

CS8078 - Green Computing.

Unit - I

Unit - 1 - Fundamentals: Business

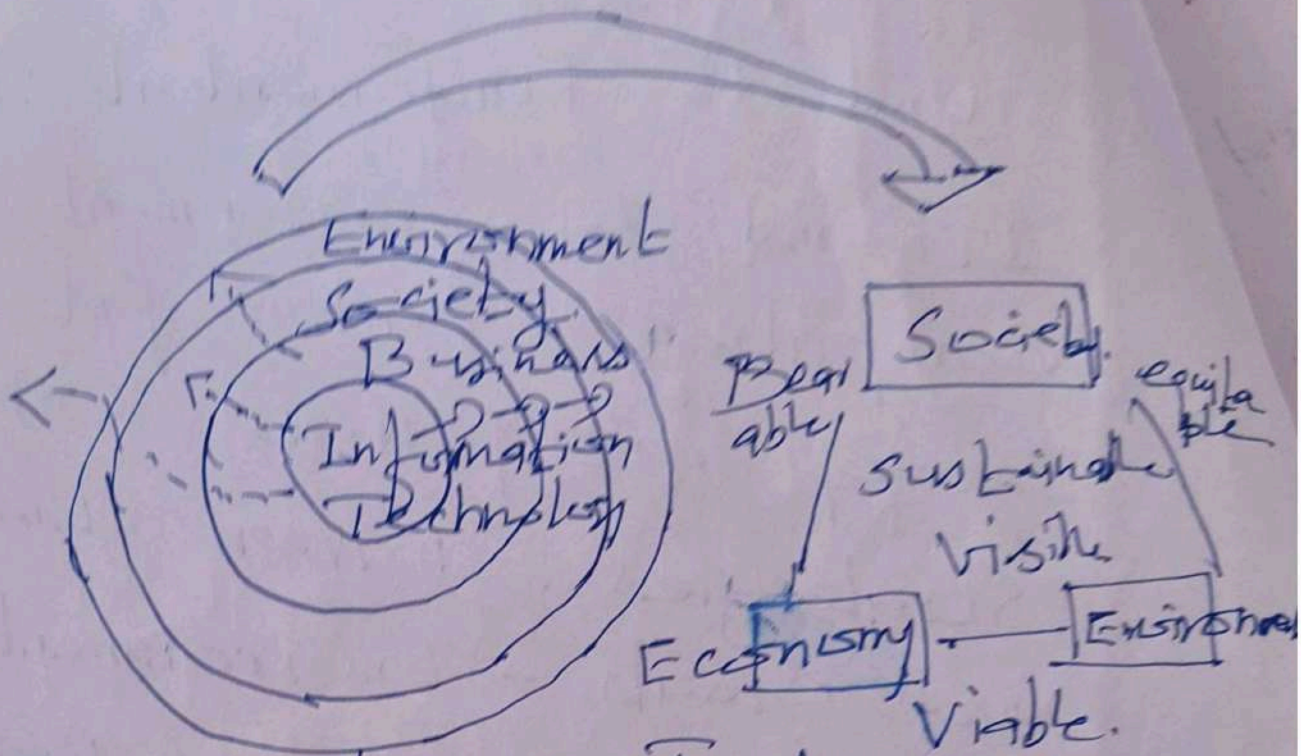
IT and the Environment - Green Computing : carbon foot print
 Scope on power - Green IT
 Strategies : Drivers, Dimensions
 and Goals - Environmentally
 Responsible Business: policies,
 practices and metrics.

Introduction:

Green IT initiatives is based on business efficiency.

Green IT is the study and practice of using computing resources efficiently.

The Environment Today



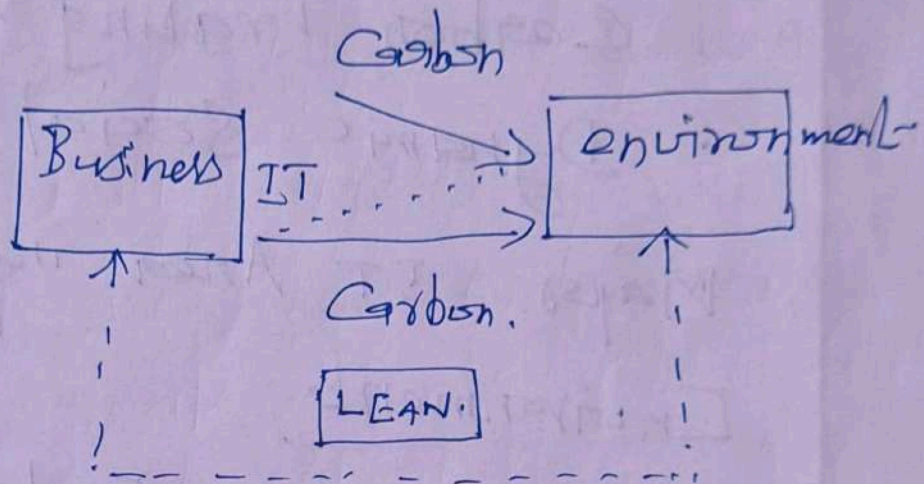
Information Technology influences business, Society and environment - key up to the sustainable triangle.

Information Technology and

Environment.

3

Interplay of Business and Environment through information Technology.



The impact of business activities through IT on the environment has to be understood in 3 ways.

1. from the length of time.
2. the depth of activity
3. the breadth of coverage of the carbon effects

4

The respective IT areas
have a dual influence.

- Software applications and packages.
- Carbon Trading Applications.
- Dynamic Social groups.

Major IT Area influencing

Environments

1. IT areas - End user devices
mobile
[desktops, laptops]
2. Data Center servers.
3. communications equipment
(switches networks)
4. Infrastructure
(buildings, towers)
5. Metrics and measurements
- L. Risk Management.

Green Enterprise Characteristics

Four layers of a Green IT

1. IT as a Producer.
2. IT as a Enabler
3. Green Enterprise.
4. Green collaboration.

Green Vision.

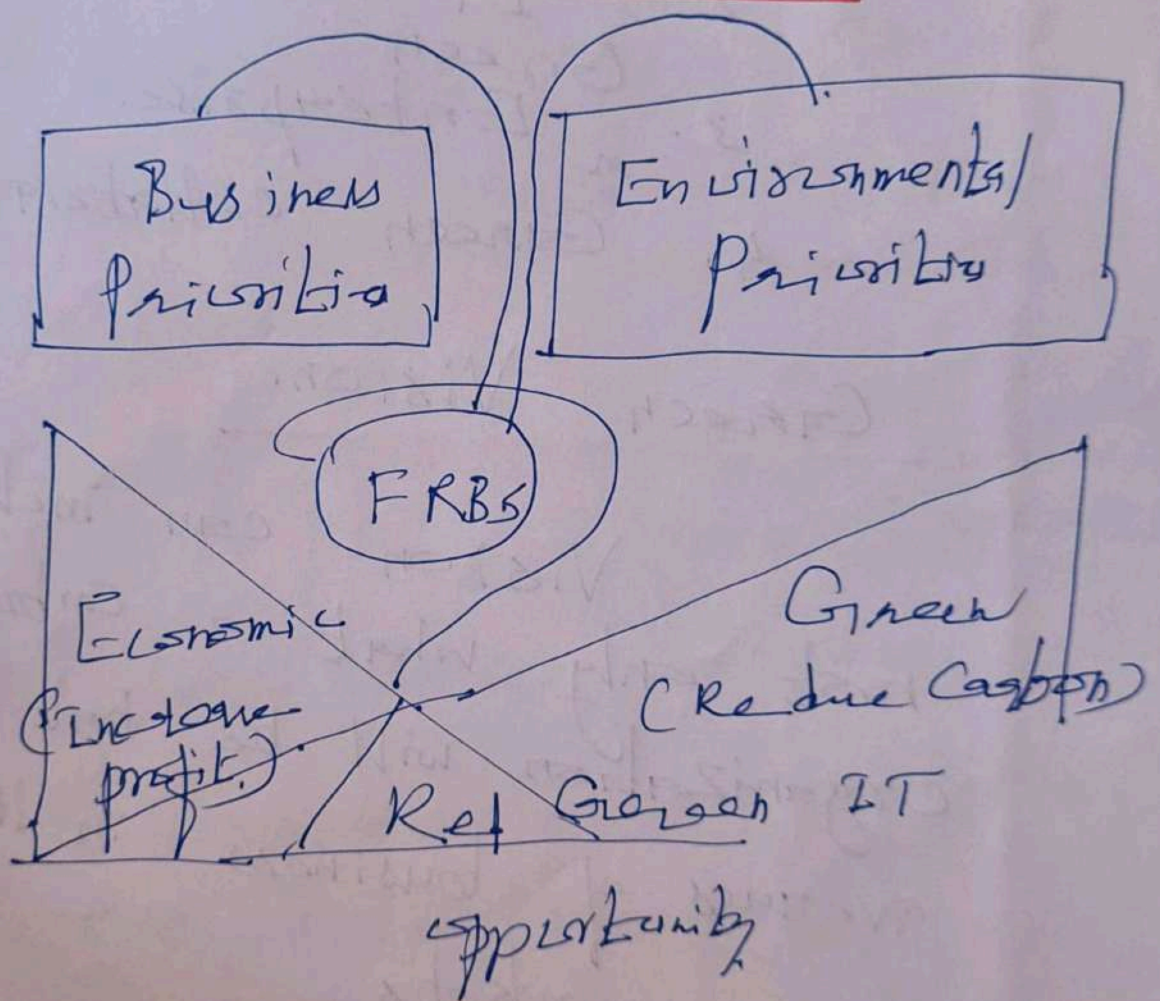
Vision can include not only what a carbon efficient organization will be but also new avenues of business in the new green markets.

Green Value:

This value is a combination of tangible and

6
intangible benefits to its
employees, customers, and
shareholders.

Green IT opportunity.



Some Approaches:

1. Engagement of key stakeholders.

Mobility to enhance the supply chain management system.

Challenges of a Carbon

Company.

. Lack of robust metrics and measurements associated with

Green IT.

Environmental Intelligence.

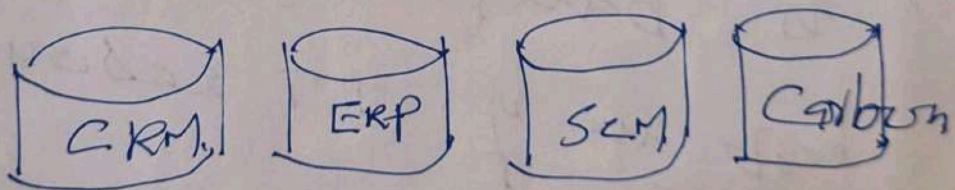
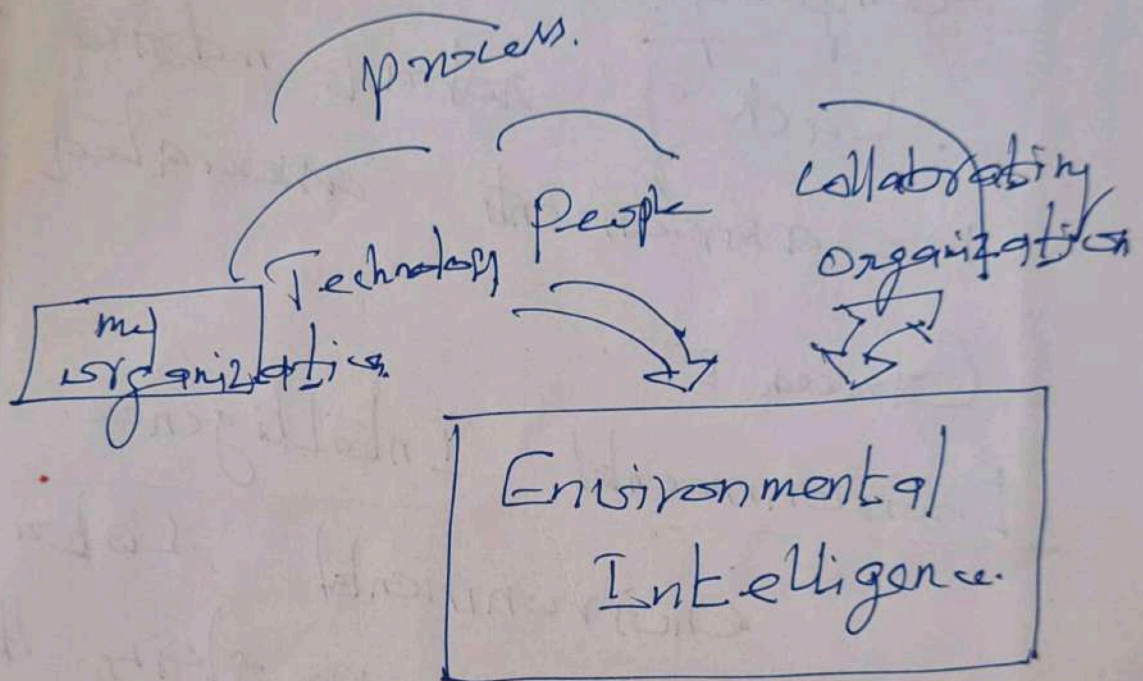
Environmental sustainability is based on making the best use of IT resources.

Business Intelligence:

← drives knowledge.

Organizational dimensions

1. Technologies
2. Processes.
3. People
4. Economic



Envisioning green future:

Future economy is the Carbon economy.

1.2 Green computing carbon

Foot print:

A foot print is a personal thing.

Knowing your carbon footprint also
 carbon dioxide is a
 green house gas.

The carbon cycle.

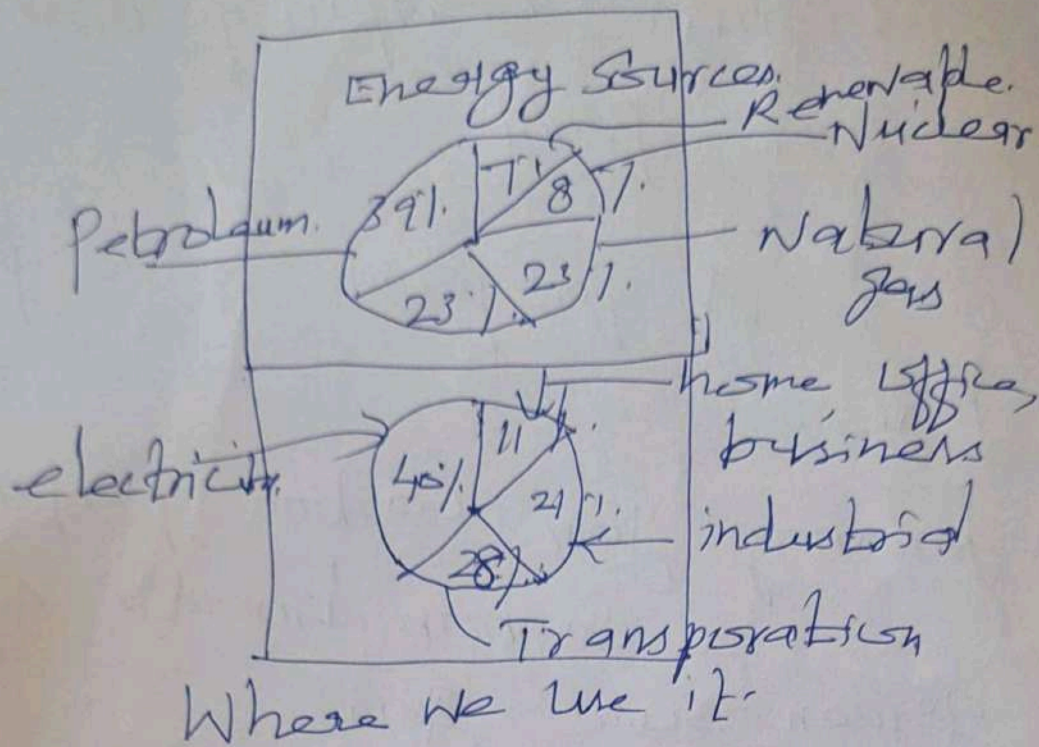
This cycle can handle
 only much carbon.
 Many things people contribute
 to excess carbon in the
 atmosphere.

connecting fossil fuels to
 carbon emissions

✓ oil

✓ coal

✓ natural gas.



- A lump of clean coal in your stocking.
- Facing the facts: Calculate your carbon footprint.
- The nature consultancy's carbon footprint calculator.
- Moving toward personal Sustainability.

• Tallying ecological footprint

• Reducing your footprint

→ The way you run your home

→ The way you use transportation

→ The way you feed yourself and your family.

1.2.2 The straight scoop on power.

- power issue
- Consumption.
- Checking of sources of Electricity
- Creating electricity

1. Renewable sources

nonrenewable energy

2. By-products of different

energy sources.

Thinking about renewable energy

Types of Renewable Energy

1. Biomass
2. Fuel cell
3. Geothermal
4. Hydroelectric
5. Solar
6. Wind.

Winds of Change

Water your World.

How much energy are you using,
anyway?

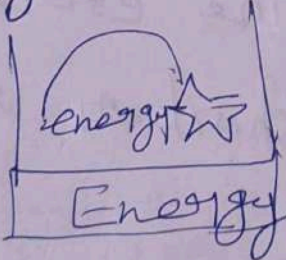
Tracking your bills in a
Spreadsheet

How much energy are you using

Anyway?

- Tracking your bills in a spreadsheet.
- Calculating costs and savings with a home energy audit.
- Monitoring usage with plugs and smart sensors.
- Checking for efficiency with the Energy Star.

Life feels better with an energy star.



penning up energy tags in your house.

Controlling power flow to electronics: Managing your ^{Media} skills.

1. Television.
2. Gaming consoles

3. Computers

Cutting the peak from appliances:

- Heat food on the stove top

This is the way we wash the

- Clothes

Trimming fuel consumption.

