Strategy Development
2. Process Study, Process Reengineering
3. Requirements Definition and System Design
4. Change Management, Capacity Building and Project Communications for e-Governance implementations
5. Development of Business Model & DPR
6. RFP Development and Bid Process Management Support
7. Project Audits, Quality

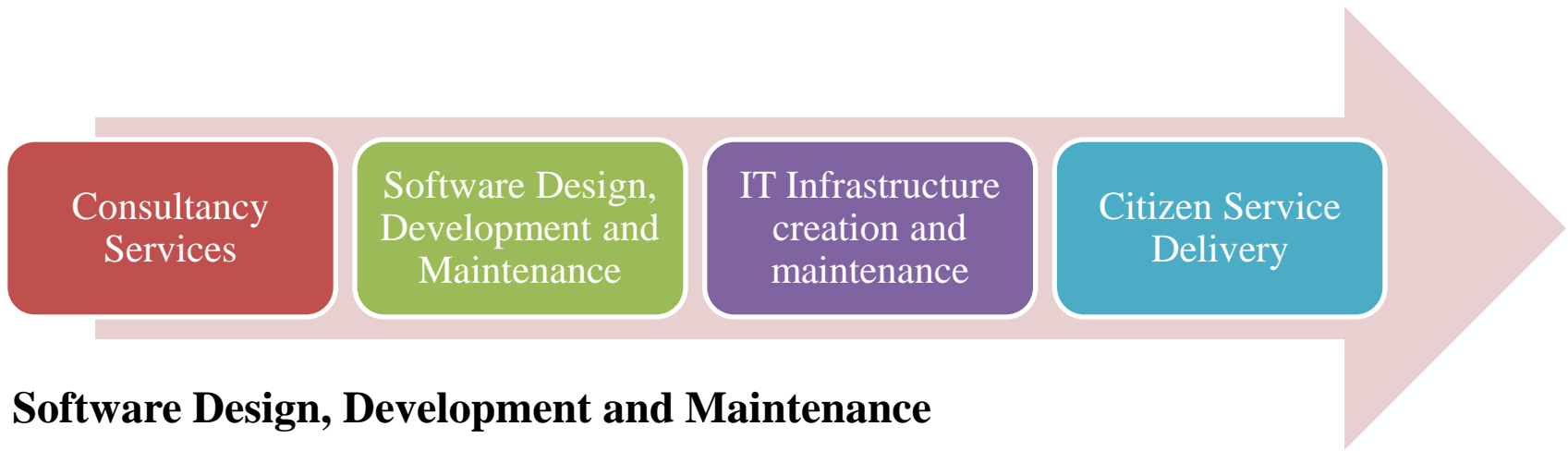
Cost Categories in e-Gov Projects



Consultancy Services (contd..)

8. Project and Programme Management
9. Third Party Audits, Governance, Risk, Compliance, and Assurance
10. SLA Monitoring and Evaluation

Cost Categories in e-Gov Projects



Software Design, Development and Maintenance

1. Definition of detailed functional and technical requirements
2. System design and development
3. Procurement and supply of software (system software, ERP..)
4. Software Testing
5. Data Digitization
6. Training and capacity building
7. Project documentation
8. Software Operations and Maintenance

Software Project Categories:

1. COTS/ERP Implementations
2. Bespoke/Custom Application Software Development

Cost Categories in e-Gov Projects

Consultancy
Services

Software Design,
Development
and Maintenance

IT Infrastructure
creation and
maintenance

Citizen Service
Delivery

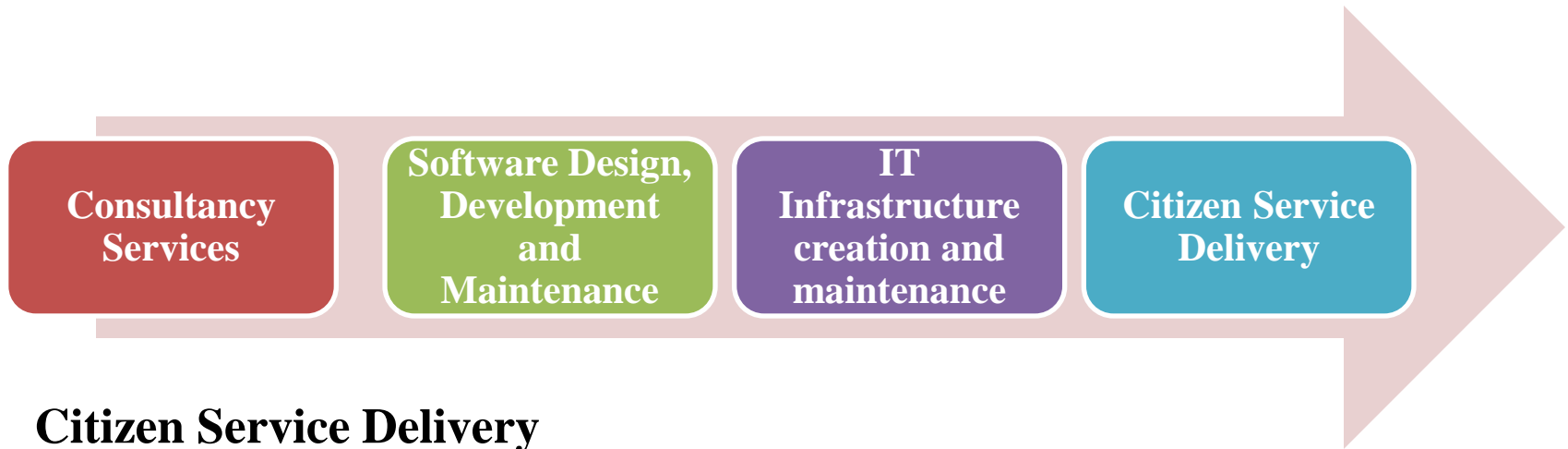
IT Infrastructure creation and maintenance

1. IT Infrastructure Procurement
2. Installation & Configuration of IT Infrastructure
3. IT Infrastructure Operations, Monitoring and Management

IT Infrastructure Categories:

1. Data Centre Infrastructure (e.g. SDC)
2. Network Infrastructure (e.g. SWAN)
3. End-user equipment (PCs, printers, Scanner..)

Cost Categories in e-Gov Projects



1. Establishment , operations & management of Citizen Service Delivery Centres
2. Establishment , operations & management of Call Centres

Cost Categories in e-Gov Projects

Project Conceptualisation and Design:

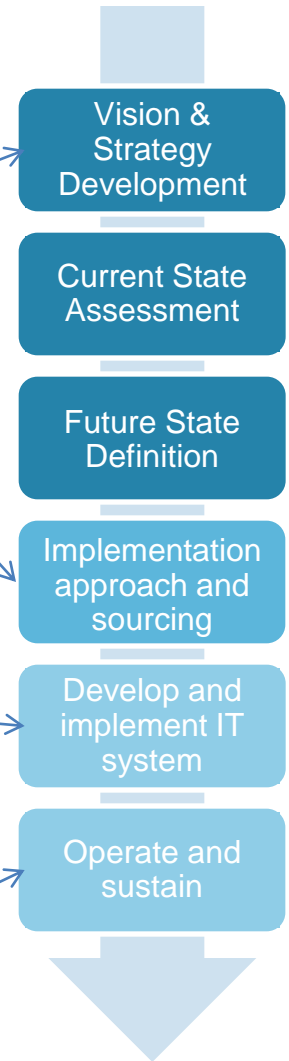
1. E-Governance Vision and Strategy Development
2. Process Study, Process Reengineering
3. Functional Requirements Definition and System Design
4. Development Change Management, Capacity Building and Communications Strategy
5. Development of Business Model & DPR
6. RFP Development and Bid Process Management Support

Systems Development/IT Infrastructure creation Phase:

1. Project and Programme Management
2. Software and Data Quality Assurance
3. Infrastructure Quality Assurance
4. Capacity Building, Change Management ,and Communications...

Project Operations Phase:

1. SLA Audits
2. Monitoring and Evaluation
3. Capacity Building, Change Management and Communications...



Project Phases

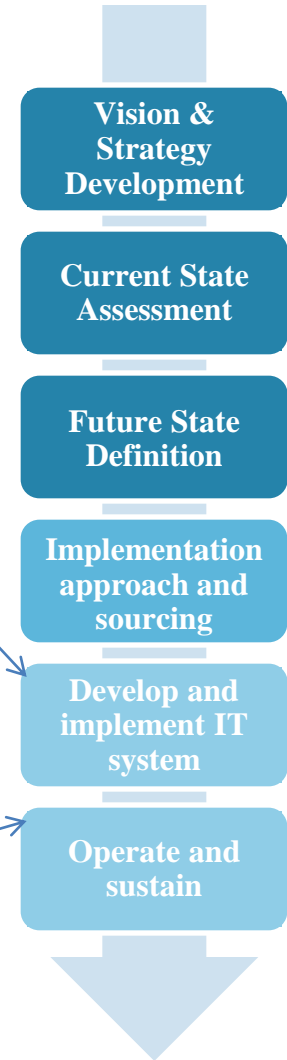
Cost Categories - Software Design, Development and Maintenance

One time costs..

1. System Software for Application Server, Database Server, Integration Server
2. Application Software
3. Workflow automation, Documentation Management Systems..
4. Requirements study and finalization
5. Software Design and Development
6. ERP Customisation and configuration
7. Project Documentation
8. Data digitization and migration

Recurring Costs:

1. AMC for software licenses
2. Training and Capacity Building
3. Software maintenance and support, Software change management, Project documentation..



Project Phases

Cost Categories – IT Infra Creation and Maintenance

One-time costs..

Data Center and Network Infrastructure (IT and Non-IT):

1. Data center site cost, preparation cost, supporting facilities (power, cooling, physical security, fire and environmental controls)
2. Computing infrastructure (servers)
3. Storage Infrastructure (SAN Switches, SAN storage, tape library, backup solutions.,,)
4. LAN and WAN (Switches, Routers, Modems, VPN)
5. Security (Firewall, IPS/IDS, Antivirus, IDM..)
6. Cabling
7. Insurance..

End User Computing Infrastructure IT Infrastructure:

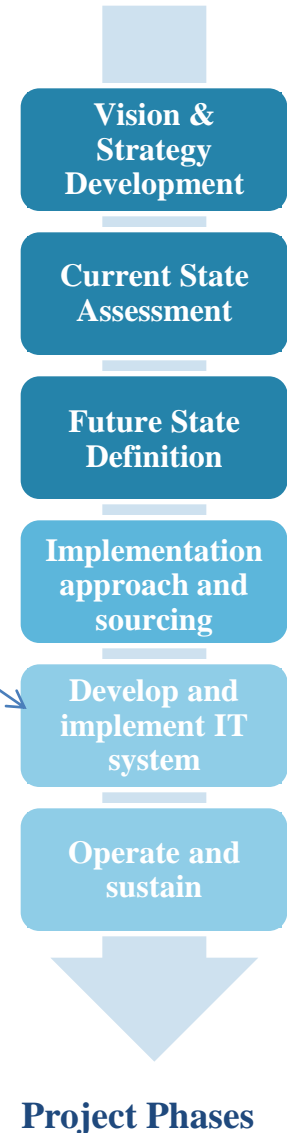
1. PCs ,Printers, Scanners, LAN, UPS, generators, LAN and power cabling...

System Software:

1. Network/Enterprise Management Software, Storage management solution, Server Operating Systems, Antivirus gateway and end-client software, email suite...

Services cost:

1. Requirements assessment, solution design, documentation
2. Installation and configuration
3. Testing and go-live

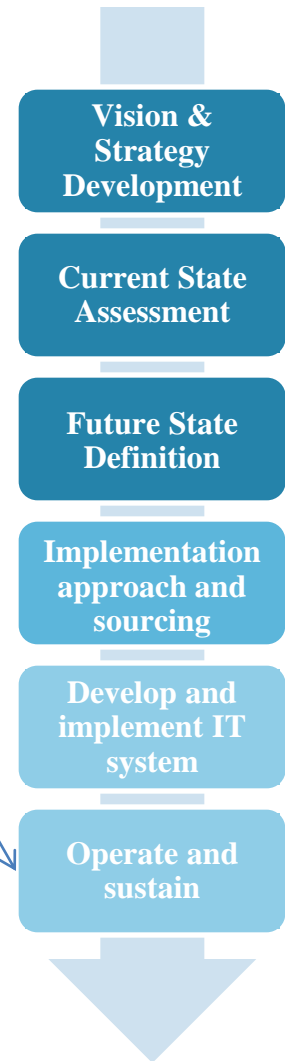


Cost Categories - Software Design, Development and Maintenance

Recurring costs..

Data Center and Network Infrastructure (IT and Non-IT):

1. AMC/ Warranty for system software and hardware
2. Facilities Management Services
3. IT Infrastructure monitoring and management services
4. Insurance
5. Consumables
6. Leased lines/ISDN – connectivity charges
7. Power, fuel



Project Phases

E- Gov Project Costs – Template (illustrative)

Recurring Cost				Y2	Y3	Y4	Y5	Y6
1	Network connectivity costs							
2	System Software AMC							
3	IT Infrastructure Hardware Maintenance							
4	Application Software Change Management							
5	Application Software Maintenance							
6	Hardware Insurance							
7	Data Entry Operators							
8	Project Management Unit/Services							
9	Monitoring and Evaluation Cost							
10	Consumables							
11	Total Recurring Costs per year			INR 0	INR 0	INR 0	INR 0	INR 0
10	Overall Project contingency cost		INR 0	INR 0	INR 0	INR 0	INR 0	INR 0
11	Grand Total							
12	Total Project Cost - Year Wise Expenditure			INR 0	INR 0	INR 0	INR 0	INR 0

E- Gov Project Costs – Template (illustrative)

Cost Component	Per Unit Price (Rs.)	No. of Units	Cost per Item (Rs.)
Application Servers			
Web or Portal Servers			
E-Mail Server			
Database Servers			
Firewall			
IPS			
Directory Server			
Antivirus Server/gateway			
Infrastructure Management Servers			
Document Management Server			
Staging & Testing Servers			
PCs - Monitoring			
Servers Cost			
Aggregation router- SDC			
Aggregation router- District Center			
Internet Router			
Proxy Server			
24 Port Manageable Switch			
SAN Solution with SAN Switches			
Tape Library			
24 Port Patch Panel			
Modems 2 Mbps - Two Pairs			
Network& Security Cost			
Laser Printers			
42 U Racks			
Peripherals Cost			
Total Hardware Cost			

E- Gov Project Costs – Template (illustrative)