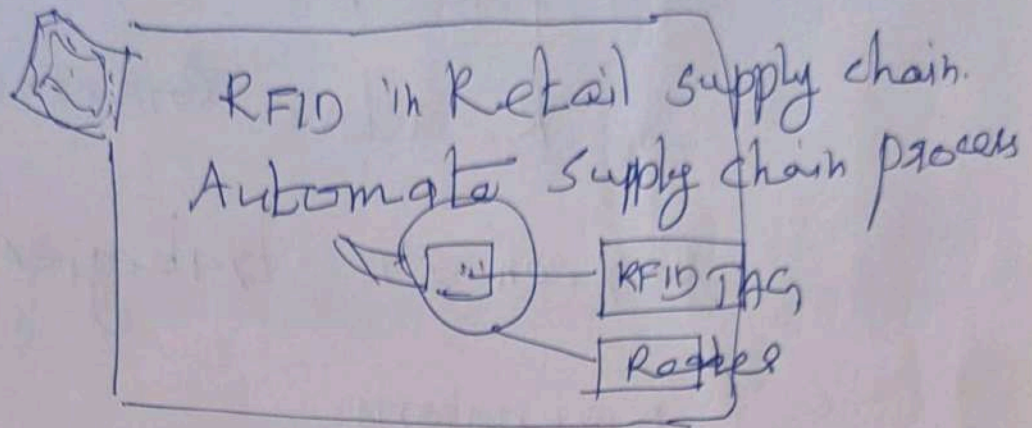
→ Think through your trips and combine errands

→ Take shorter routes wherever possible.

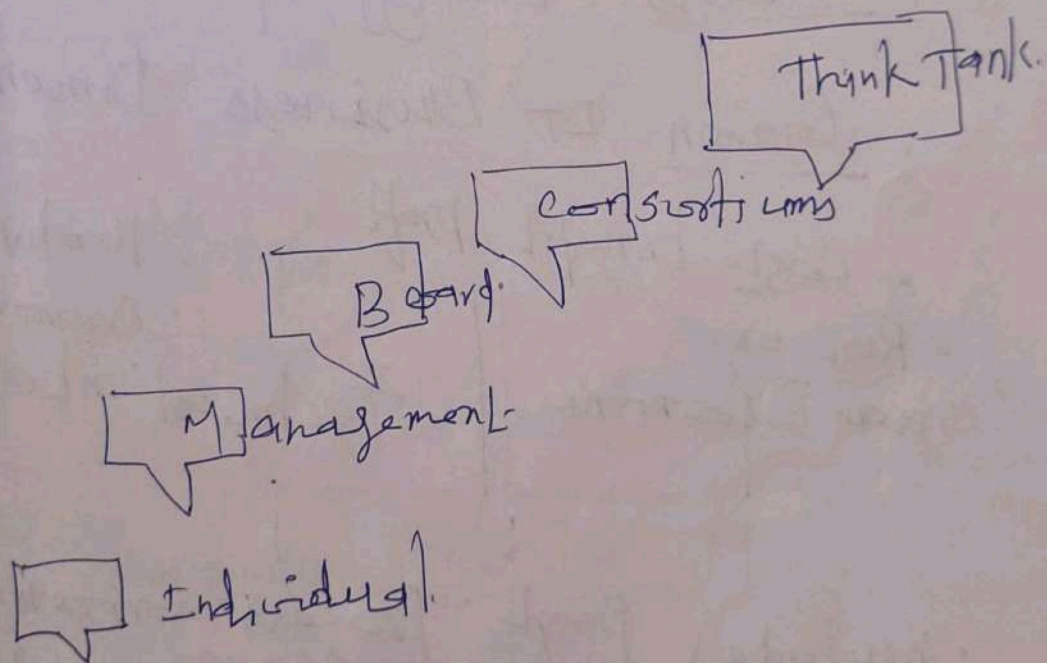
1.3. Green IT Strategies

Drivers, Dimensions, and Goals

Introducing Green strategies



Green IT strategies: Range of Impact



Green Strategic Alignment

→ proactive Green Strategy

→ Reactive Green

Green IT Strategies Mix

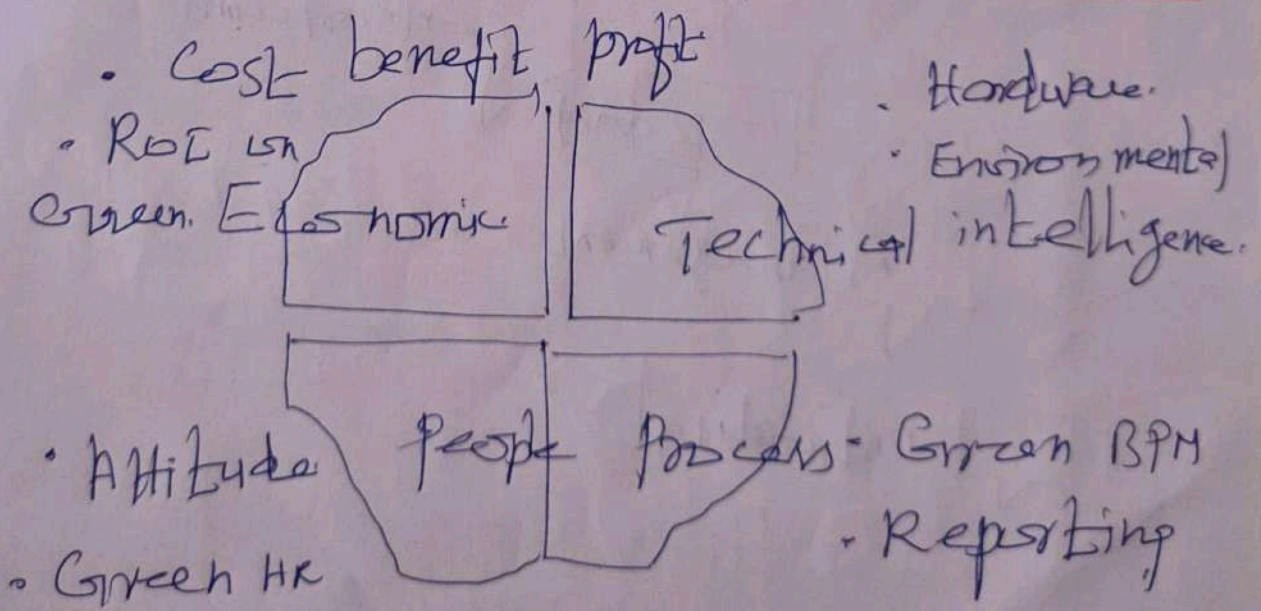
Dimensions

Business

Intelligence

Costs (Energy, operational)

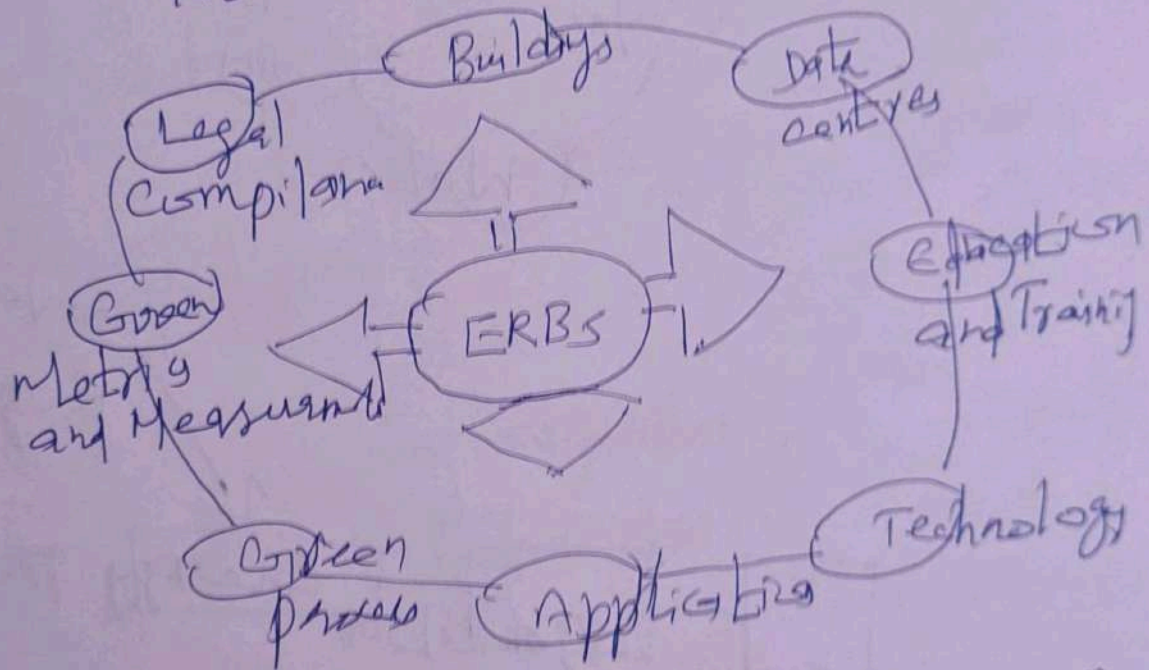
Green IT Business Dimensions



- Economy
- Technologies
- Processes
- People

WIDE Ranging Considerations

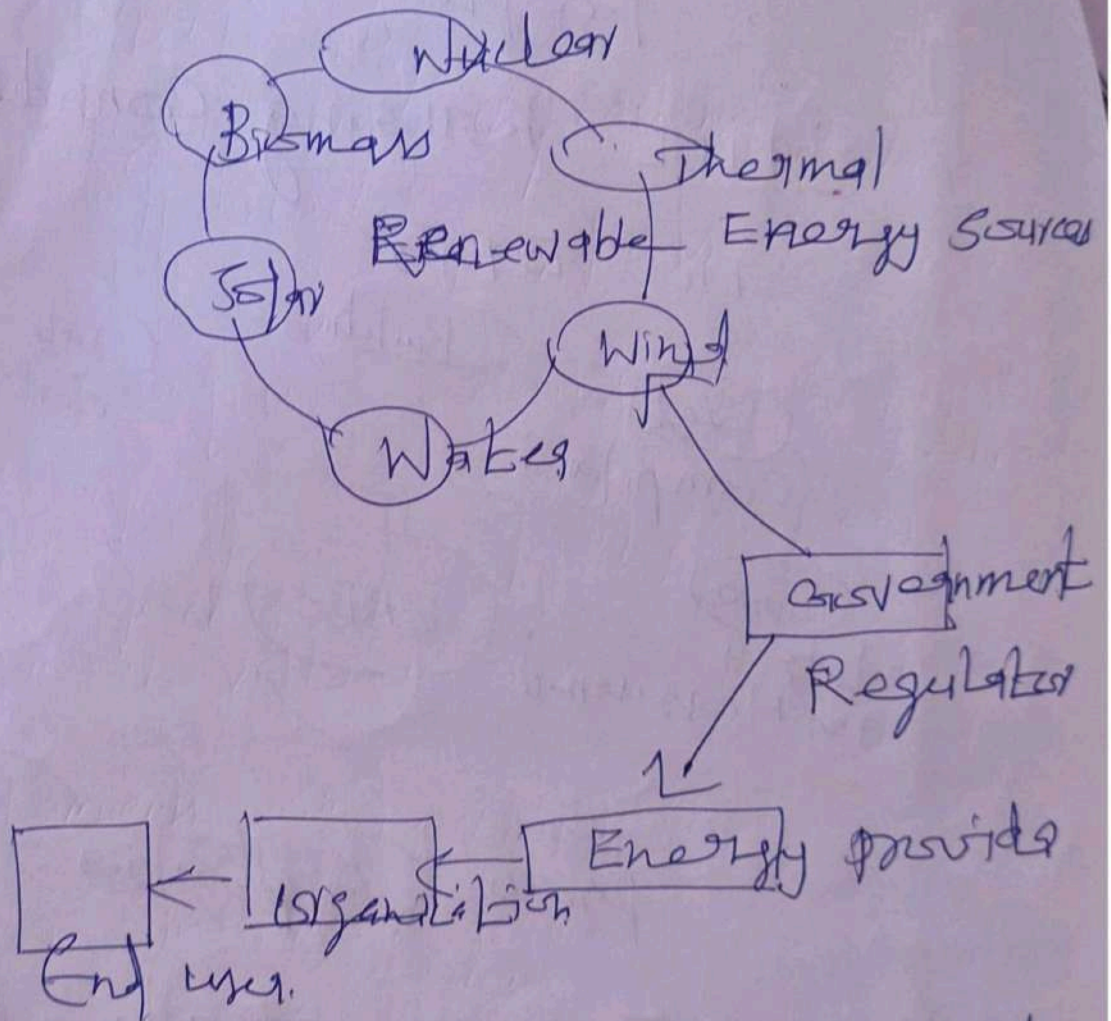
in ERBS



1-4. Environmentally Responsible

Business: Policies, Practices, and Metrics.

Renewable energy sources
need to be increasingly incorporated
in green policies

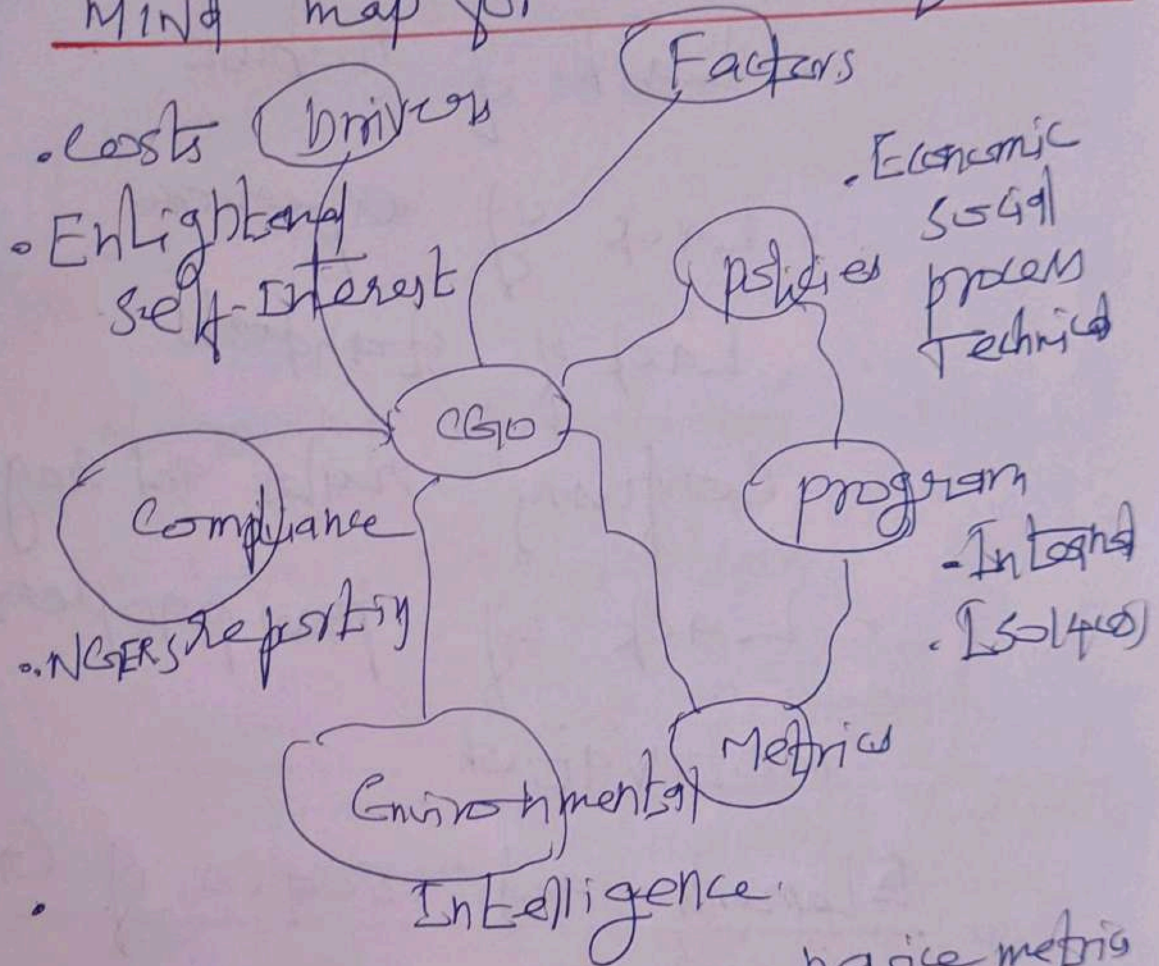


Renewable energy sources need
to be increasingly incorporated
in green policies.

Mind Map for the role of

a CGO.