Cost Component	Per Unit Price (Rs.)	No. of Units	Cost per Item (Rs.)
System Software			
Application Server Software			
Database Server - Enterprise Edition (including RAC)			
Antivirus Server			
Enterprise Management Software			
Document Management System			
Directory Solution			
Collaboration suite (e-mail)			
Data Backup Management software			
Total cost			
Application Software			
License Management			
Birth & Death Registration			
Scheme Management			
Drug Distribution Management (including asset mgmt)			
Patient Care Management			
Decision Support Systems & MIS			
Disease Surveillance System (including GIS system sot)			
Call Centre Management & GR System			
HR System			
E-Learning			
Knowledge Management System			
Total Cost			
Total Software Cost			

E- Gov Project Costs – Template (illustrative)

Infrastructure Component	No. of Units	Per Unit Cost	Total
Personal Computers			
Printers			
Scanners			
Digital Certificate			
UPS			
Modems			
LAN Switch			
Total Cost for End User Infrastructure			0

E- Gov Project Costs – Template (illustrative)

S.N	Name of the Training Programme	Indicative Duration (Days)	No. of Users for training	Avg Batch Size	Total no. of batches	Per batch cost	Total Cost
1	Orientation to change management						
2	Change Management						
3	Communication Skills						
4	Teamwork Skills						
5	Presentation Skills						
6	Project Management						
7	IT Training						
8	Application Training						
Total Cost							

Revenue sources in e- Gov Projects

- Various projects undertaken by the government have significant revenue generation potential
- Revenue referred here is different from the taxes and duties expected to be paid by the citizen under the constitution
- These revenue sources are new money to the government

Illustrative Revenue sources

e-Governance Projects:

- Portal registration/subscription charges
- Transaction fees for the online services
- Advertising revenue from the portal
- Advertising revenues from service center
- Fees for delivery of B2C and B2G services through common service centers
- Convenience fees – enhancement in the current fees/charges

Non e-Governance Projects:

- Toll charges – Roads
- Development charges – Airports...

When and in which phase of project do we prepare Cost estimates?

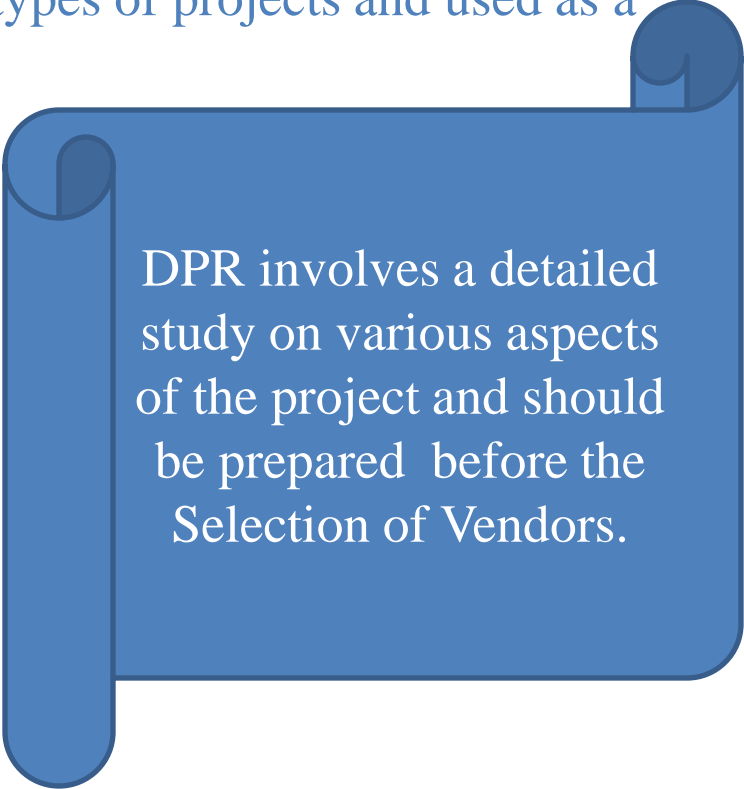
Detailed Project Report (DPR)

- The Detailed Project Report is an essential building block for firming up a proposed project initiative
- The DPR contains details about the proposed project to enable appraisal, approval, and subsequently implementation
- Usually prepared according to funding agencies' templates and guidelines e.g. MeitY guidelines for NeGP projects, World Bank guidelines...

What is DPR used for?

It is a comprehensive proposal prepared for all types of projects and used as a basis for:

- Investment decision making
- Approval of plans and designs
- Project planning
- Implementation scheduling and budgeting



DPR involves a detailed study on various aspects of the project and should be prepared before the Selection of Vendors.

When is DPR prepared?

e-Governance Project Lifecycle (eGLC)

Vision & Strategy Development

Current State Assessment

Future State Definition

Implementation approach and sourcing

Develop and implement IT system

Operate and sustain

Stakeholder Needs Assessment

Define clear vision & objectives

Prioritization of services and projects

Incorporate domestic and global learnings

Identify institutional structures & capacities for implementation

Define funding requirements

Define monitoring and evaluation approach.

Critical assessment of current business processes and pain areas

Best practices in similar environments

Assess legal framework and current limitations

Assess current ICT systems and their ability to support future plans

Assessment of current capacities at all levels and their preparedness for e-governance.

Process reengineering and to-be process definition

Identify IT enablement opportunities and requirements

Define changes to the legal and regulatory environment

Develop People change and capacity building plan

Develop project awareness and communication requirements...

Define implementation approach and phasing plan (functional and geographic)