MIND map for the role of a CGO



- Data Warehouse
- Collaborating
- Partners

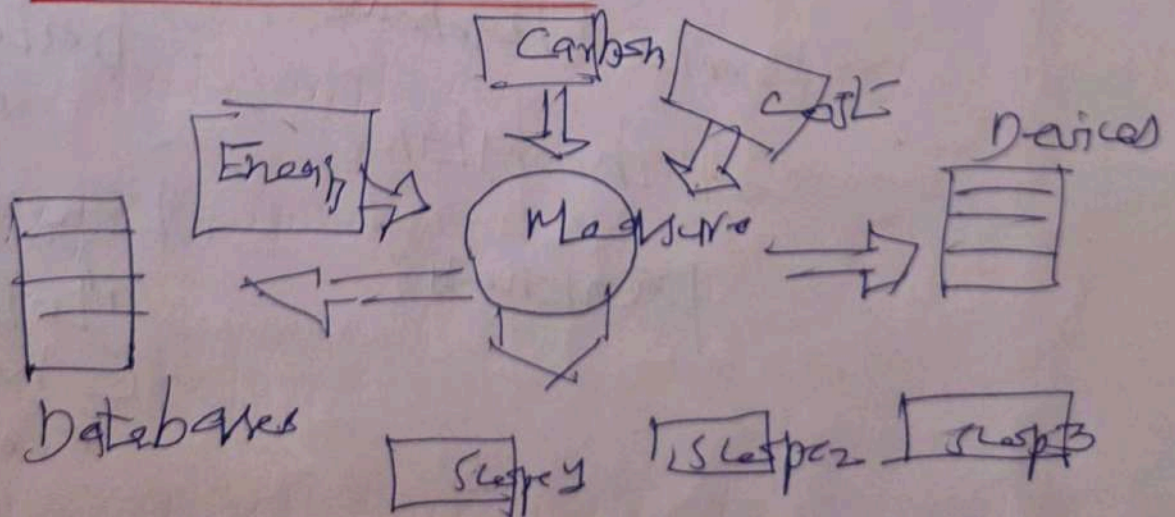
- Device metrics
- Data Center Metrics
- Life cycle Metrics
- E Waste Metrics

Green IT measurement challenges

- Lack of availability
- Lack of robust
- Lack of experience
- Lack of standards
- Confusing rules and regulations
- Lack of ~~pro~~ proper motivation

Elements and scopes of Green

IT metrics



Measuring the Carbon Footprint

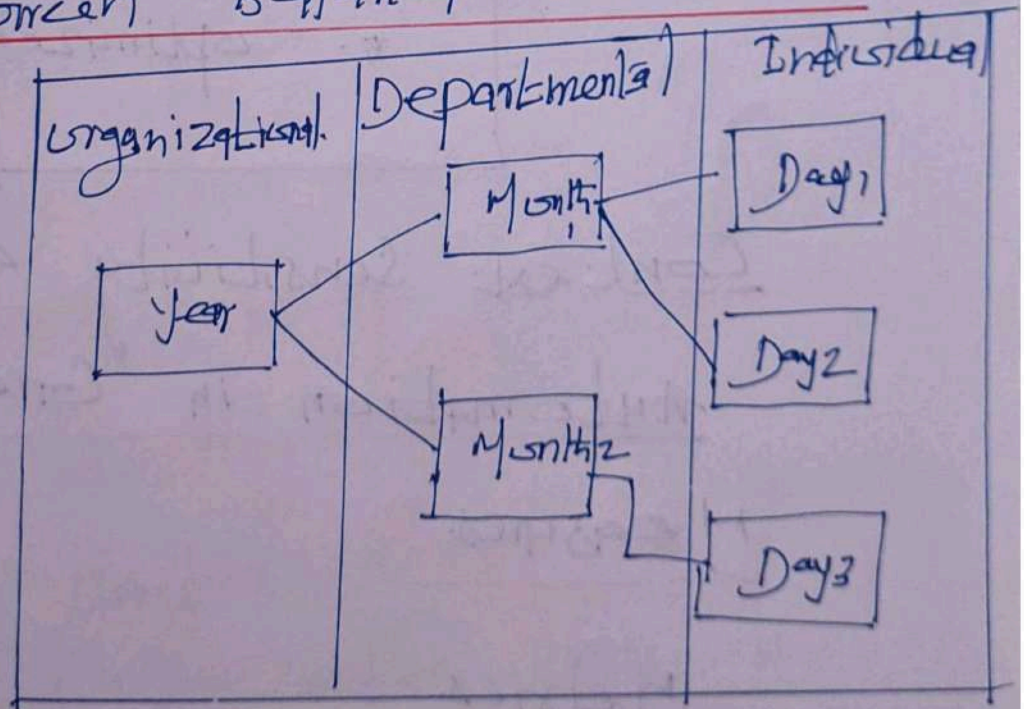
of your Organization.

1. Dynamic measures.

2. Static "

Measuring operational costs
in your organization.

Green Balanced Scorecard.



Green IT Readiness and

CMM

0 No Intention
1 Initial
2. Replicable
3 Defined
4. Managed
5. Optimized

Context: Sensibility and

Automation in Green IT

Measures.

Metrics.

1. Cost of Green IT transformation for the enterprise.

2. Cost associated with change to business
3. Savings resulting from the Green IT transformation.
4. potential penalty costs.
5. Green IT strategy within Green strategy.

Enterprise Data center metrics.

1. Carbon emission per megabyte of data stored on the servers.
2. Carbon emission of the data center per user.

3. power usage effectiveness

versus PUE of outsourced

data centers.



UNIT II

2.1 Green Assets : Buildings, Data centers, Networks and Devices.

Introduction.

Green Assets

1. Establish [Procure]
2. Operate [Run]
3. Dispose [Demolish]

Building and Facility Management.

→ as depends on the material of the building itself.

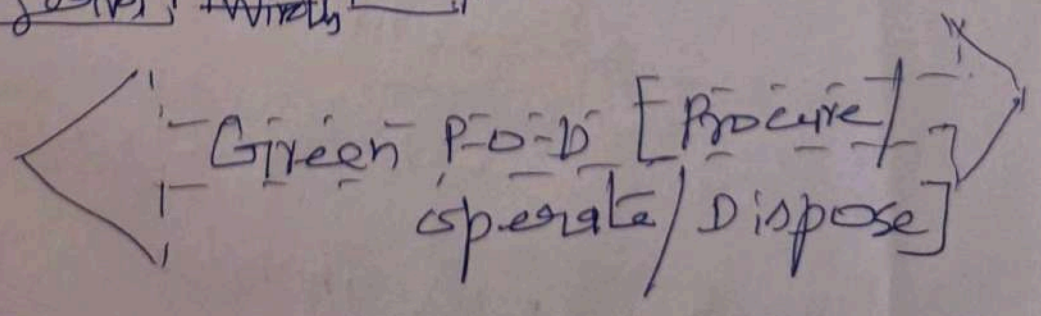
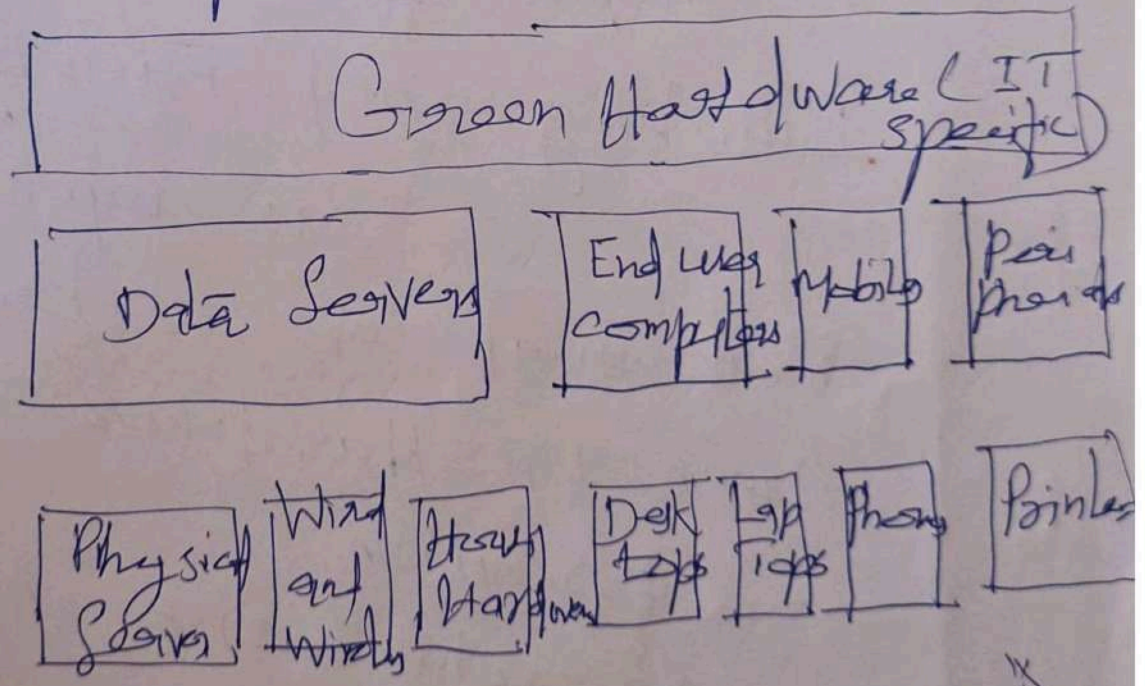
Green IT Hardware:

1. Location
2. Architecture and design.
3. Construction
4. Livability
5. Visibility

Data Centers.

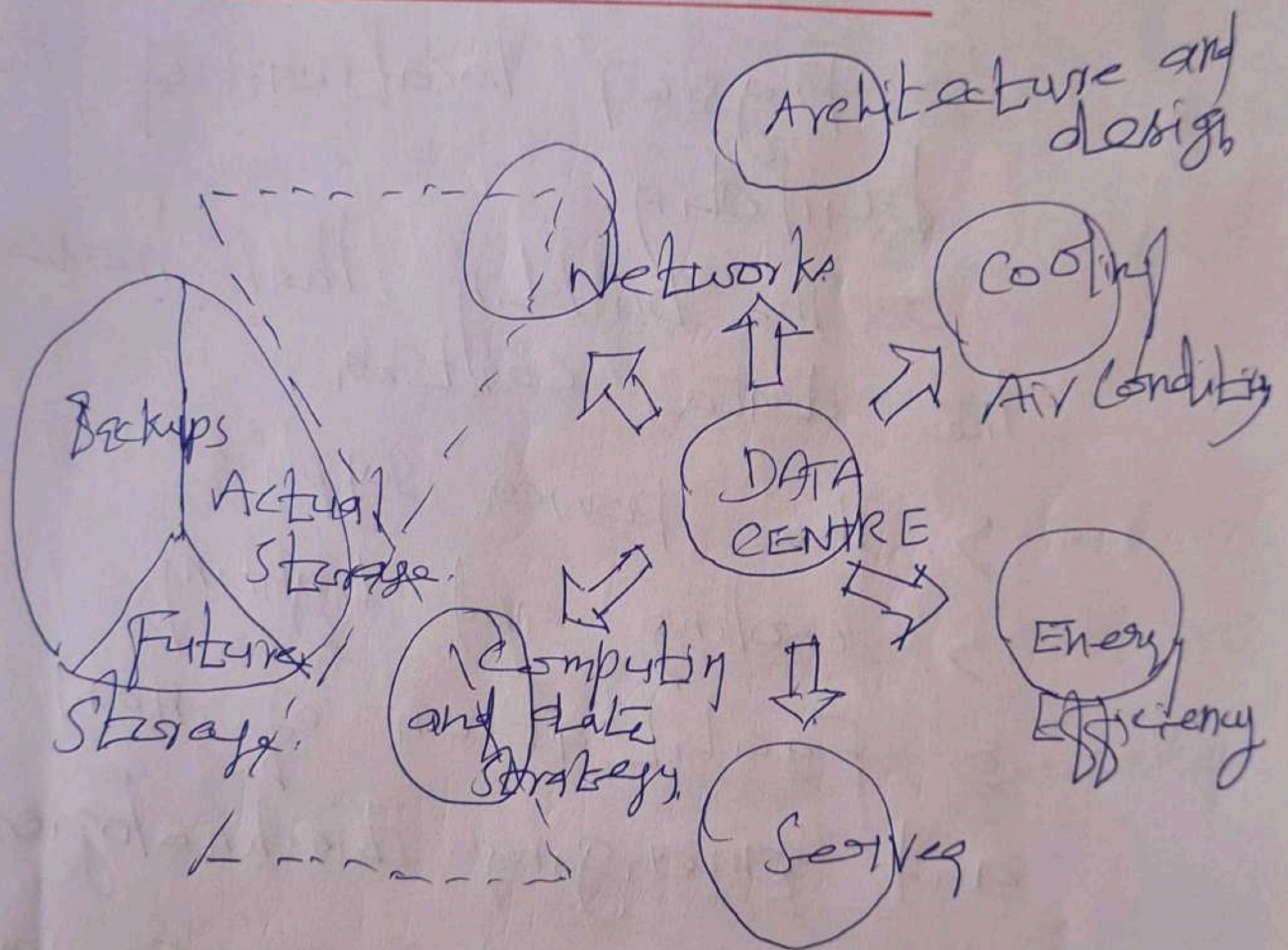
- deals with the physical machines and the specific buildings in which they are housed.

- End-user computers
- Mobile devices
- Peripherals



1. Procurement
2. Operation
3. Disposal.

Green Data Centres



- Data centre design layout and location
- Cooling Air conditioning
- power management
- Servers

Networks and communication equipment.

2.1.6. Data center Building

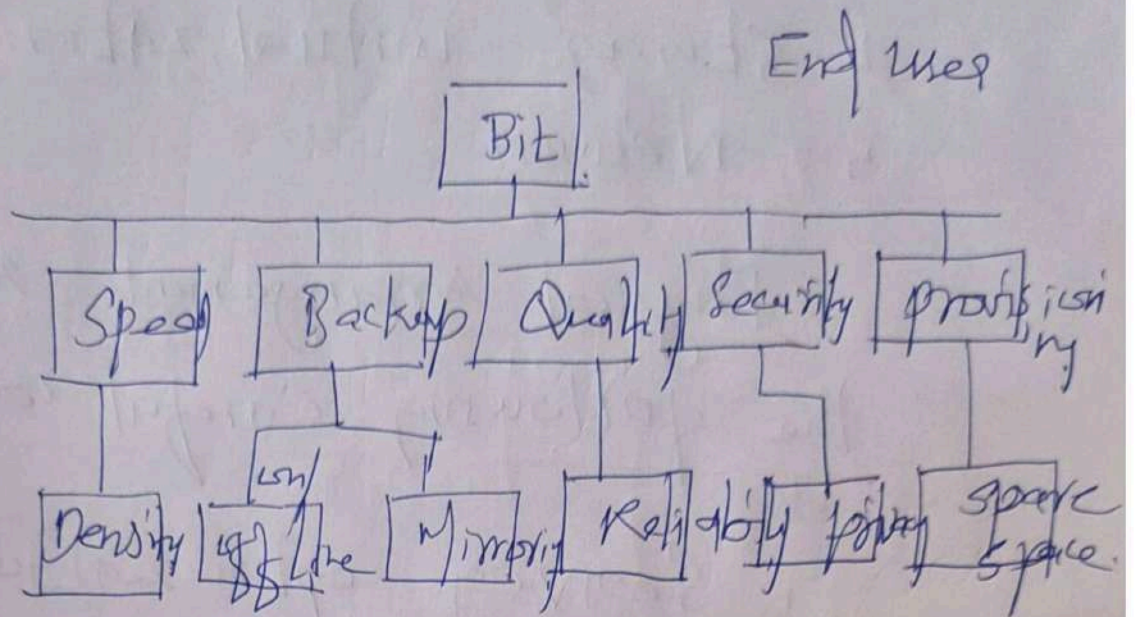
Design, Layout and Location

- > Physical location of the building
- > The building that houses the data center.
- > The power supply
- > cooling and lighting
- > Facilitation of new and emerging technologies

2.1.7. Data Center IT Equipment

Server strategies

2.1.8. Data strategy and the carbon emitting bl.



Data Center

2.1.9. Data Services

Optimization

Optimization improved through better organization of the databases.

2.1.10. Data Services

Virtualization

1. presentation virtualization
2. application "
3. desktop "

4. Storage virtualization
5. Network "

Physical Arrangements require the following careful considerations

1. Server optimization
2. Disk identification
3. Equipment Reuse
4. Re-engineered Layouts

2.1.11. Cloud computing and data centers.

2.1.12. Networking and Communication

Infrastructure

Categories of Networks

1. WAN
2. Mobile Network
3. Wireless LAN/WAN
4. Wi max

2.13. End - User Devices

2.14. Smart Meters in

- Real time

Smart meters are meters that not only measure the power consumption automatically.

Tactical Green IT

Activities

1. Eliminate the use of active screen savers
2. Implement active power Management
3. Printer setup.

2.1.5 Managing Devices

for data contextual Green

Services

They can include specific
use of tools

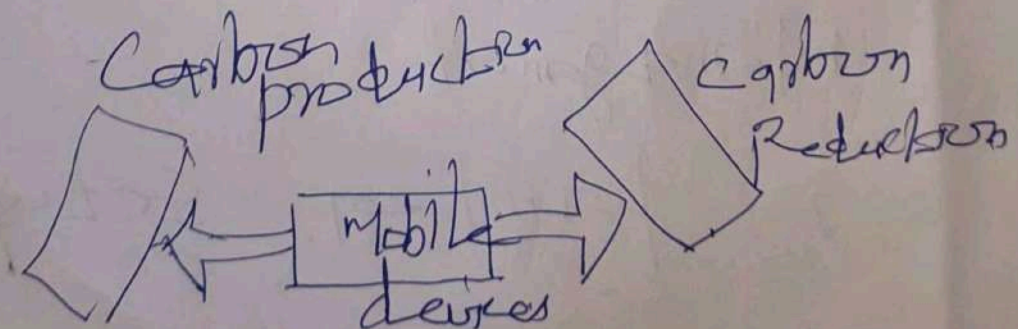
2.16. Devices and organizational

Boundaries for Measurements

1. Dashboard displays attached
to the devices to display
emissions.

2.17. Mobile devices and

Sustainability



2.2. Green Business Process

Management: Modeling, Optimization and Collaboration.

Introduction.

Basic Process characteristics and corresponding Green connotation.

Process characteristic.