Assess detailed funding requirements and business model

Prepare DPR

Develop vendor evaluation and selection criteria

Develop RFP performance services and systems

Develop RFP

Bid evaluation and vendor selection

Definition of detailed

System operations

The highlighted activities in the EGLC provide inputs to the DPR

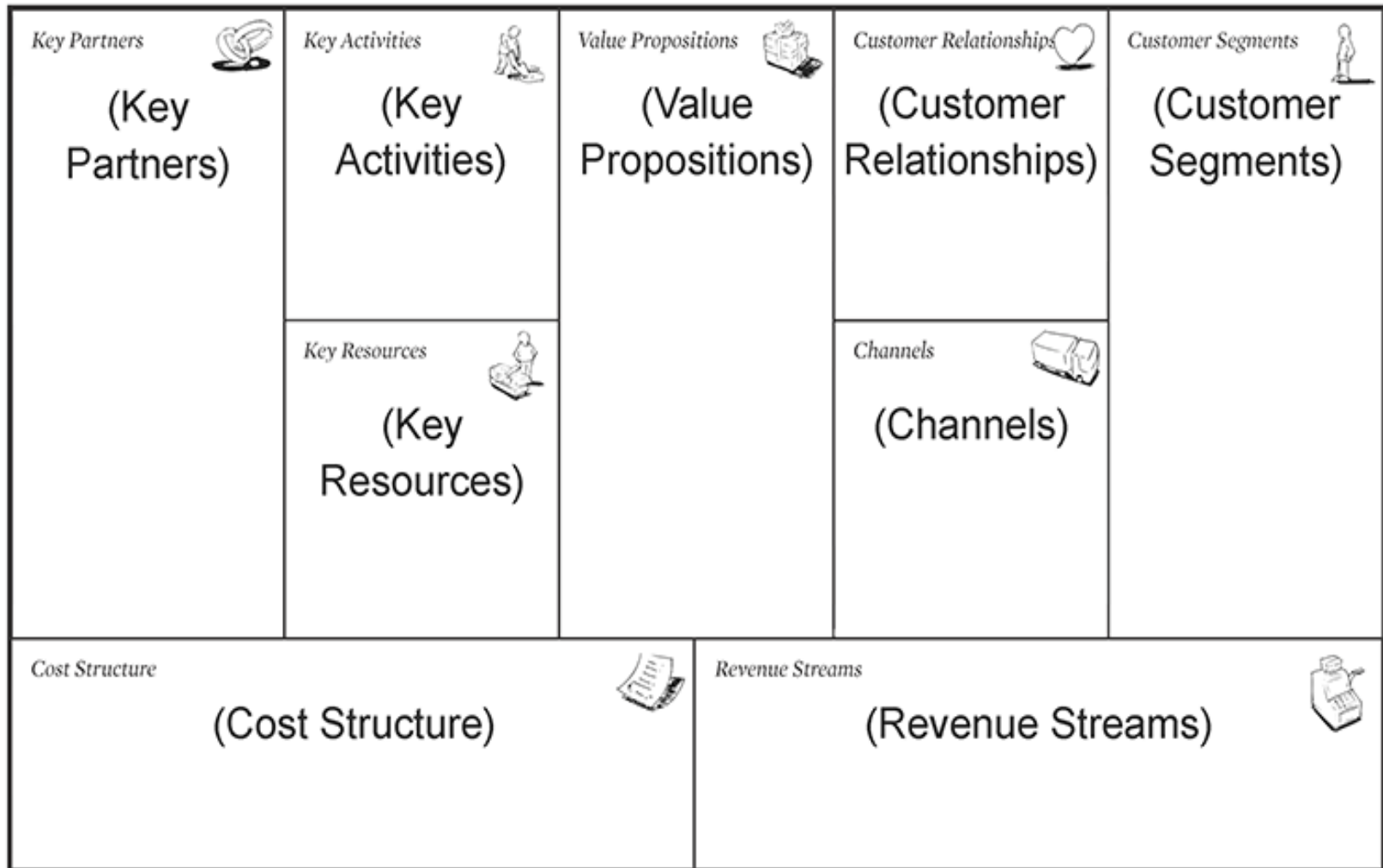
However, the DPR may make provisions of detailed study or implementation in some of these areas e.g. Legal reforms may be a separate project

Understanding Business model...

A Business model for a project should address/answer the following:

- How much does it cost to create and maintain the project?
- Is the project feasible?
- Who is funding for the Project?
- Who is developing or implementing the project?
- Who is paying for the project?
- What are payment terms?
- Roles and responsibilities of the parties concerned with the business model
- Duration of the contract.... etc.

Business model Canvas



Business model Canvas

Together these elements provide a pretty coherent view of a business' key drivers—

- **Customer Segments**: Who are the customers? What do they think? See? Feel? Do?
- **Value Propositions**: What's compelling about the proposition? Why do customers buy, use?
- **Channels**: How are these propositions promoted, sold and delivered? Why? Is it working?
- **Customer Relationships**: How do you interact with the customer through their 'journey'?
- **Revenue Streams**: How does the business earn revenue from the value propositions?
- **Key Activities**: What *uniquely* strategic things does the business do to deliver its proposition?
- **Key Resources**: What unique strategic assets must the business have to compete?
- **Key Partnerships**: What can the company *not* do so it can focus on its Key Activities?
- **Cost Structure**: What are the business' major cost drivers? How are they linked to revenue?

Business Model - 1

Parameter	Component	Ownership	Roles & Responsibilities
Policies	Defining IT & Security Policies, Access control & Privacy Policies	D.G.Shipping (Data Owner)	D.G.Shipping
Governance / PMU	Management Oversight & Service Delivery	D.G.Shipping	D.G.Shipping & Dedicated PMU (In-source / Out-source)
Fixed Cost	IT Equipment		Bidder shall mention the required BOM (IT H/W, S/W & Licenses) in their proposal, D.G.Shipping will procure
	Data Centre Infrastructure		Inhouse Data Centre - D.G.Shipping
Variable Cost	Day to day Operations	External Vendor / Implementation Agency	Implementation Agency
	Helpdesk Operations	External Vendor / Implementation Agency	Implementation Agency
	LRIT Application Development	External Vendor / Implementation Agency	Implementation Agency Payment is made in EQI's during the project duration of 5 years
Audit & Assurance cost	External Auditor	Third Party	TPA will be engaged by D.G.Shipping

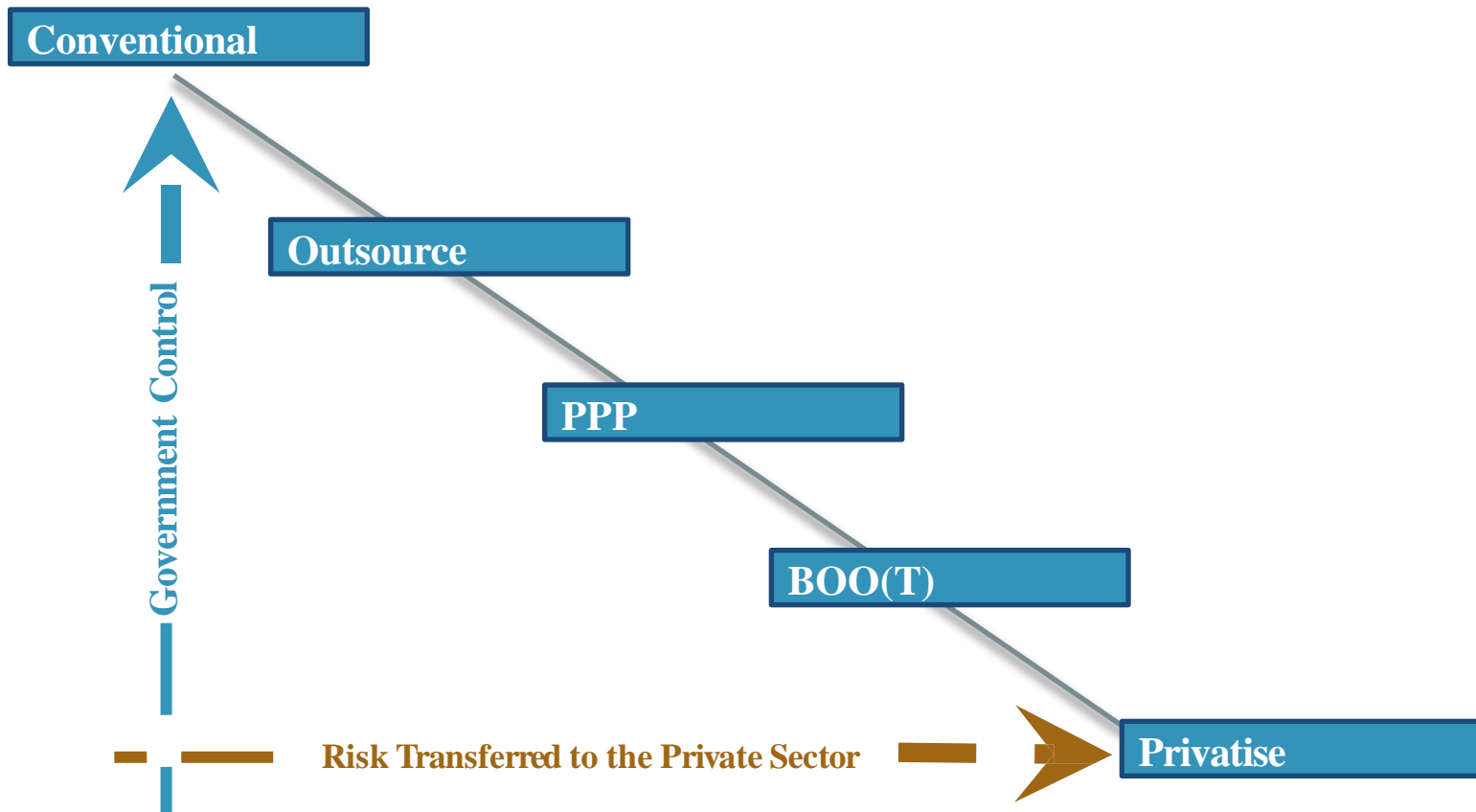
Business Model - 2

Parameter	Component	Ownership	Roles & Responsibilities
Policies	Defining IT & Security Policies, Access control & Privacy Policies	D.G.Shipping (Data Owner)	D.G.Shipping
Governance / PMU	Management Oversight & Service Delivery	D.G.Shipping	D.G.Shipping & Dedicated PMU (In-source / Out-source)
Fixed Cost	IT Equipment	External Vendor / Implementation Agency	Implementation Agency will procure (IT HW, S/W & Licenes) Payment is made in EQI's during the project duration of 5 years
	Data Centre Infrastructure		Implementation Agency - Maintenance of Inhouse Data Centre. Payment is made in EQI's during the project duration of 5 years
Variable Cost	Day to day Operations		Implementation Agency
	Helpdesk Operations	Implementation Agency	
	LRIT Application Development	Implementation Agency Payment is made in EQI's during the project duration of 5 years	
Audit & Assurance cost	External Auditor	Third Party	TPA will be engaged by D.G.Shipping

Business Model - 3

Parameter	Component	Ownership	Roles & Responsibilities
Policies	Defining IT & Security Policies, Access control & Privacy Policies	D.G.Shipping (Data Owner)	D.G.Shipping
Governance / PMU	Management Oversight & Service Delivery	D.G.Shipping	D.G.Shipping & Dedicated PMU (In-source / Out-source)
Fixed Cost	IT Equipment	External Vendor / Implementation Agency	Implementation Agency will procure (IT HW, S/W & Licenses) Payment is made in EQI's during the project duration of Year 1.
	Data Centre Infrastructure		Implementation Agency - Maintenance of Inhouse Data Centre. Payment is made in EQI's during the project duration of Year 1.
Variable Cost	Day to day Operations		Implementation Agency
	Helpdesk Operations	Implementation Agency	
	LRIT Application Development	Implementation Agency	Payment is made in EQI's during the project duration of 5 years
Audit & Assurance cost	External Auditor	Third Party	TPA will be engaged by D.G.Shipping

Identifying suitable business models



Various models for private sector participation

Conventional



Outsource

PPP

BOO(T)

Privatise

- Government maintains complete control on the project creation, execution and assets
- Government funds the project investments for the capital and operational expenditure during the project tenure
- Government creates/develops the project
- Government Maintains the project including operations and maintenance of the project
- 100% of the project risk and returns are accrued to government only

Various models for private sector participation

Conventional

Outsource



PPP

BOO(T)

Privatise

- Government maintains complete control on the project creation, execution and assets
- Government funds the project investments for the capital and operational expenditure during the project tenure
- Government leverages private sector strengths for creation of the project or maintenance of the project or both
- Risks are allocated to the government and private sector based on the responsibilities (e.g. government will have the risk of project demand, the private sector will carry the risk of performance and quality of the services delivered to the government)

Various models for private sector participation

Conventional

Outsource

PPP

BOO(T)

Privatise



- The government does not need to own infrastructure to deliver services
- The government retains political responsibility/accountability to deliver services for the community;
- The government defines the timeframe in which the services must be delivered; and the quality and quantity of services needed;
- The private sector delivers the services and finances or part finances the project;
- Government provides the concessions for the private party, if needed
- Private sector remunerated through services charges/transaction fees/gap funding..
- Risks are allocated between the public and private sectors;
- Various flavors of PPP exist with varying roles and

Various models for private sector participation

Conventional

Outsource

PPP

BOO(T)

Privatise



- The government retains political responsibility/accountability to deliver services for the community;
- The government defines the timeframe in which the services must be delivered; and the quality and quantity of services needed;
- Private entity receives concession from government to finance, design, construct, implement and operate the project
- Private sector is remunerated through services charges/transaction fees/gap funding..
- The assets of the project are transferred to the government at the end of the concession period

Various models for private sector participation

Conventional

Outsource

PPP

BOO(T)

Privatise



- The responsibility for delivery of services is completely transferred to the private sector
- The ownership of the project or a business is completely transferred to the private sector
- Government only regulates the functioning of the private sector

Typical project risks

- Land acquisition, planning and permissions
- Design
- Construction
- Commissioning
- Latent defects
- Operating performance
- Operating and maintenance costs
- Third party revenue
- Demand (volume)
- Residual value
- Inflation
- Regulatory
- Taxation
- Force Majeure
- Changes in requirement

6 problems facing large Govt IT Projects

1. Lack of good governance Structures
2. The “ Waterfall” method for Systems Design
3. “All at once” funding
4. Scope Creep
5. Automating before redesigning
6. Failing to budget for Clean up

Source: Six Problems Facing Large Government IT Projects (And Their Solutions), By:
Rita Gunther McGrath, HBR Oct 2008

The Truths about IT Costs

1. Enhancements don't deliver results
2. Projects are too big and often take too long, partly because unnecessary functionality is built into the projects
3. Previously purchased applications and infrastructure technology are often underutilized
4. Project failures are too high
5. Tech teams do not have incentives for high quality and quality is often not measured
6. Managers do not know enough about the systems that support their areas.
7. IT is too risk averse.

Source: The truths about IT costs by, By: Susan Cramm, HBR Oct 2009

Agenda

- **IT Infrastructure**
- IT infrastructure
- Components of IT infrastructure?
- Trends in computer hardware platforms?
- Trends in computer software platforms
- Challenges of managing IT infrastructure
- **COTs vs Custom Development Vs Cloud**
- **Implementation Plan**

IT infrastructure

Set of physical devices and software required to operate an enterprise

Set of firm-wide services including:

- Computing platforms providing computing services
- Physical facilities management services
- IT management, education, and other services

“Service platform” perspective

- More accurate view of value of investments

Evolution of IT infrastructure

- General-purpose mainframe and minicomputer era: 1959 to present
- Personal computer era: 1981 to present
- Client/server era: 1983 to present
- Enterprise computing era: 1992 to present
- Cloud and mobile computing: 2000 to present

Technology Drivers of Infrastructure Evolution

1. Moore's law and micro processing power
 - Computing power doubles every 2 years
2. Law of Mass Digital Storage
 - The amount of data being stored each year doubles.
3. Metcalfe's Law and network economics
 - Value or power of a network grows exponentially as a function of the number of network members.