1. Necessary
2. Efficient
3. Effective.
4. Agile.
5. Measurable.

2.2.2. Green Business Process

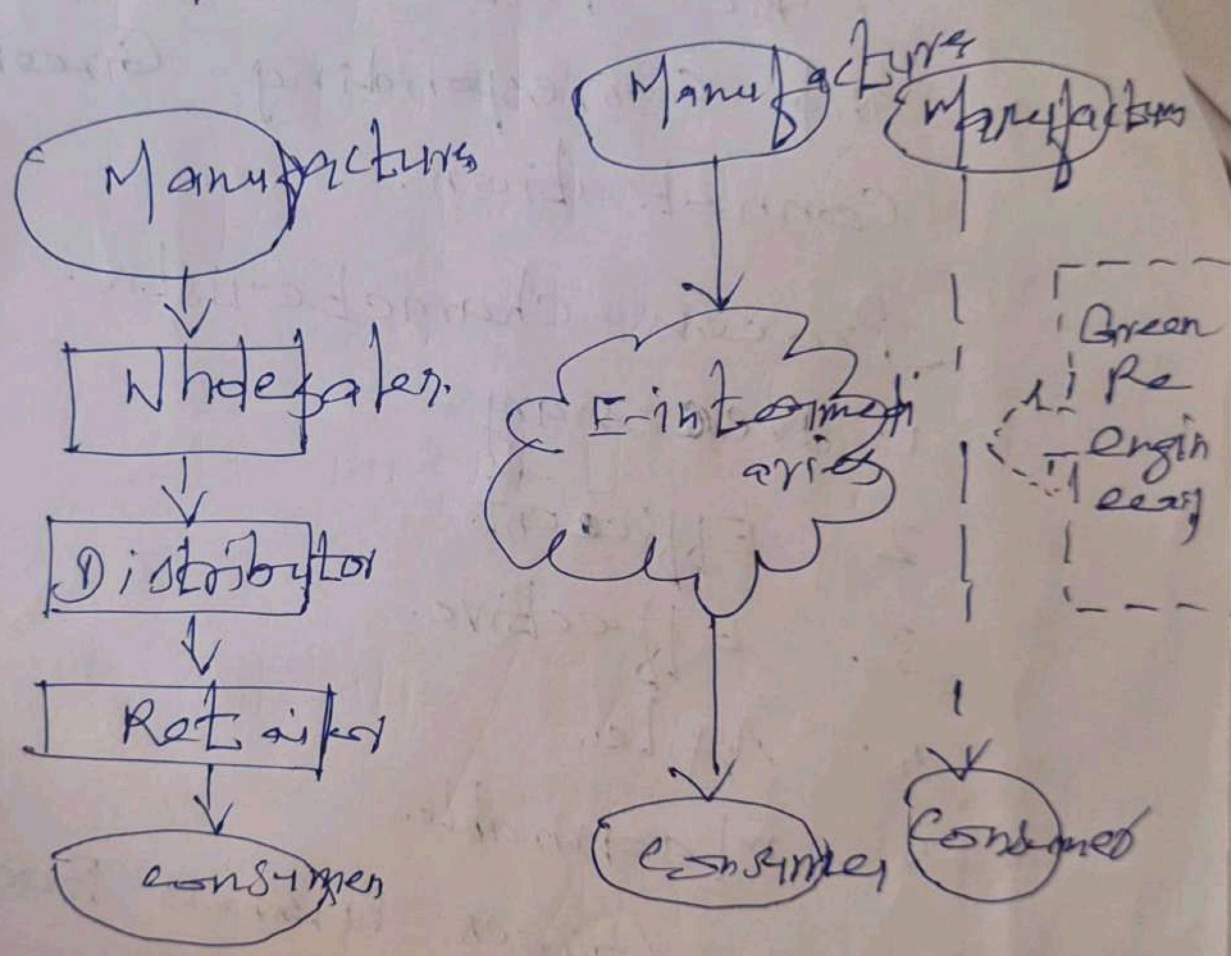
Management.

— Overall approach to modeling, optimizing, consolidating and executing business processes of an

organization from a carbon perspective.

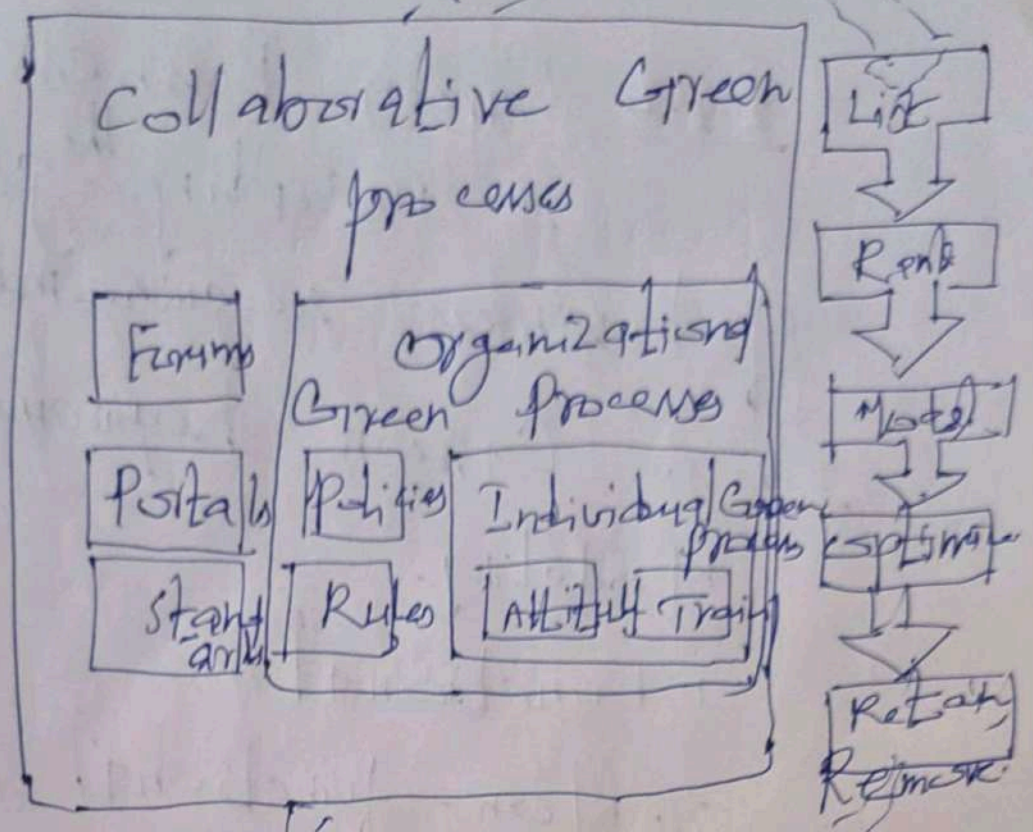
2.2.3. Green Reengineering.

business processes to optimize their emissions



2.2.4 Green Processes:

Individual, Organizational and Collaborative.



Green Process Categories

1. Individual
2. Organizational
3. Collaborative

Listing, Ranking, Modeling, Optimizing, Retaining, Renewing

225 Green BPM and

Standards.

to produce greater quantity of goods which improved production capacity.

2.2.2. Green Business Analysis — including the gathering

of business requirements.

2.2.7. Green Requirements

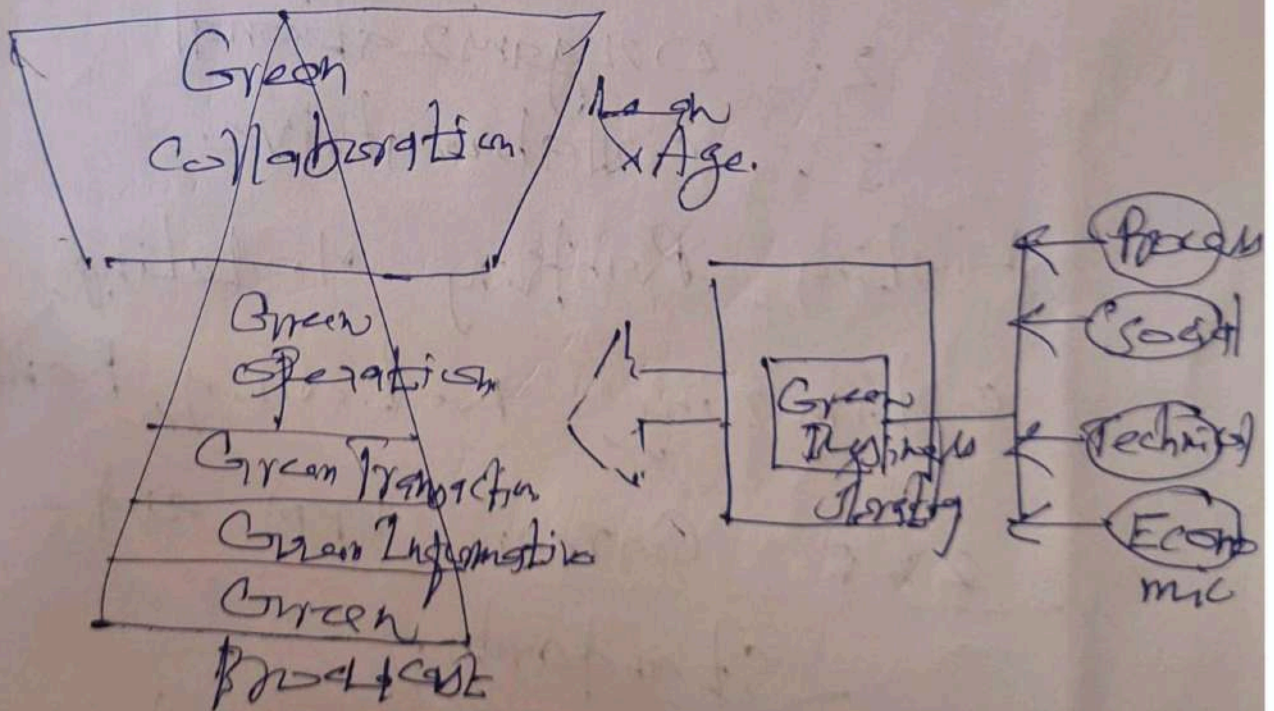
Modeling.

1. Functional.

2. Non-functional.

2.2.8. Green Business Process

Incremental complexity.



1. Broadens process

13
2.2.9. Green Business

Applications.

— Financial management
Information systems, ERP,
Supply chain Management (SCM)
and customer relationship
management.

2.10. Modeling Green

Business processes.

The modelling of processes
is a crucial step in
process optimization.

2.2.11. Quality of Service
and Green Business processes

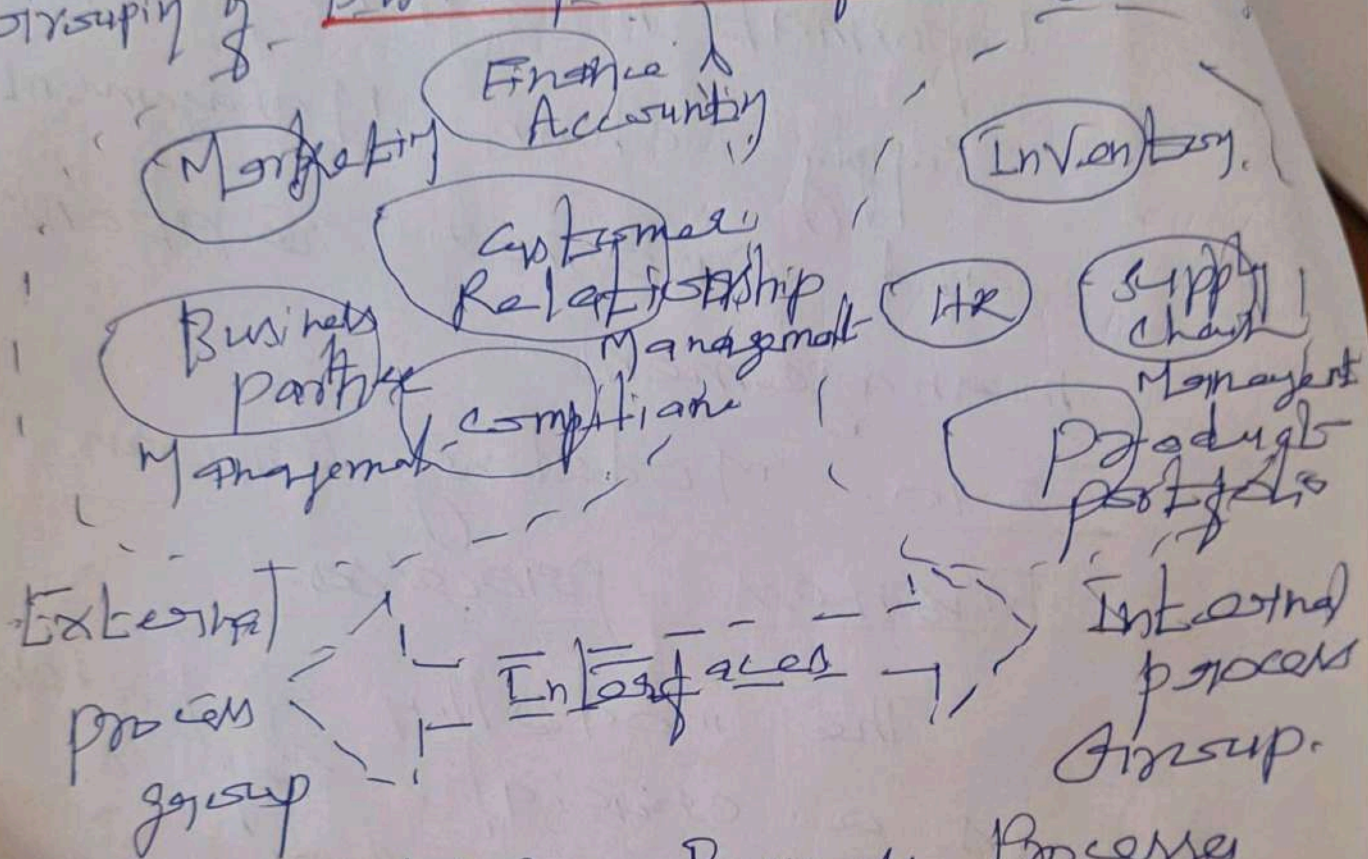
Enhancement in QoS
has a high potential for
reduction in QoE over
the entire life of the
interaction of the customer
with the organization.

2.2.12. Documenting Process

Goals:

Each process has to be measured for its carbon cost.

Grouping of Business processes for Reengineering



Green Mobile Business Processes

- Mobile - Broadcast
- Mobile - Informative
- Mobile - Transactional
- Mobile - Operative
- Mobile - Collaborative.

Four dimensions are discussed.

1. Environmental Economic Mobile use
2. Technical Mobile use
3. Environmental process Mobile use
4. Environmental social Mobile use

2.2.14. Example - Digital

Library GPR

2.3. Green Enterprise

Architecture - Environmental
intelligence - Green supply
Chains.

- relationship between
the specific domain Architecture

Green Enterprise Architecture

The aim of a GEA is
to develop the understanding

and Models of the
Business, as well as Techn

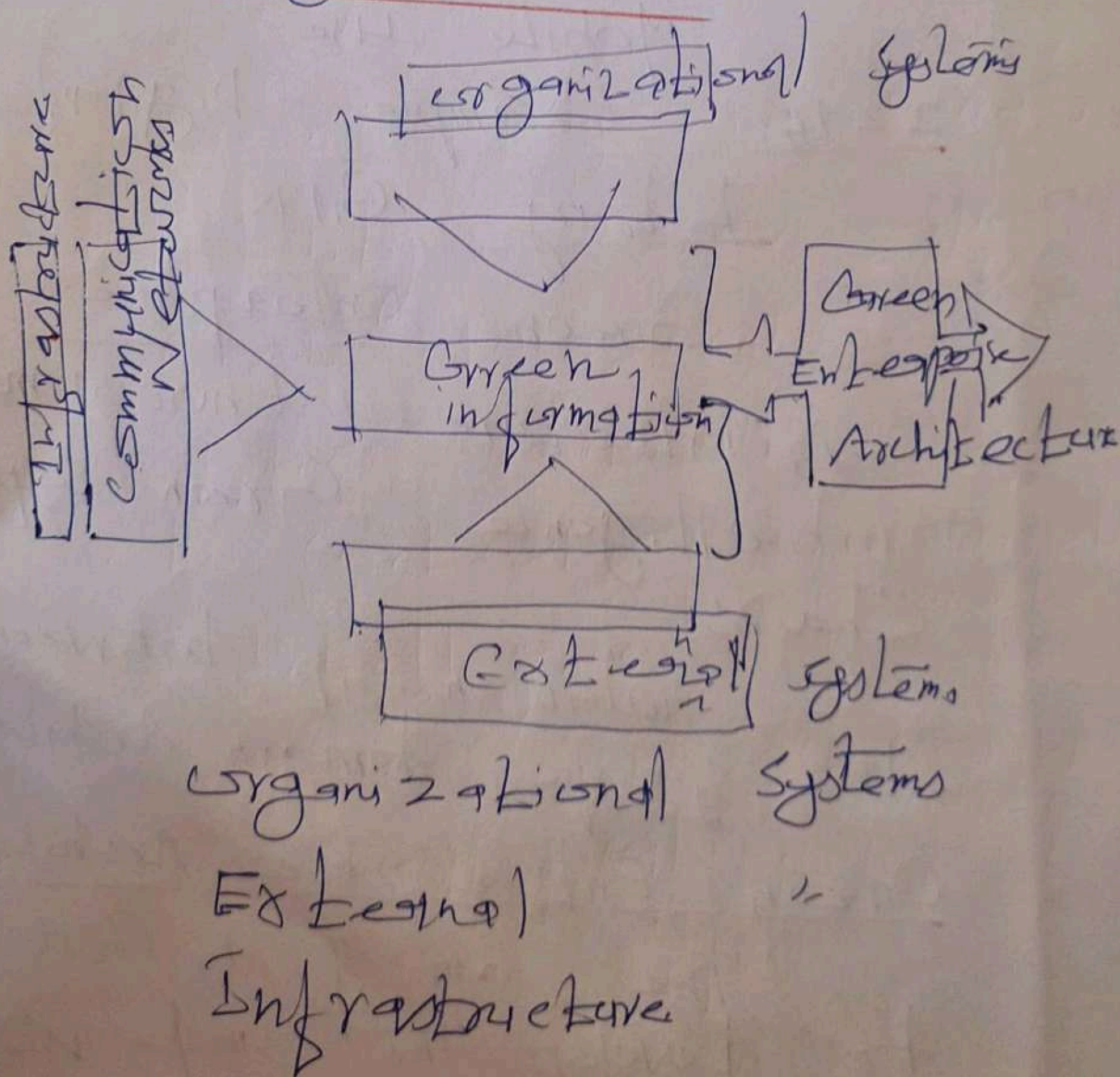
Green

Views of Green Enterprise
Architecture.

Green Enterprise Architecture
- categories of Requirements

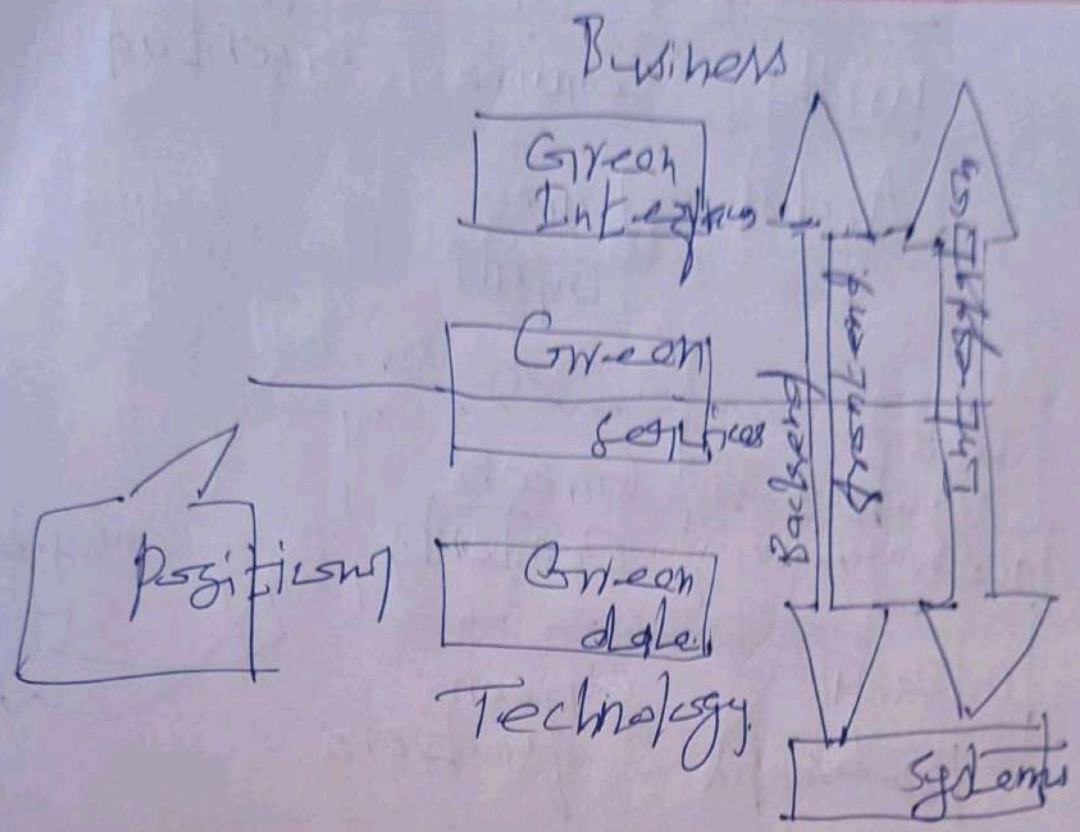
Green IT and Organization

Systems



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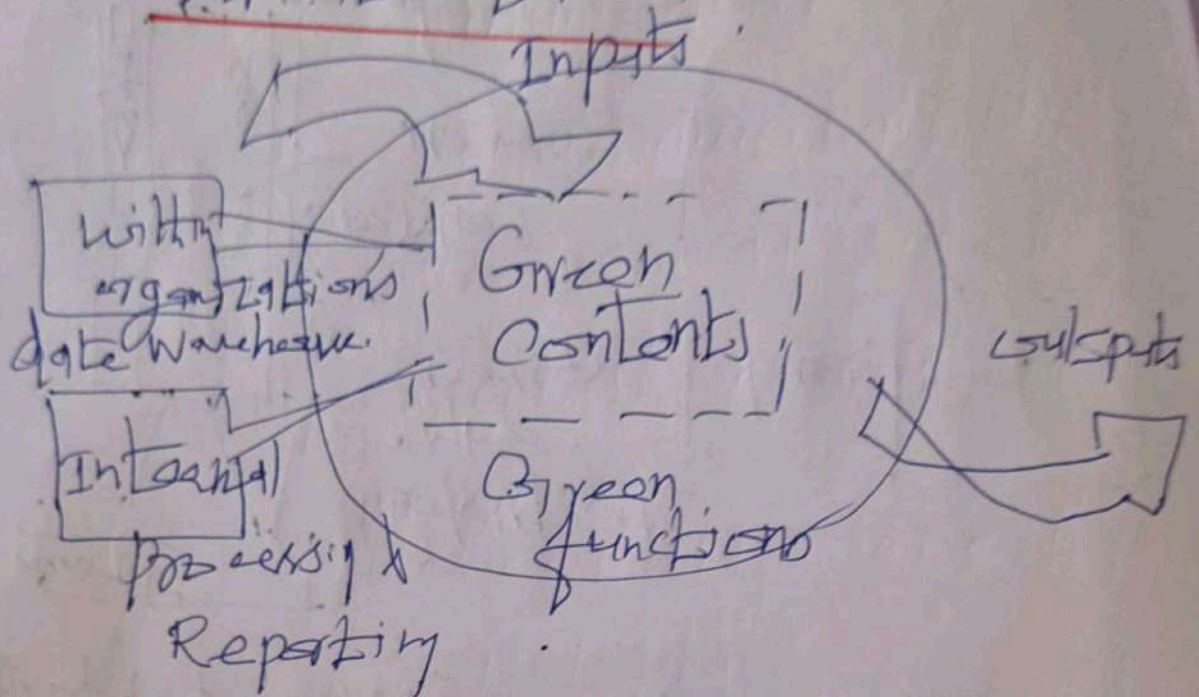
Green Solutions Architecture



- Evolving green systems architecture
- Aspects of Green solutions Architecture.
- Cloud Computing
- Virtualization
- Smart Networks
- Alignment
- Optimization
- Integration

Content and integration with service oriented

Architecture



- Green Supply chain Management
- Mobility in Green Supply Chain Management.
- Suppliers contract conditions in the context of Environmental Intelligence.

Suppliers contract conditions

1. certification.
2. maturity.

3. Suppliers' supplier.

4. Attitude.

5. Reactivity and Responsiveness.

Green portals in Green

Enterprise Architecture

> The possible sources of green information

> The scale of green information is available at any given time.

> combines reliability and relevance of the available information.

• Business Intelligence and Green IT

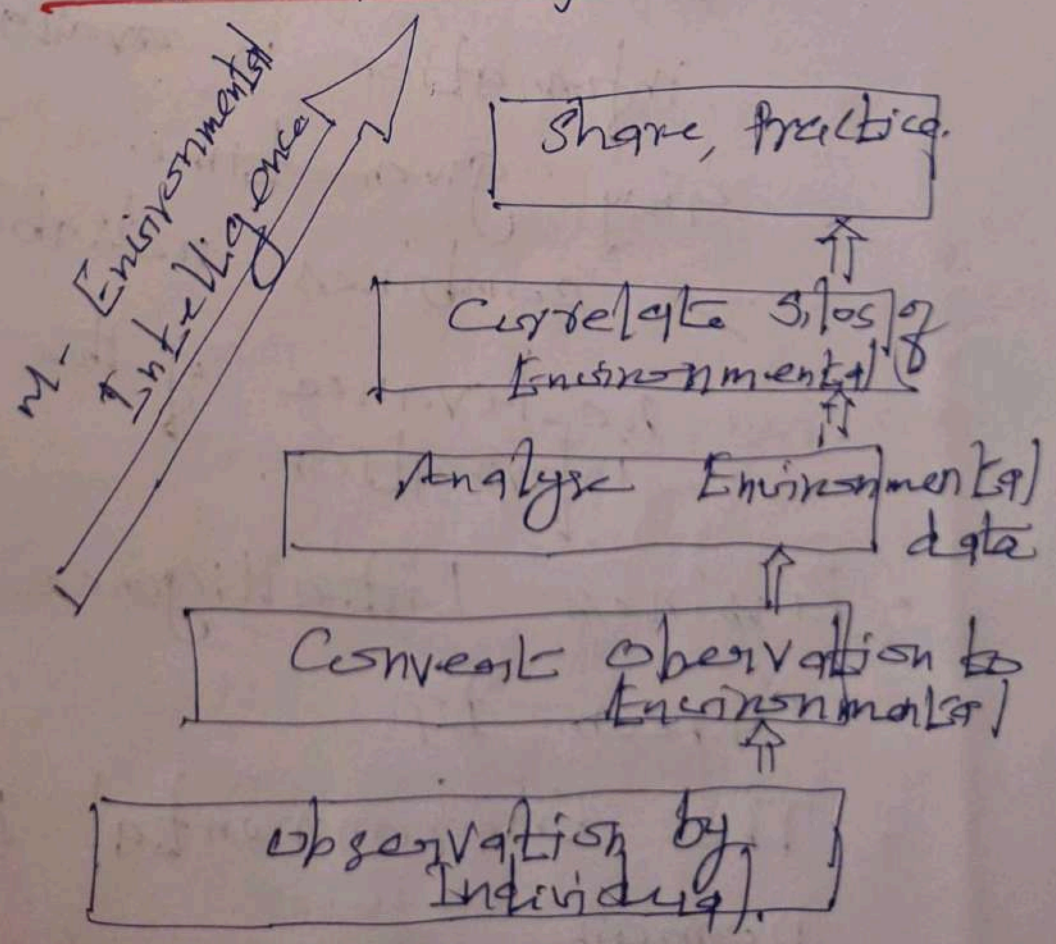
• The Environmental Intelligence Domain.

Environmental Intelligence Systems Evolving Complexity

Communication channels in Environmental intelligence

Environmental Intelligence Implementation with web services.

Environmental intelligence with Mobility.

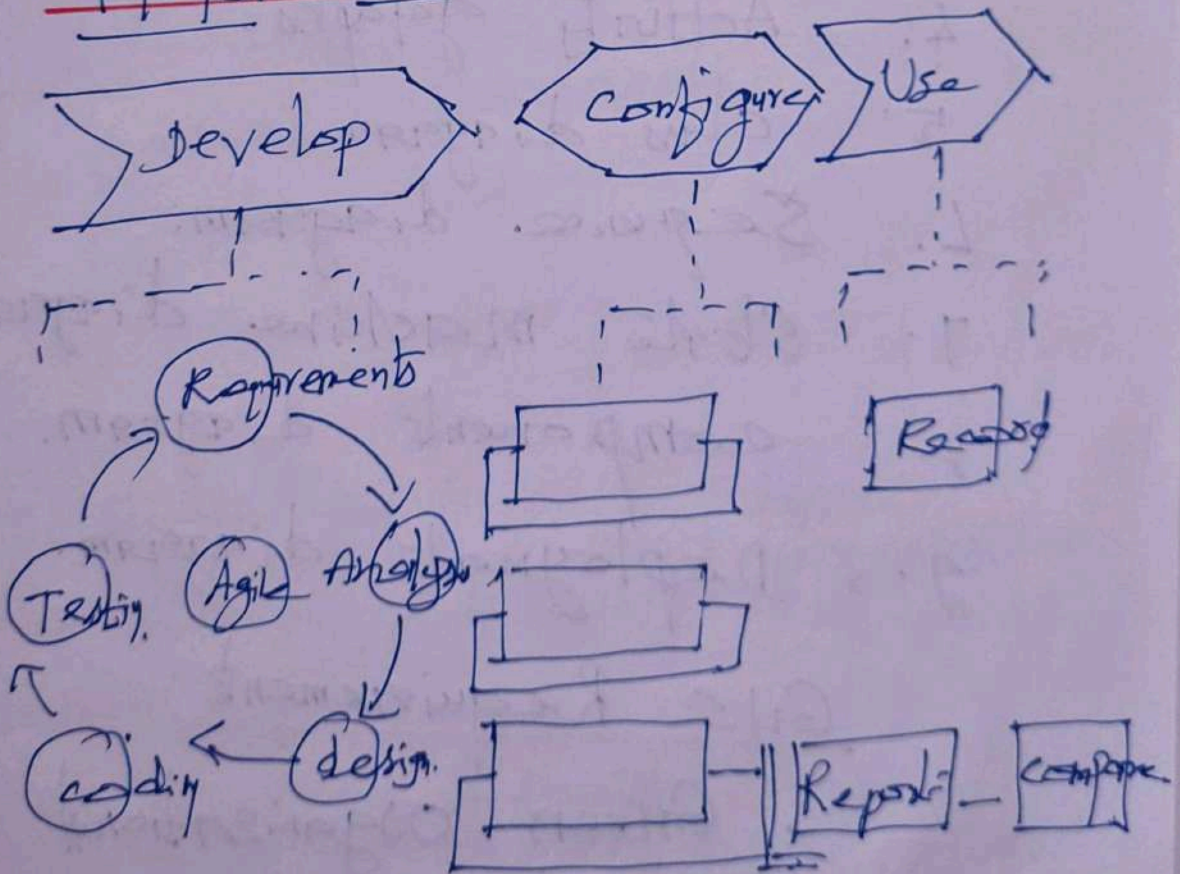


An example of Green Enterprise Architecture.

Input analysis - output Activities which are technically supported by the emissions monitoring layers.

2.4. Green Information Systems: Design and development Models.

Major Phases in GIS



development, configuration and use.

> Configure

> use.

Modeling and Architecting GUS

Requirements design implementation
and Testing.

1. package diagrams.
2. Use Cases
3. Use case diagrams.
4. Activity graphs.
5. class diagram.
6. Sequence diagram.
7. State machine diagrams.
8. components diagram.
9. Deployment diagram.

GUS Requirements

- Green organizational portal [GOL]
- Regulatory standards portal [RSP]

Green Organizational Portal

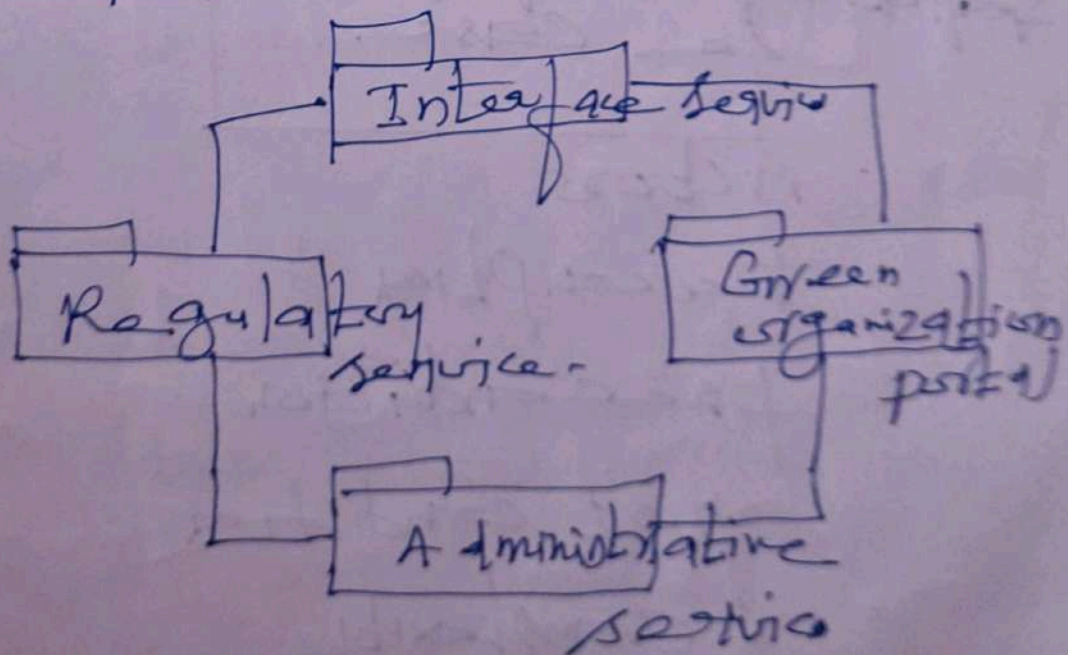
— made up of (organizational) data on its 'green' performance.
Regulatory Standards Portal

RSP is a large portal that will be maintained by government agency.