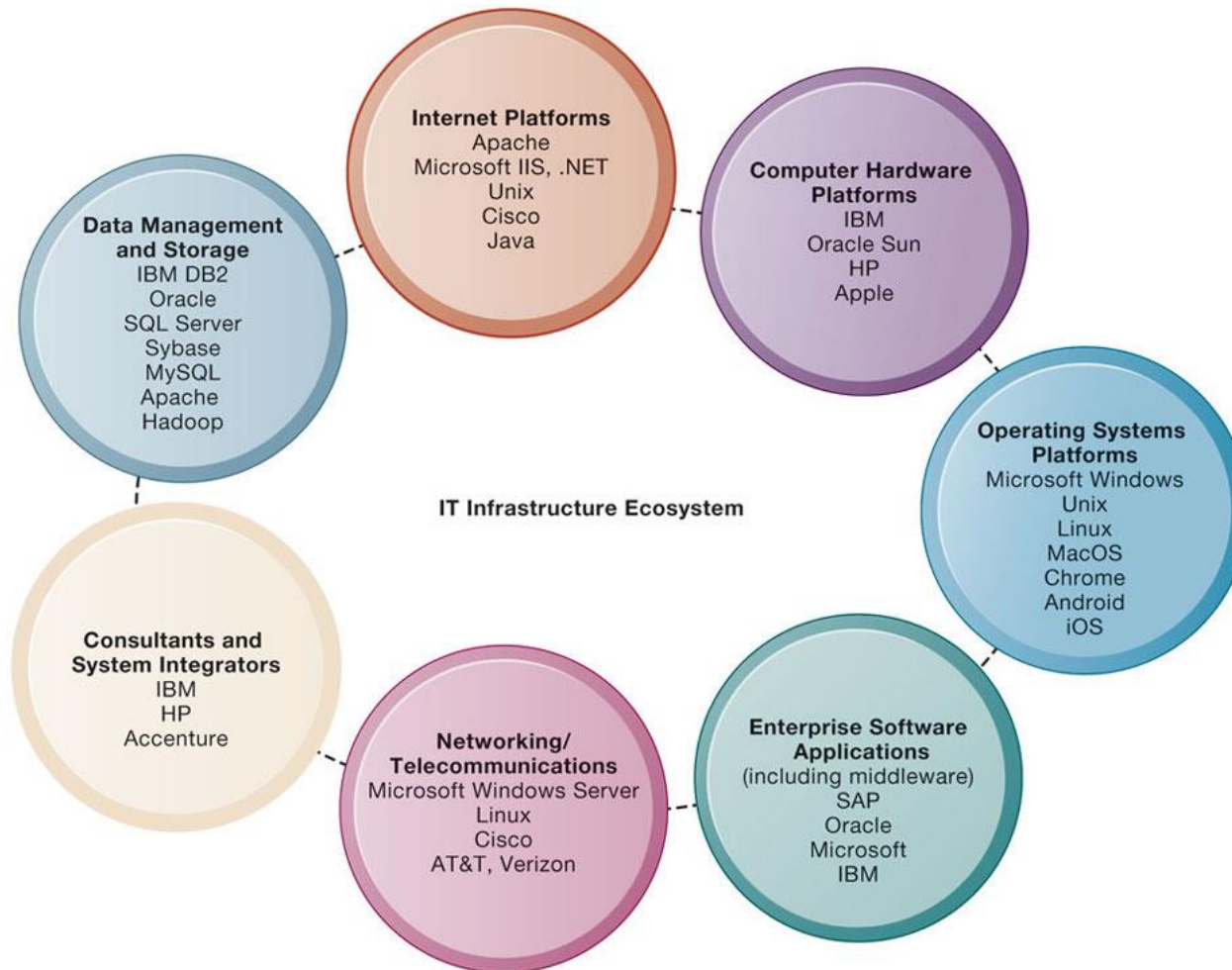
Technology Drivers of Infrastructure Evolution

1. Declining communication costs and the Internet
 - Exponential growth in size of the Internet
2. Standards and network effects
 - Technology standards
 - Specifications that establish the compatibility of products and the ability to communicate in a network
 - Unleash powerful economies of scale and result in price declines

Components of IT Infrastructure

1. Computer hardware platforms
2. Operating system platforms
3. Enterprise software applications
4. Data management and storage
5. Networking/telecommunications platforms
6. Internet platforms
7. Consulting & System integration services

IT Infrastructure Ecosystem



Computer Hardware Platforms

- Client machines
 - Desktop PCs, laptops
 - Mobile computing: smartphones, tablets
 - Desktop chips vs. mobile chips
- Servers
- Mainframes

Operating System Platforms

Corporate servers

- Windows Server
- Unix
- Linux

Client level

- Microsoft Windows
- Android, iOS, Windows 10 (mobile/multitouch)
- Google's Chrome OS (cloud computing)

Enterprise Software Applications

In 2018, firms spent \$389 billion on software for enterprise applications.

Largest providers: SAP and Oracle

Middleware providers: IBM, Oracle

Data Management and Storage

Database software providers

- IBM (DB2)
- Oracle
- Microsoft (SQL Server)
- Sybase (Adaptive Server Enterprise),
- My SQL
- Apache Hadoop

Physical data storage for large-scale systems

- Dell EMC
- Hewlett Packard Enterprise (H3C)

Networking & Telecommunication Platforms

Network operating systems

- Windows Server, Linux, Unix

Network hardware providers

- Cisco, Juniper Networks

Telecommunication services

- Telecommunications, cable, telephone company charges for voice lines and Internet access
- AT&T, Verizon

Hardware, software, management services to support company websites, intranets

- Web-hosting services
- Routers
- Cabling or wireless equipment

Internet hardware server market

- IBM, Dell, Oracle, HP

Web development tools/suites

- Microsoft (Visual Studio and .NET), Oracle-Sun (Java), Adobe

Even large firms do not have resources for full range of support for new, complex infrastructure.

Leading consulting firms: Accenture, I B M Global Services, H P, TCS, Infosys, Wipro Technologies etc.,

Software integration: ensuring new infrastructure works with legacy systems.

Legacy systems: Older T P S created for mainframes that would be too costly to replace or redesign

Trends in Hardware Platforms

The mobile digital platform

- Smartphones
- Netbooks
- Tablet computers
- Digital e-book readers and apps (Kindle)
- Wearable devices

Consumerization of I T and B Y O D (bring your own device) forces businesses and I T departments to rethink how I T equipment and services are acquired and managed

Quantum computing

- Uses quantum physics to represent and operate on data
- Dramatic increases in computing speed

Virtualization

- Allows single physical resource to act as multiple resources (i.e., run multiple instances of OS)
- Reduces hardware and power expenditures
- Facilitates hardware centralization
- Software-defined storage (SDS)

Trends in Hardware Platforms

Cloud computing

On-demand computing services obtained over network

- Infrastructure as a service (IaaS)
- Software as a service (SaaS)
- Platform as a service (PaaS)