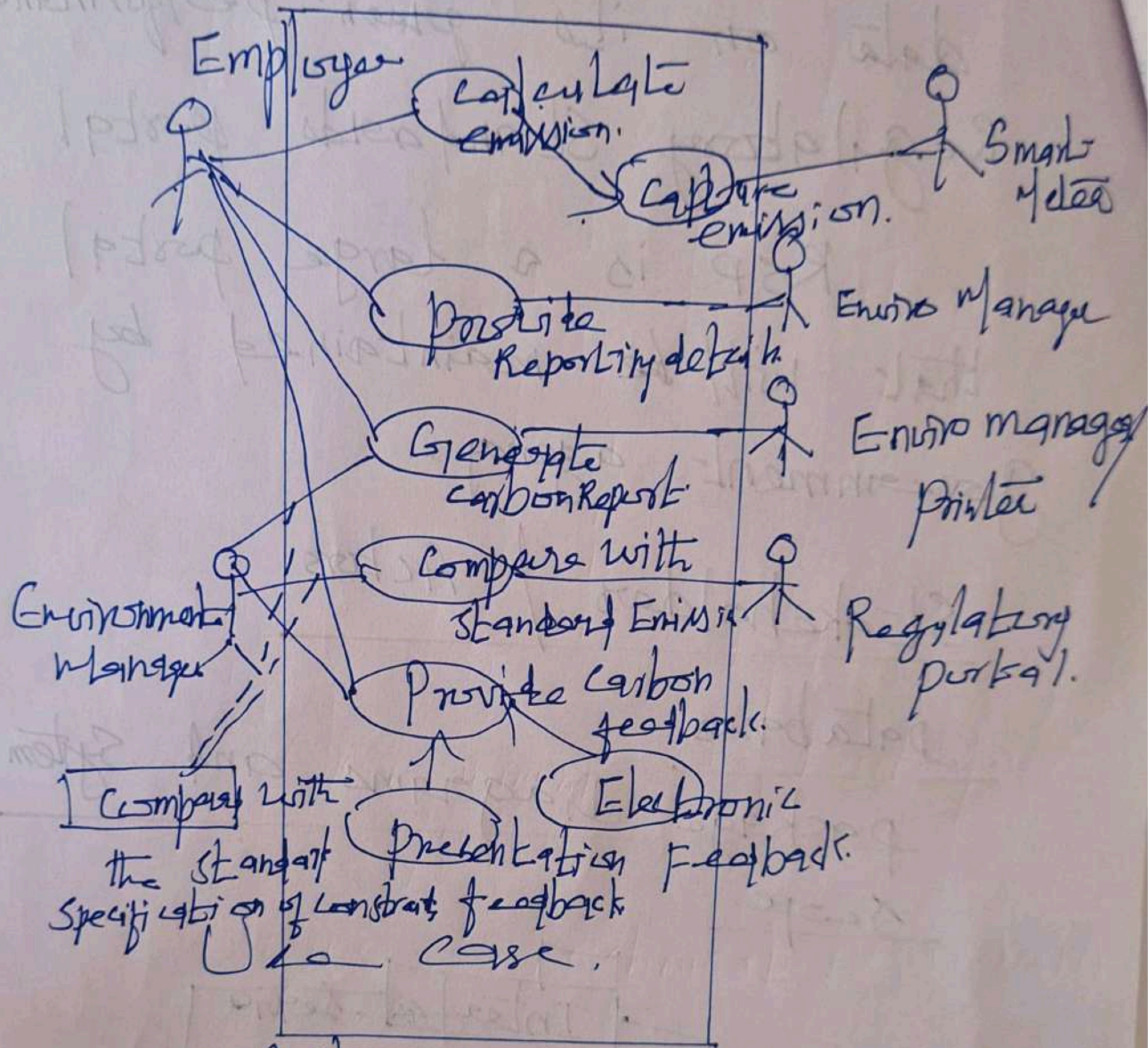
Stakeholders / Actors.

Databases

package Diagrams and System Scope.



Use Case Diagram for GOP.



Actor

Description

pre-condition

post-condition

Complexity

Normal course of events

Alternate course of events.

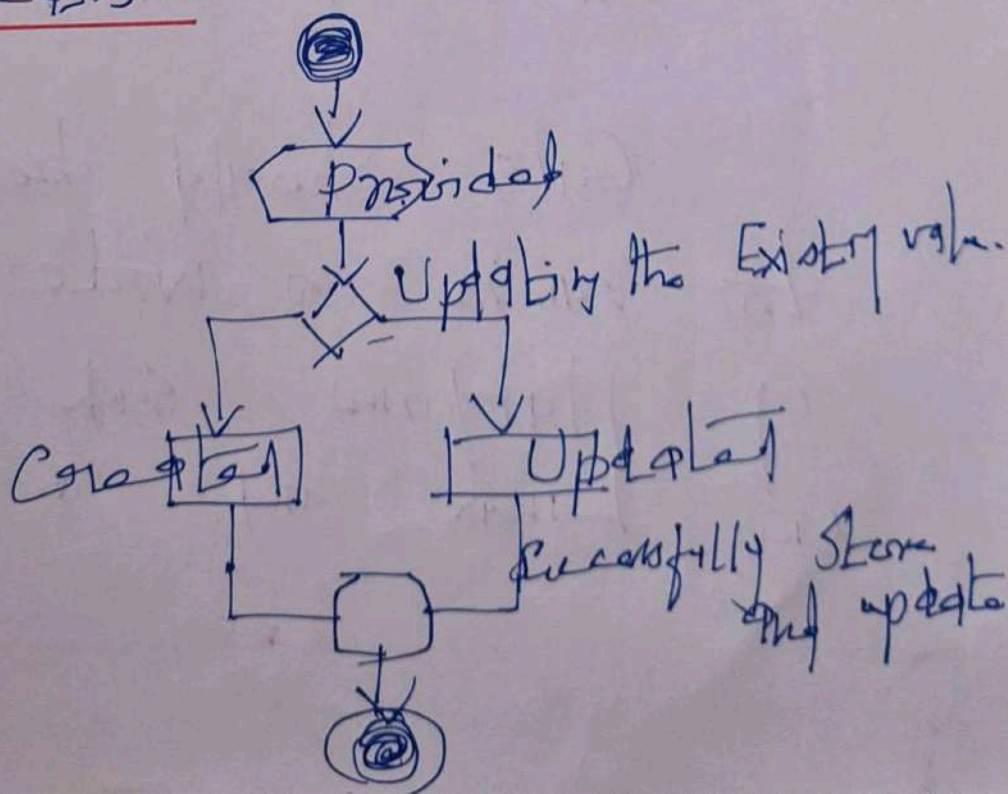
References

Class diagram for Gop

Sequence diagram for "Setting Standard Emission Value"

State machine diagrams for "Emission Standard Value"

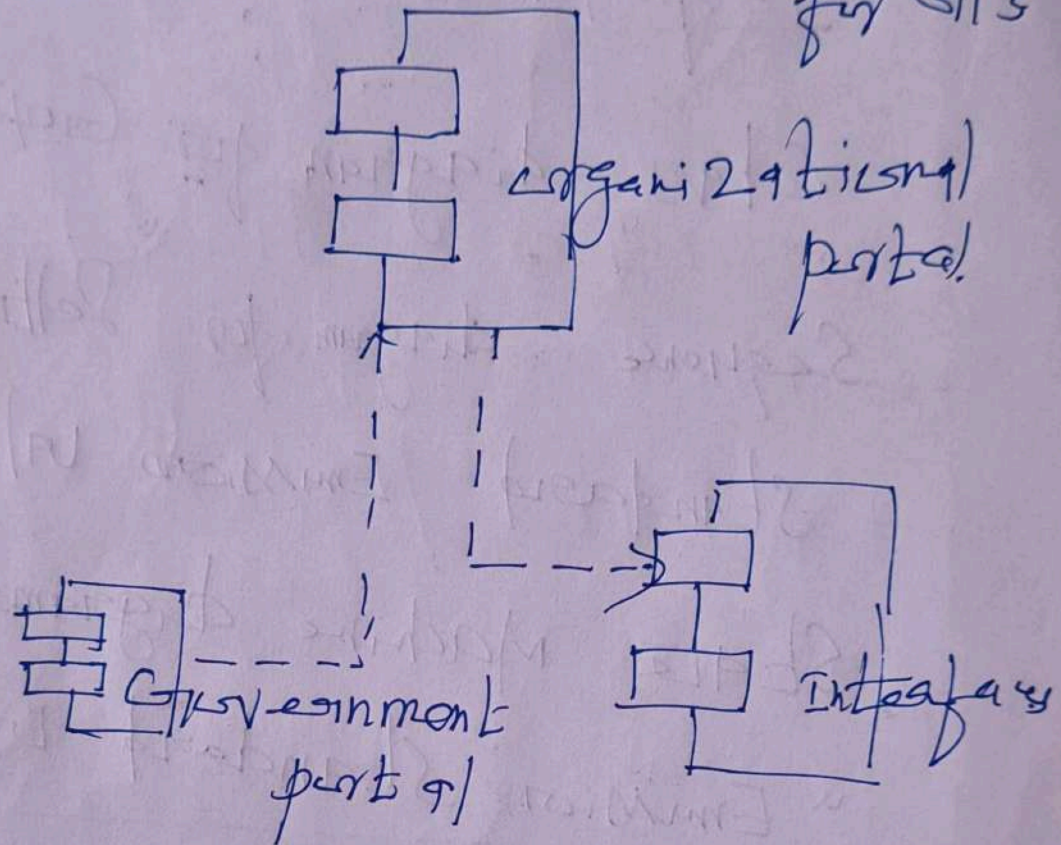
obj eds.



Implementation Diagrams

for GIS

Component diagram
for GIS



GIS - Technical Requirements

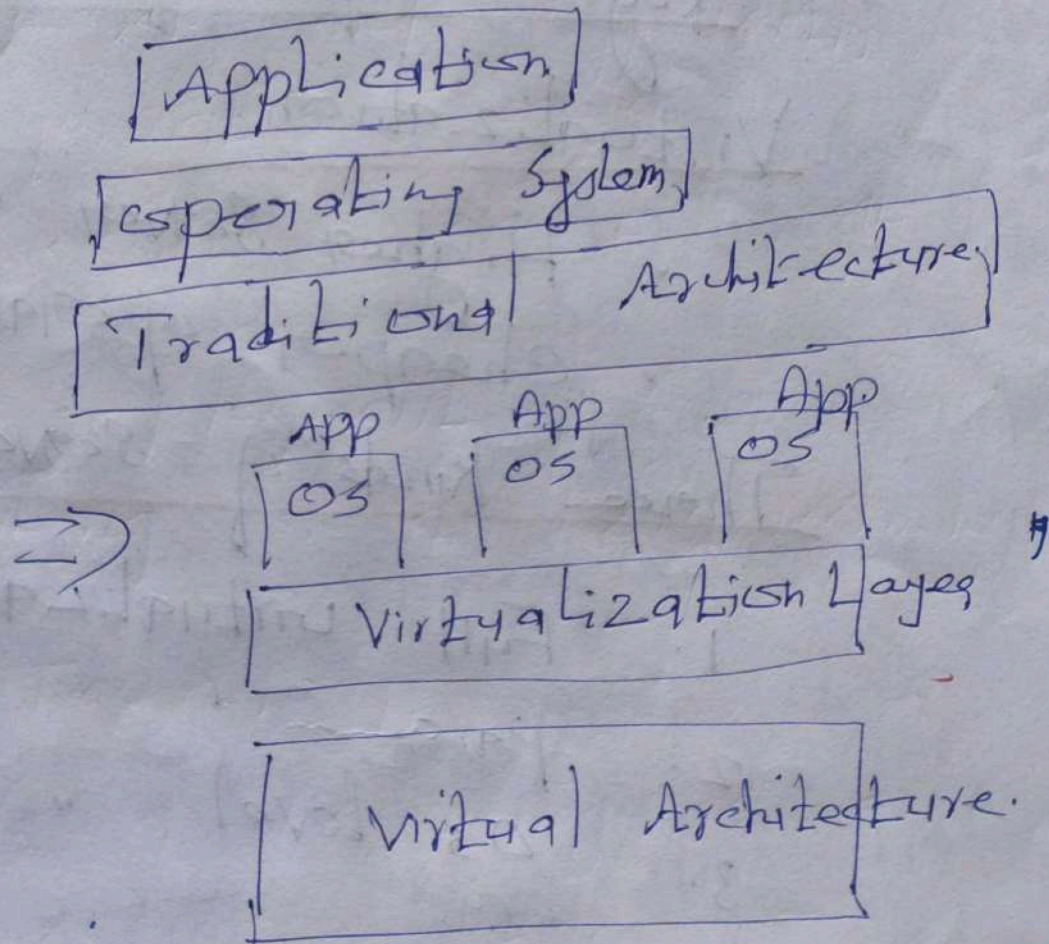
GIS should be able to run in a wide variety of platforms such as Windows, Unix, Linux and so on.

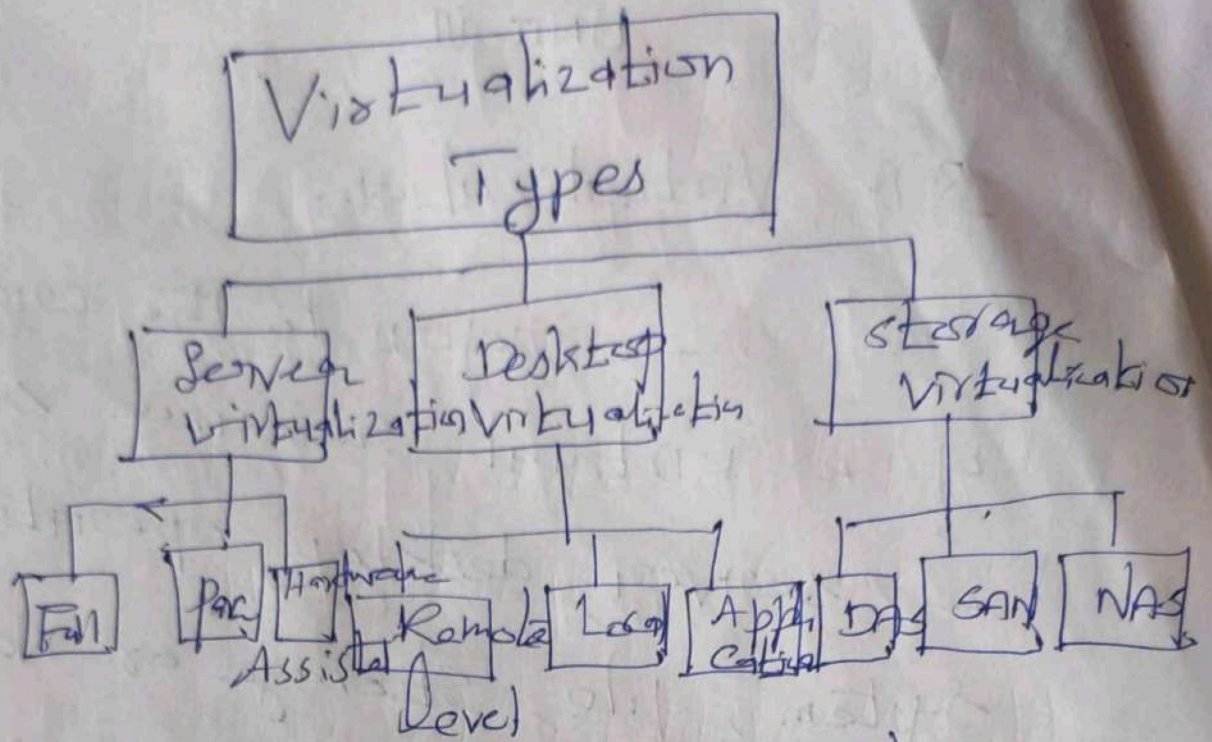
UNIT III

3.1. Virtualization.

— refers to the creation of a virtual resource such as a server, desktop, operating system, file, storage or network.

Traditional and Virtual Architecture.





1. Server Virtualization.

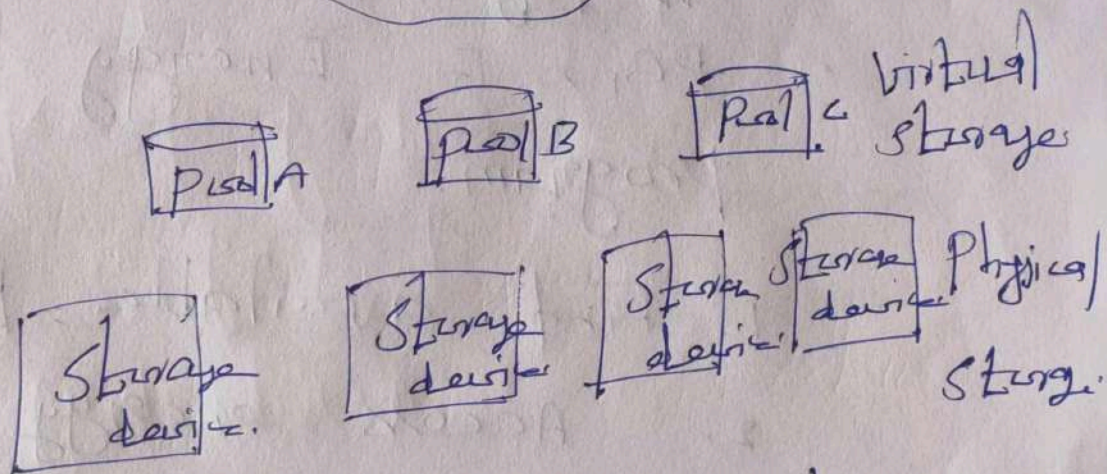
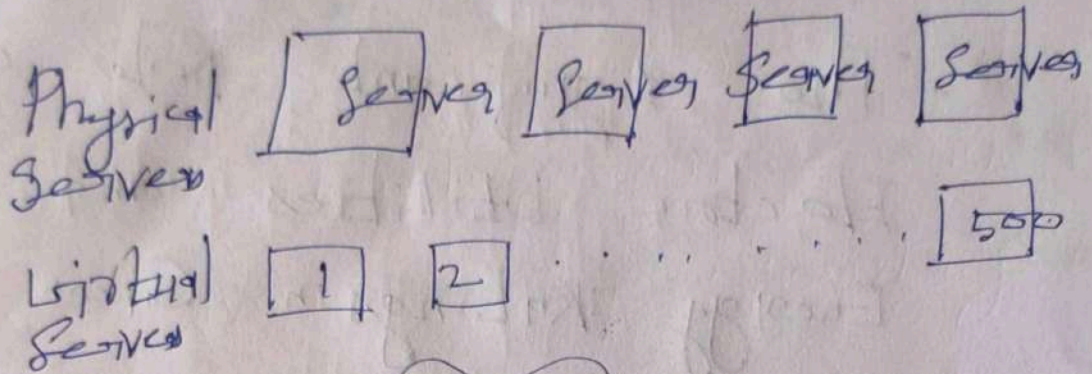
Key Benefits of Server Virtualization.

- Highest server ability
- cheaper operating costs.

Three kinds of server virtualization.

1. Full virtualization
2. para
3. OS level

2. Storage virtualization.



3. Client virtualization.

1. Shared services

2. Virtual clients

3. Workstation blades

3.2 The Role of Electric Utilities.

- The significant Role of Electric Utilities and IT Energy Ratings in Green IT.
- PG & E Led Utility Energy - Efficiency Coalition.
- PG & E Energy - Efficiency program.

1. Find available programs.
2. Assess energy usage.

3. Take Advantage of project design and energy efficiency

4. teams. Calculate energy savings.
5. Submit incentive.

3.3. Telecommuting, Teleconferencing and Teleporting.

• Working at home, or
Working remotely for a company
also called telecommuting.