Cloud can be public or private

Allows companies to minimize IT investments

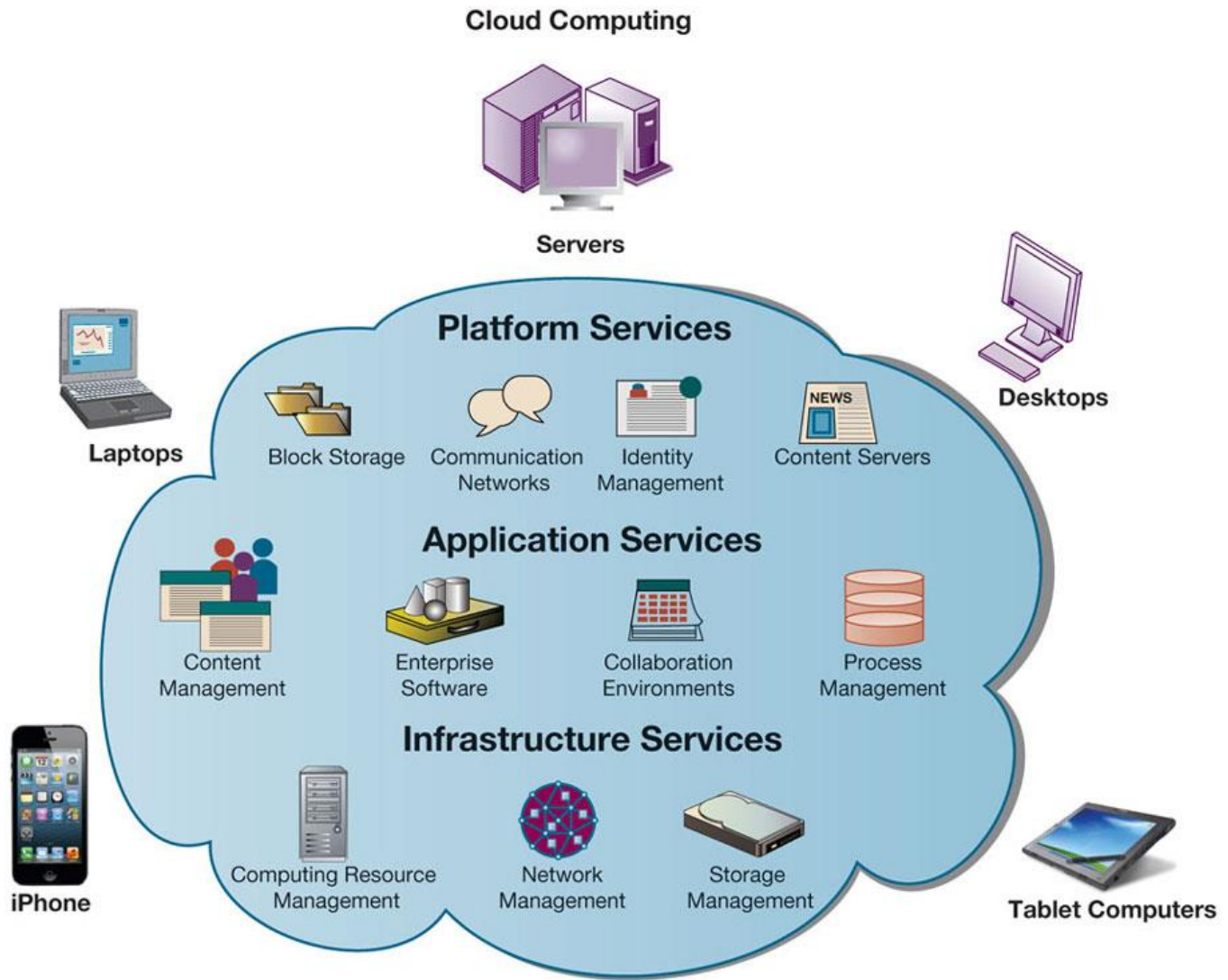
Drawbacks: Concerns of security, reliability

Hybrid cloud computing model

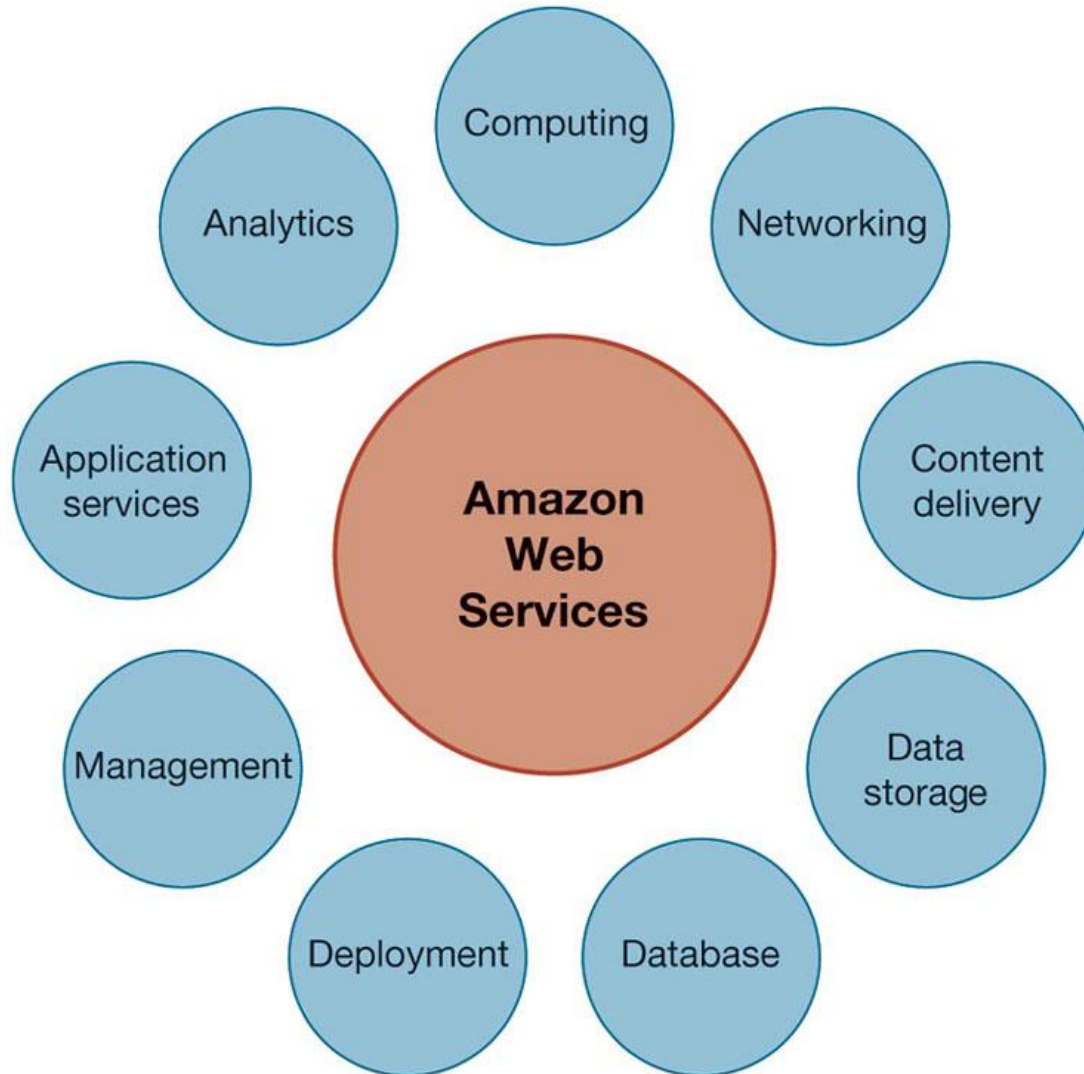
Edge computing

- Servers at the edge of the Internet
- Reducing latency, and network traffic

Cloud Computing Platforms



Amazon Web services (illustrative)



Green computing (Green IT)

Practices and technologies for manufacturing, using, disposing of computing and networking hardware

Reducing power consumption a high priority

Data centres

High performance, power-saving processors

Multicore processors

Power-efficient microprocessors

Trends in Software Platforms

Linux and open-source software:

Produced by community of programmers

Examples: Apache web server, Mozilla Firefox browser, OpenOffice
Linux

Software for the web:

Java, HTML, and HTML5

Java Virtual Machine

Web browsers

Python

Web services and Service-oriented architecture (SOA) :

Web services

X M L : Extensible Markup Language

S O A : Service-oriented architecture

- Set of self-contained services that communicate with one another to create a working software application
- Software developers reuse these services in other combinations to assemble other applications as needed

Trends in Software Platforms

Web services and service-oriented architecture

Web services

XML: Extensible Markup Language

SOA: service-oriented architecture

Set of self-contained services that communicate with one another to create a working software application

Software developers reuse these services in other combinations to assemble other applications as needed

Dealing with Platform and Infrastructure Changes

As firms shrink or grow, IT needs to be flexible and scalable.