→ Saving time.

→ Saves energy

→ Saves gas.

→ Reduces CO₂ emissions.

→ Reduces in the office

resources.

Rating yourself: could you

work at home?

Work at home e-possibilities.

Category

1. Accounting
2. Administrative
3. Financing
4. Creative

- 5. Customer service
- 6. Engineering
- 7. Health Care
- 8. Human resources
- 9. Information Technology.
- 10. Nonprofits.

Managing the challenges of
Telecommuting.

- Setting up expectations
- Staying in the loop
- Demonstrating your value.
- Establishing Expectations.
- Managing time effectively.
- Distractions and boundaries.
- Challenges.
- Arrange for data exchange.

Sorting out software
licenses.

Meetings here, there and
everywhere.

Resolving difficulties.

- ✓ people
- ✓ projects
- ✓ process.

• Clear communication.

• Compassionate "

• And communication.

Telecomm Central : The Greenham
Office.

- Reduce
- Reuse
- Recycle.

Figuring out what you need to work efficiently

- ✓ Email and Web research.
- ✓ Writing and editing documents.
- ✓ Managing Accounts.
- ✓ Room for research
- ✓ Room for conversation

Choosing your office location.

Your computer and peripherals need access to power, a router

and each other.

Talking Green Furnishings

- ✓ A small printer.
- ✓ Lighting
- ✓ Window treatments.

Collaborating and Cloud Computing
Meeting the Ramda and Globally
Green-Team.

- ✓ know your common goal
- ✓ coordinate your process.
- ✓ keep communication clear

Exploring communication options

Adding your work email address
to a web-based account.

just in time messaging.

- ✓ Windows Live Messenger
- ✓ Yahoo! Messenger
- ✓ Skype.

Sticking your head in
the clouds: A smart way
to work.

- Google Apps.

- Zoho

Hardware to work with clouds.

A to Zonbu.

Zonbu Computer is ^a tiny system
with a small footprint

- ✓ Browser, email, IM and Skype
- ✓ Word processing
- ✓ Photo editing
- ✓ Web publishing.
- ✓ Games
- ✓ Music and movies.

The Modern X Pack.

Making the connection: Virtual

presence.

Instant messaging, instantly.

Web meeting.

Web meeting give you a great way to save lots of things.

Reduce your Carbon Emissions

with Free Phone service.

Presenting via Webinars

Webinar is one of those

post modern words that mixes

Web with seminar.

✓ Make presentations in a media-rich format.

✓ Record the presentation as a podcast.

moderate discussion.

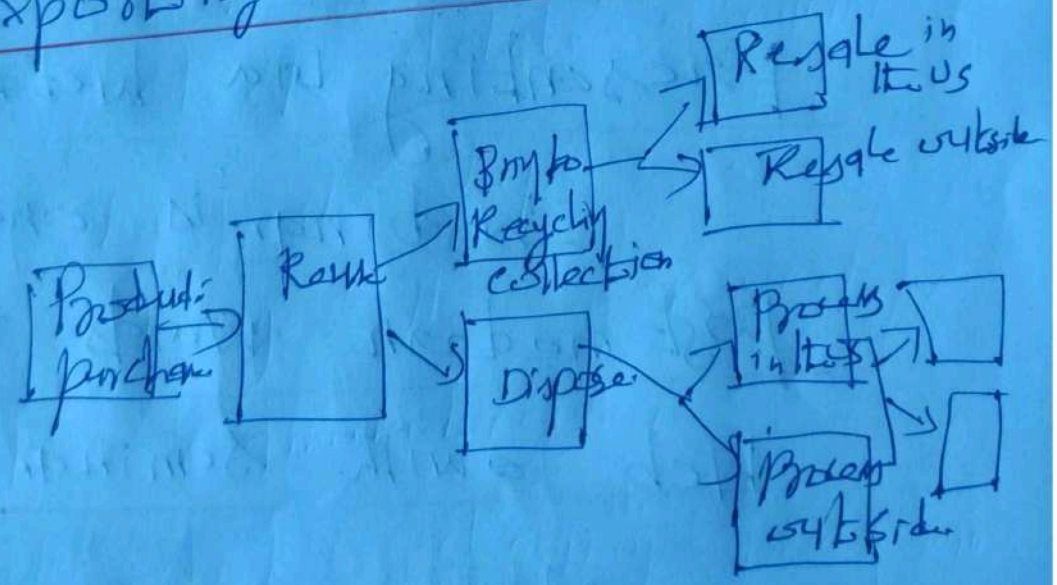
Lead training sessions

3.4. Recycling Your Computer

What is computer waste?

- > Lead
- > Mercury
- > copper
- > chemicals
- > plastics.

Exporting the e-Waste Problem.



Phase 1. Phase 2 Phase 3 Phase 4

Reasons to Recycle Computers.

reduce, reuse, recycle Mantra,
recycle.

Planning your Computer's Retirement.

- know what you're giving.
- know where you'd like to give it.
- Include the peripherals.
- Include the software.
- know how to clean off your personal information.

Wiping your System clean.

Uninstall as needed.

- Choose Start ⇒ Run.
- Type reg / Edit in the open field and click ok.

Back it up.

Delete the rest
clear your browser files.

1. Choose tools \Rightarrow Internet options.
2. Click delete
3. Select all check boxes and then click delete.

Remove all user accounts.

1. Click Manage another Accounts
2. click delete ^{the} account
3. click delete [^] files.
4. click delete account.
5. Repeat steps 2-4
6. change the password for the Administrator

Use a disk - cleaning program to remove everything else.

15
Use for an old computer

Doing the pre-donation paperwork.

Finding a refurbisher.

Donating to a worthy cause.

- not-for-profit organizations

- Schools.

- Religious organizations.

Finding a Reputable Recycler.

- Do your research

- Ask questions.

- Know the recycling laws in your area.

Giving Back to the source.

Recycling Computer, Supplies.
Two

Taking Local Action to Clean up
Global computer waste.

1) Spread the word.

2) Download the e-waste
briefing book.

3) Find out about the
recycling laws that are
in effect in your state.

4) Tell the story your way

3-5 Ten Best ways to

Make your computer Greener.

1. Turn ^{off} ₁

17
2. Manage the power.

3. Let your computer Get its

Beauty Sleep.

4. Use a smart strip.

5. Keep an Eye on your power

Use (i) A smart power meter

(ii) A plugg.

6. The Energy Star.

7. Boost your RAM.

8. Increase Air flow, Reduce Heat.

✓ Allow several inches of
ventilation

✓ Clean the back of the fan

✓ Make sure cables are

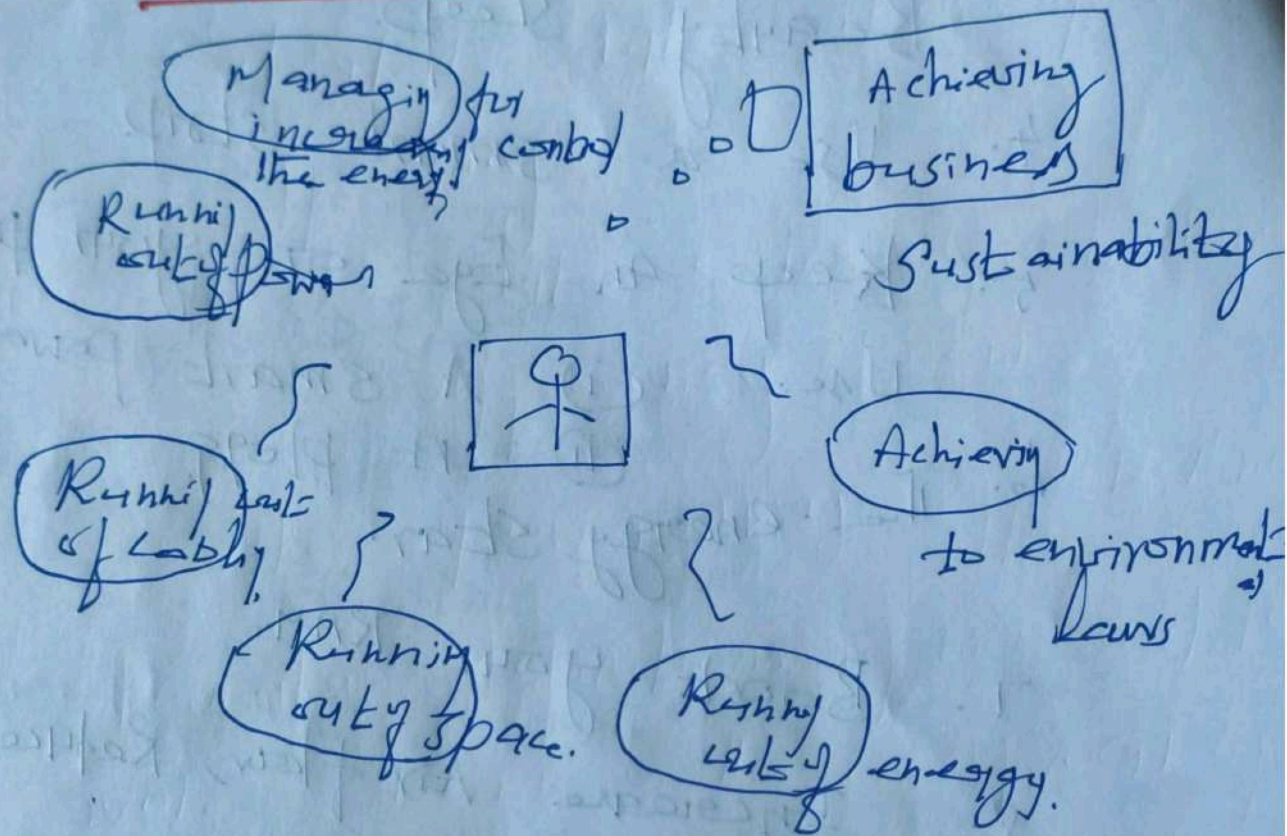
organized

✓ And while you're in there

blow any accumulated dust
bunnies out of the inside of
the computer.

9. Share your resources.

3.6.1. Green Data center

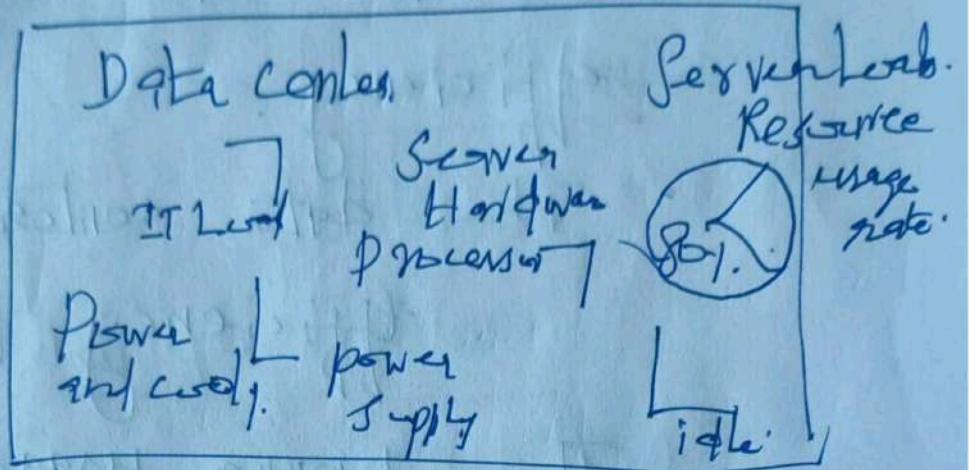


Managing the increasing cost
of the energy.

- Running out of power capacity.
- Running out of cooling capacity.
- Running out of space.

3.6.2. How energy is used

in a data center



3.6.3. Environmental laws

and the company image.

The benefits.

1. Financial
2. Organizational
3. Environmental.

3.6.4. Assess the greenness of

your data center.

- > facilities
- > IT equipment.

- > Utilization techniques
- > Use of best practices

Calculate data center infrastructure

efficiency.

- The data center infrastructure efficiency (DCIE)
- The power usage effectiveness.

Formula definitions of DCIE and PUE.

Note: DCIE is the reciprocal of

PUE.

$$DCIE = \left(\frac{\text{IT equipment power}}{\text{Total facility power}} \right) \times 100$$

$$PUE = \frac{\text{Total facility power}}{\text{IT equipment power}}$$

$$DCIE = \frac{1}{PUE}$$

Important Questions to Consider.

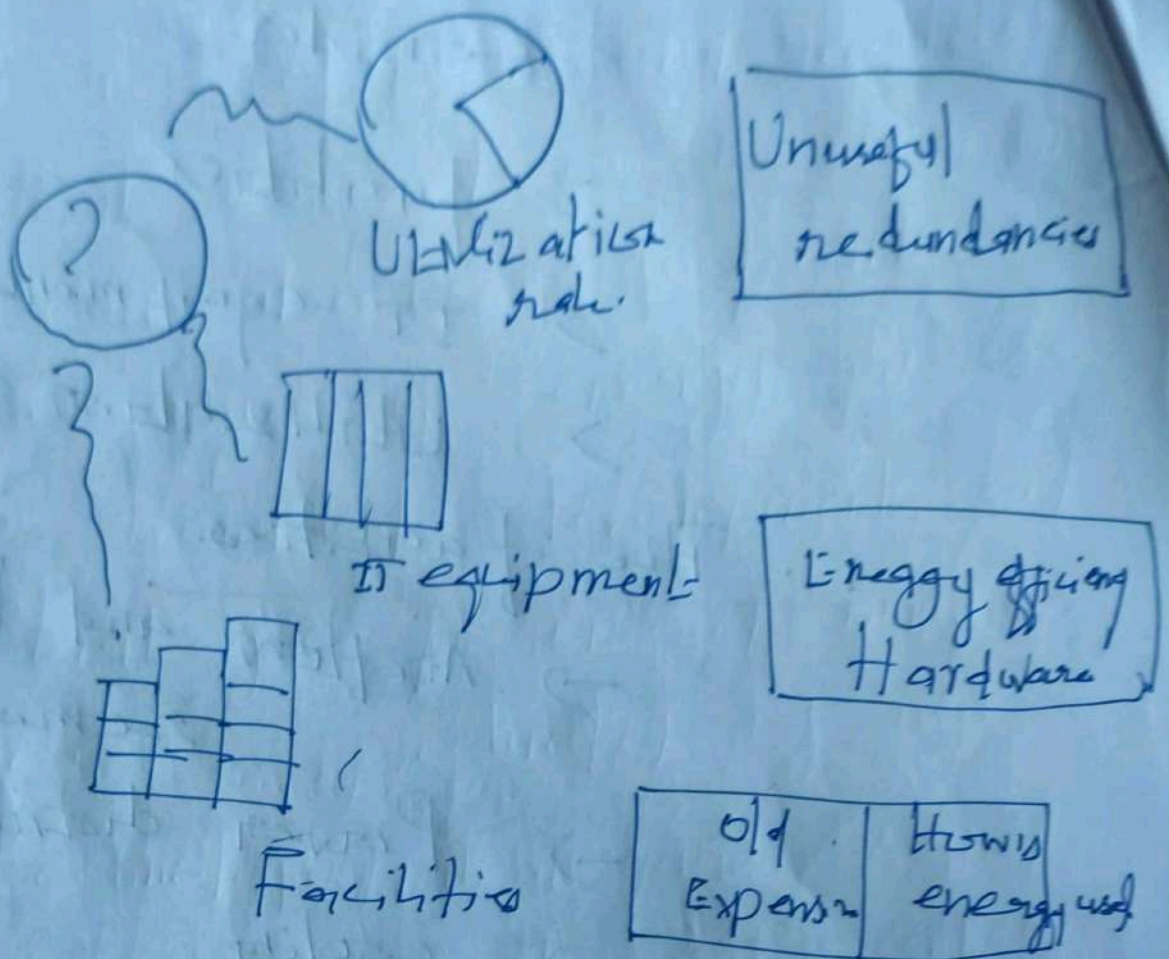
- > facilities
- > IT equipment
- > Utilization rate.

1. The facilities.

- Airflow and heat removal.
- Power distribution.
- cooling
- Lighting.
- Monitoring and management.

2. The IT equipment.

3. The Utilization rate.



Strategy Recommendation

A summary of best green practices.

1. Research private and public energy-efficiency initiatives.

2. Have executive management approval have a dedicated

23
Team, and involve everybody.

3. Make plans that consider IT and site / activities together.

4. Make energy costs part of every business case.

3.7. Green Grid computing.

a. Management of Resources

Effectively and Efficiently.

b. Information Service.

c. Security Against Threat.

The Employment of Grid Computing in a Rising Technology

Grid Technology:

Grid technology is very useful for large IT infrastructures.

the utilization of dangerous materials

• The Green Grid Consortium is a world wide non-profit organization that the enhancement of the energy efficiency within the information technology sector.

• It is also aiming to promote various technologies that processes can help the data centers in improving the performance against different metrics.

4.1. Sociocultural Aspects of
Green IT.

Introduction:

The society, governments, industry sector, and the organizations are involved in and affected by the changes resulting from GreenIT different levels and at varying speeds.