Scalability

- Ability to expand to serve larger number of users

For mobile computing and cloud computing:

- New policies and procedures for managing these new platforms
- Contractual agreements with firms running clouds and distributing software required

Governance

Who controls IT infrastructure?

How should IT department be organized?

Centralized

Central IT department makes decisions

Decentralized

Business unit IT departments make own decisions.

How are costs allocated between divisions, departments?

Making Investment decisions

Under-investment and over-investment can hamper firm performance

- Make /Rent-versus-buy
- Cloud computing
 - Security requirements
 - Impact on business processes and workflow
- Outsourcing

Analyze direct and indirect costs

Hardware, software account for only about 20% of TCO

Other costs: Installation, training, support, maintenance, infrastructure, downtime, space, and energy

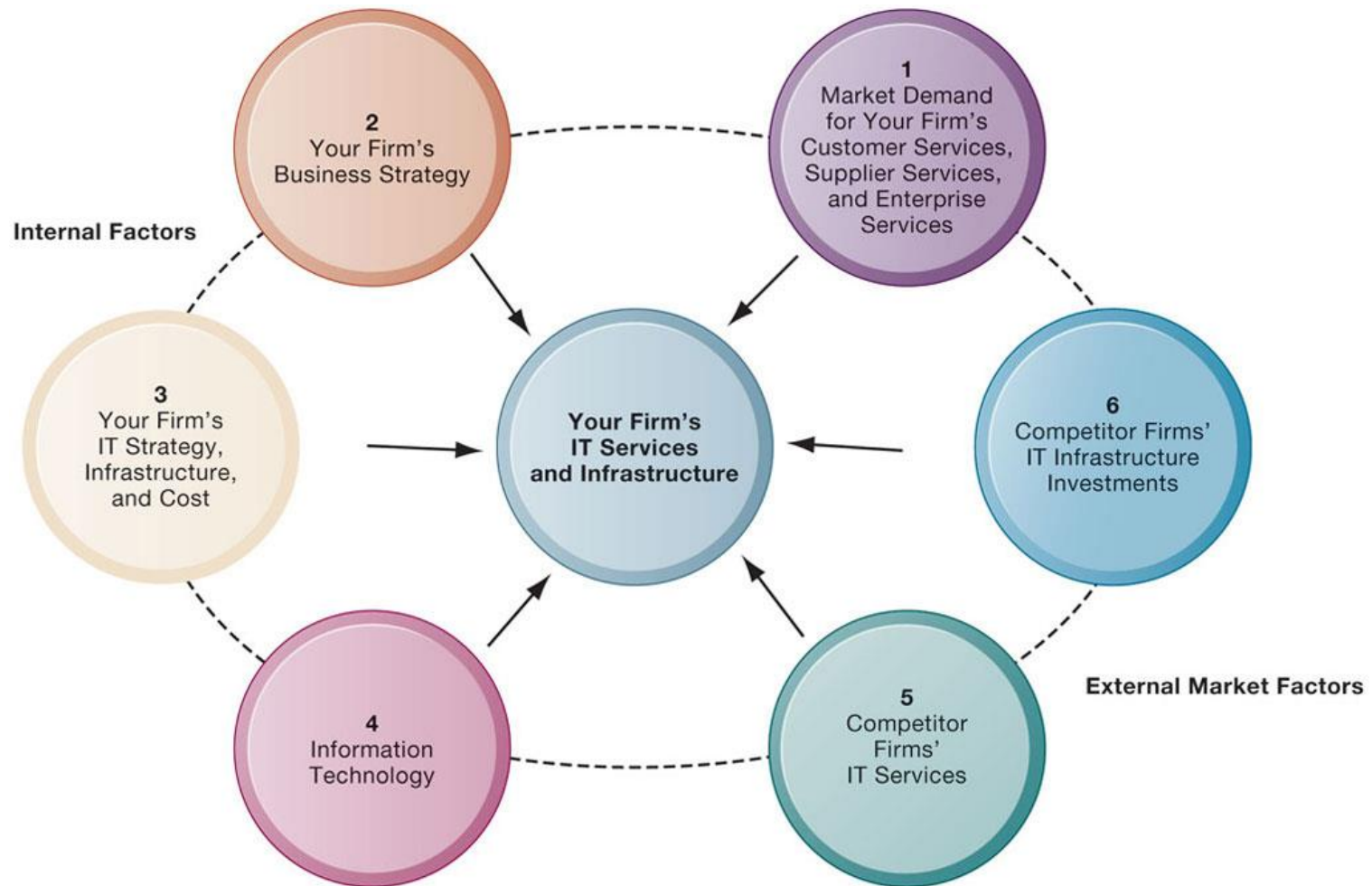
TCO can be reduced

Use of cloud services, greater centralization and standardization of hardware and software resources

Competitive Forces Model for IT investments

- Market demand for firm's services
- Firm's business strategy
- Firm's IT strategy, infrastructure, and cost
- Information technology assessment
- Competitor firm services
- Competitor firm IT infrastructure investments

Competitive Forces Model for IT infrastructure



Business Value of Enterprise Systems

- Increase operational efficiency
- Provide firm-wide information to support decision making
- Enable rapid responses to customer requests for information or products
- Include analytical tools to evaluate overall organizational performance and improve decision-making

Enterprise Applications Challenges

Expensive to purchase and implement enterprise applications

- Multi-million dollar projects in 2018
- Long development times

- Technology changes
- Business process changes
- Organizational learning, changes
- Switching costs, dependence on software vendors
- Data standardization, management, cleansing

Next Generation Applications

Enterprise solutions/suites

- Make applications more flexible, web-enabled, integrated with other systems
- Open-source applications
- On-demand solutions
- Cloud-based versions
- Functionality for mobile platform

Next Generation Applications

Social CRM

- Incorporating social networking technologies
- Company social networks
- Monitor social media activity; social media analytics
- Manage social and web-based campaigns

Business intelligence

- Inclusion of BI with enterprise applications
- Flexible reporting, ad hoc analysis, “what-if” scenarios, digital dashboards, data visualization

Implementation Strategy

- **Project management structure**
 - Steering Committee structure
 - Project Management structure
- **Identify the project phases**
 - Project inception
 - Requirement definition
 - Design
 - Implementation
 - Stabilization
 - Support
- **Identify project milestones in each of the phases**
- **Define the deliverables for each of the mile stones**

Implementation Strategy

- **Payment structure**
 - Payment linked to mile stones
 - **Budget provisioning**
 - Financing model
 - Year wise allocation of funds
 - **Resource deployment**
 - Capacity building
 - New recruitments
- **Transition from private sector to department**

Q&A