- Green IT's Social impact

- Learning Organization

- Green social stakeholders

Various level of Cross sections

of society

1. Children

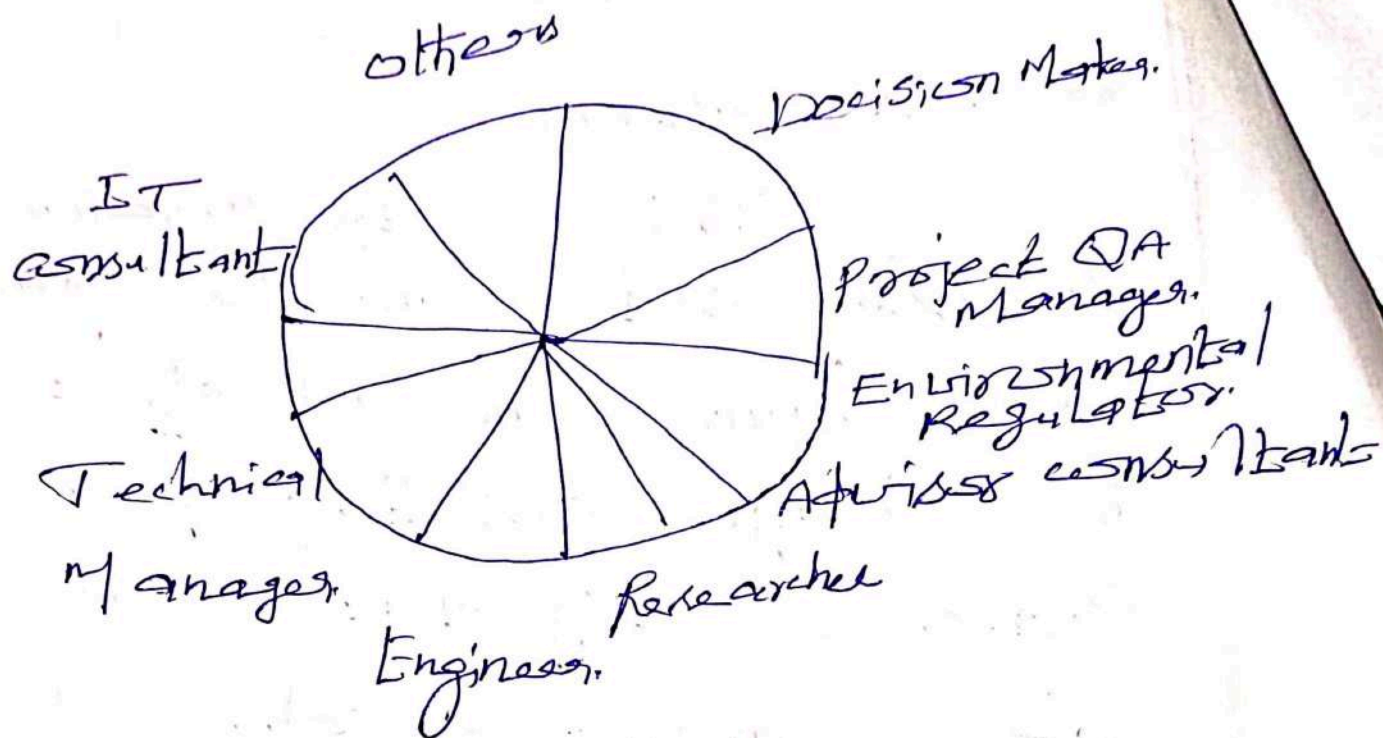
2. Adolescents.

3. Adults

4. Elders

5. People with special needs.

Role-Based view of Green

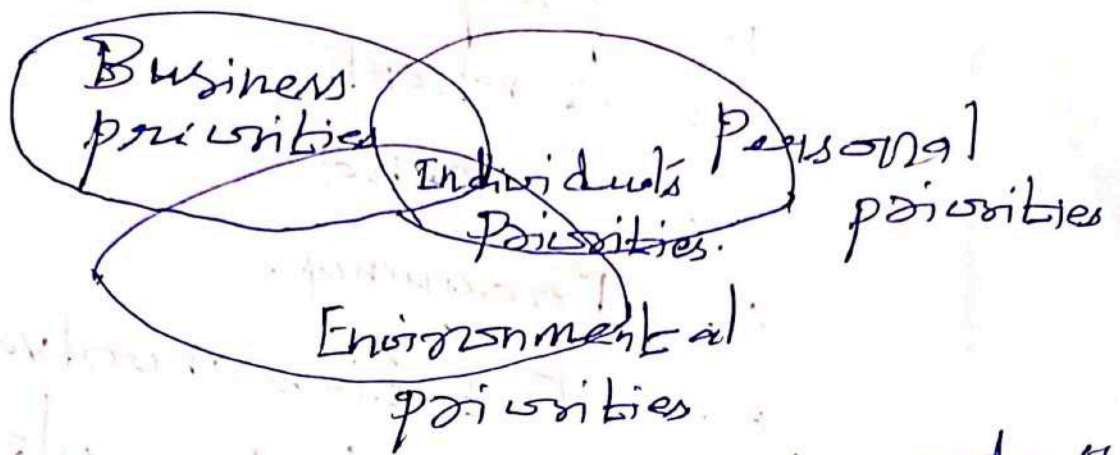


Green Uses Practices.

The Major areas of changes in working lifestyles that are involved in a green enterprise Transformation.

Attitude of subjectivity in

Green IT.



Green IT Ethics and code of conduct.

privacy and security of Green Information.

Green washing.

Communications in Green Transformations
Aspects and projects.

- within the organization.
- Outside of the organization.

communication format and

Green IT implications.

1. purpose
2. Content
3. Channel
4. Frequency.
5. Entities involved levels.
6. Feedback interactivity.

Green IT Project - Channels of

Communication.

- > personal
- > collaborative.
- > Mobile
- > Asynchronous
- > Physical.
- > Group. - that makes use
of electronic as well as
Physical communication facilities.

Green HR and changing Organizational structures.

The environmental offices have a very practical, operational focus.

4. Green - collar Workforce: Roles and skill sets.

potential mapping of Green skills to skills framework for Information.

- 1. Fellow
- 2. Assist
- 3. Apply
- 4. Enable
- 5. Ensure Advise.
- 6. Initiate, Influence
- 7. Strategize, Inspire.

SFLA Skill sets and Green

Roles.

> operational | tactical

implementation of Green IT

> 1-3 year Green IT strategies

> 3-5 year Green IT strategies

Green Virtual Communities.

— can be social groups
that transcend the organizational
boundaries to discuss and form
opinions on green issues

Green Enterprise Transformation

Roadmap.

4.2: Green Enterprise Transformation Roadmap.



Influence of Economic Dimension on GET

Influence of Technical Dimension on GET

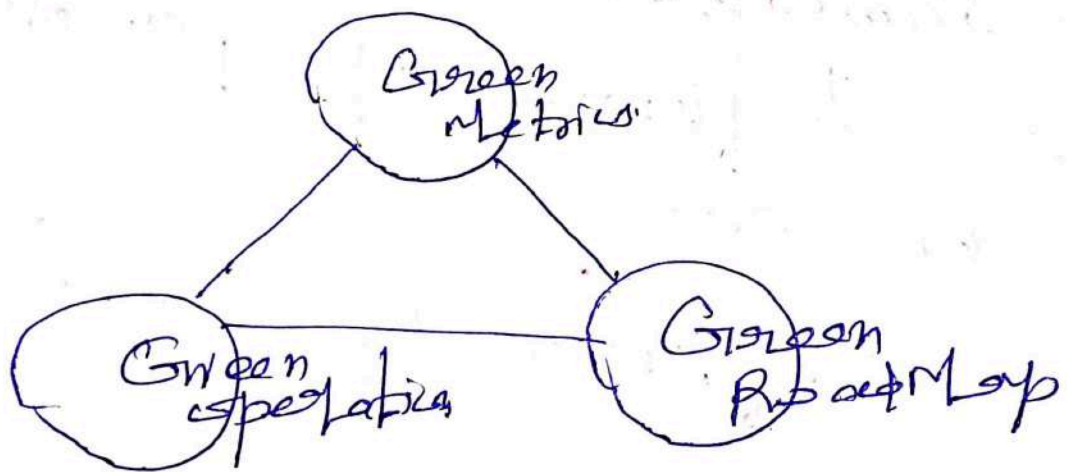
Influence of Political Dimension on GET

Influence of Social Dimension on GET

Influence of the individual Organizational and Collaborative processes.

Business Transformation
considerations of the firm
Dimensions of individual,
Organizational and, collaborative
levels.

- (i) Economic
- (ii) Technology
- (iii) process
- (iv) sociology.



A Green ICI Framework.

1. Attitude, policy, practice,
Technology Metrics.

- Equipment Life cycle.
- Procurement.
- Recycle and Reuse.
- Disposal of ICT systems.
- End user computing.

- (i) Desktop computing
- (ii) Mobile computing.
- (iii) Departmental computing.
- (iv) printing and consumables

Enterprise and Data Center

- > Data center ICT equipment
- > Data center Environments
- > Networking and Communications
- > Outsourcing and Cloud Computing.
- > Software Architecture

IT for Enterprise.

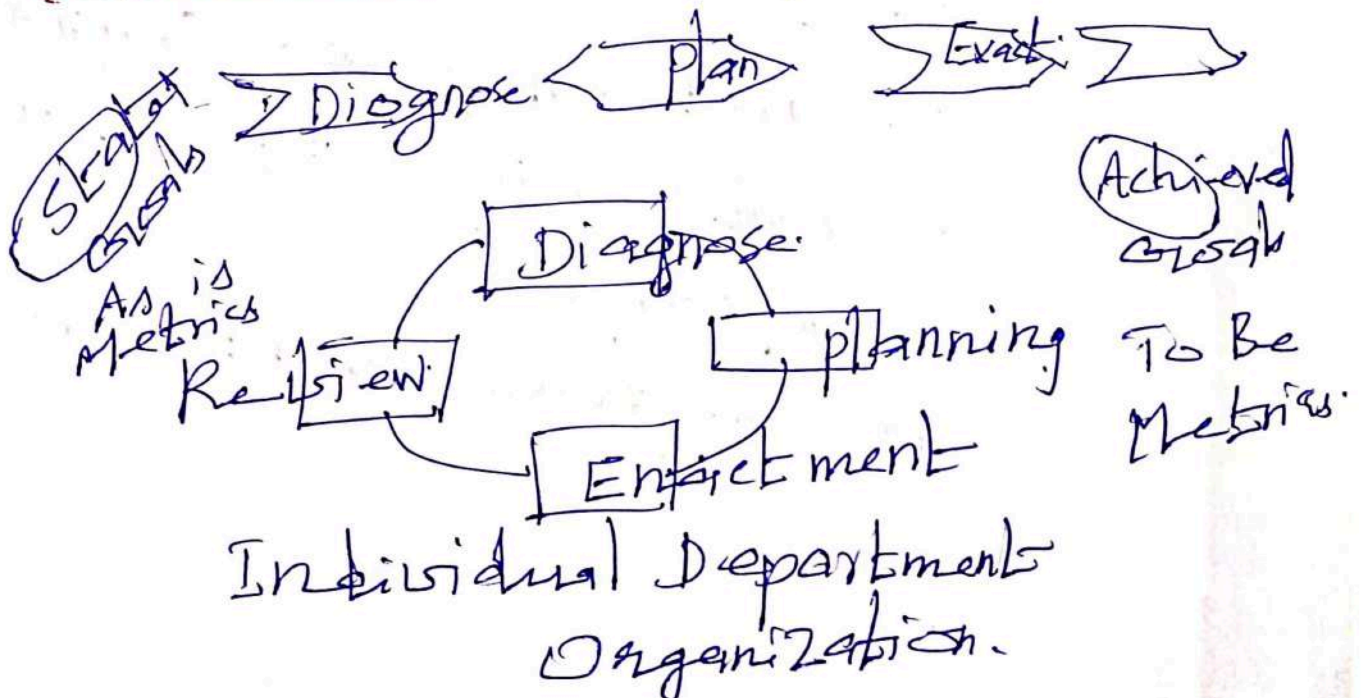
1. Governance and Compliance
2. Teleworking and collaboration
3. Business process Management
4. Business Applications.
5. Carbon Emissions Management

Attitude

- policy
- practice
- Technology

Metrics.

The Green Transformation process



Organizational focus areas for

GET:

- > Business Model.
- > products and service portfolio.
- > customers and partners.
- > ICT systems, Applications and databases.
- > operational, organizational
- > Business processes.
- > Regulatory.

Configuring a GET Road Map.

- Type and size of organization
- Nomination of roles and responsibilities.
- Diagnose
- plan
- Review
- Measure.

GIET program: Roles deliverables.

- Setting up a Business Transformation office. [BTO]
- Forming Transformation Work areas.

Green IT project Roles.

- Business Partners
- Business Architect
- Technical Architect
- Green IT champion
- End User Representative
- IT Managers
- IT Governance
- Business Managers
- Data center Director
- Green IT Auditor
- Corporate Governance

GIEE: Diagnosis phase.

• Diagnosis

• challenges

GIEE: Planning and Scoping phase.

Enterprise Lifecycle Plan.

→ Green IT Champion.

→ Business Management

→ IT Governance.

→ Corporate Governance

Inputs

Output

Challenges

GIEE: Enactments phase.

— Enactments is the execution of the business transformation plan created in the previous phases. Enactments requires full gamment of Projects Management skills.

Technology - Driven Enactment

> Customer Relationships

Management

> Supply change Management

> Human Resource and payroll systems.

Business partners systems

• Data Migration

• Integration

Business process: Driven enactment

GRET: Review and Measure Plan

4.3. Green Compliance: Protocol

SL standards and Audit

Introduction:

1. protocols.
2. SL standards.
3. Legislations.
4. Initiatives.

Protocols and standards.

United Nations framework
convention on climate change.

Kyoto protocol

Greenhouse Gas protocol.

Copenhagen.

The ISO 14000:2004 Family
of standards.

Government Initiatives

policy

planning.

Implementation and operation.

Checking and corrective action.

Management review

EPEAT - Electronic product

Environmental Assessment Tool.

EU RoHS - Restriction of

Hazardous Substances Regulation

EU WEEE - Waste Electrical

and Electronic Equipment Regulation
Industry and Vendor Initiatives

Green Grid - 2007.

CSCE - Climate Savers Computing

Initiative.

IT Vendor Initiative

Global Reporting Initiative

Green IT Audit.

- Green Audit investigate the

five areas of green metrics

• Measure

• Monitor

• Manage

• Mitigate

• Monetize.

Audit types.

- > Data collection mechanisms and corresponding gadgets/meters.
- > Data Analysis undertaken by software system
- > Carbon trends
- > Carbon compliance

The primary stakeholders

- > Individual users
- > Departmental heads
- > CEO / Chief green officer (CGO)
- > Regulators

Green IT Audit - Approach, Maturity, and comparison.

Undertaking Green IT Audit.

1. Walk throughs.
2. Inspections
3. Reviews.
4. Audit.

Audit and Use of Carbon Emissions Management Software

Comparative Audit:

4.4 Emergent Carbon Issues - Technologies and Future

Green ICT and Technology Trends..

cloud computing software as a service.

Eco design and Biomimicry

Quantum Computing Trends
Nanotechnologies.

ISO and Governance Standards

Social Networking.

Renewable Energy source

Security and Legal

frameworks.

Carbon
Footprint

cloud computing

in the future context of IT

- Infrastructure
- Applications development execution
- Application
- Reusable Data Service

SaaS

Software as a service - provides an ideal way to deploy software

Applications

Nanotechnology

deals with computing at a microscopic level.

Quantum / Terahertz computing

— It is not only for computing itself but also for improving the carbon footprint of IT.

New Renewable Energies.

ISO - new and upgraded

Standards.

Security and Legal

Ecolog^{ic}
y

Biomimicry

Dichotomy of Developing Economic

Sustainability dimensions elements

1. Social
2. process
3. Technology
4. Economy.

Collaborative Environmental

intelligence.

1. collaborative carbon data for trend plotting
2. collaborative data warehouses
3. collaborative ES with mobil

Technologies.

4. collaborative EE and
Green Blogs.

5. Collaborative EE and web

2.0 / Web 3.0

Collaborative EE and GRID
computing.

Unit 5

5.1 Case study Scenarios for

Trial runs.

New Bank Carbon Scenarios

Notes:

New Bank plans to grow through acquisition.

Following is the result of the Initial Green IT undertaken by the Bank.

Desktop Machines

Mobile devices

printers and peripherals.

Data Center IT and Communication Equipment.

Network devices: Routers

- 10 devices - 50 routers
- 20 switches.

5.2. Case study in Applying
Green IT strategies and
Applications to a Hospital.

GoodMead Hospital.

is a hypothetical large hospital in a metropolis providing public sector medical services.

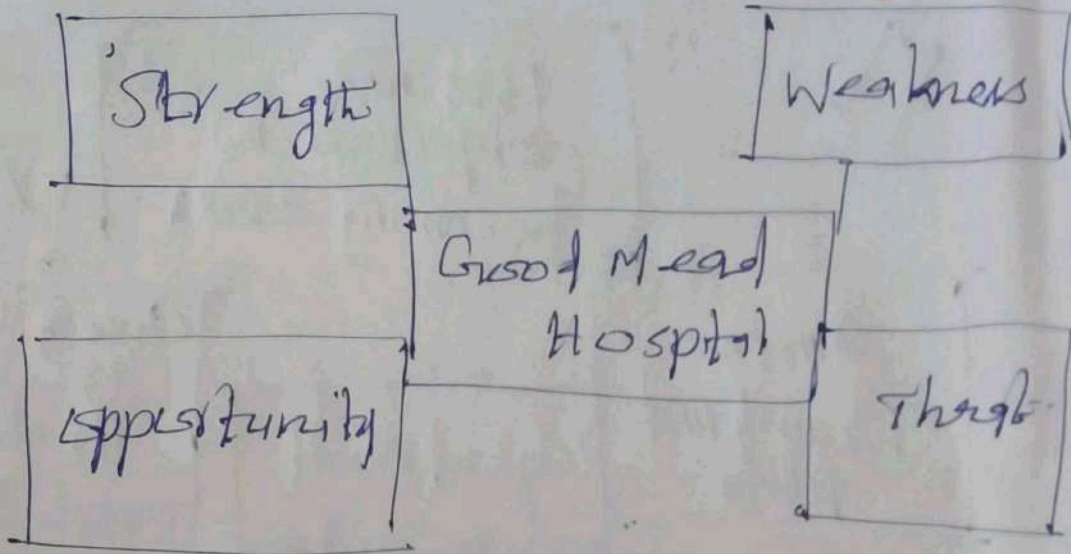
preliminary Green investigation

The hospital has significant opportunity to influence its partner organizations

Green Business objectives.

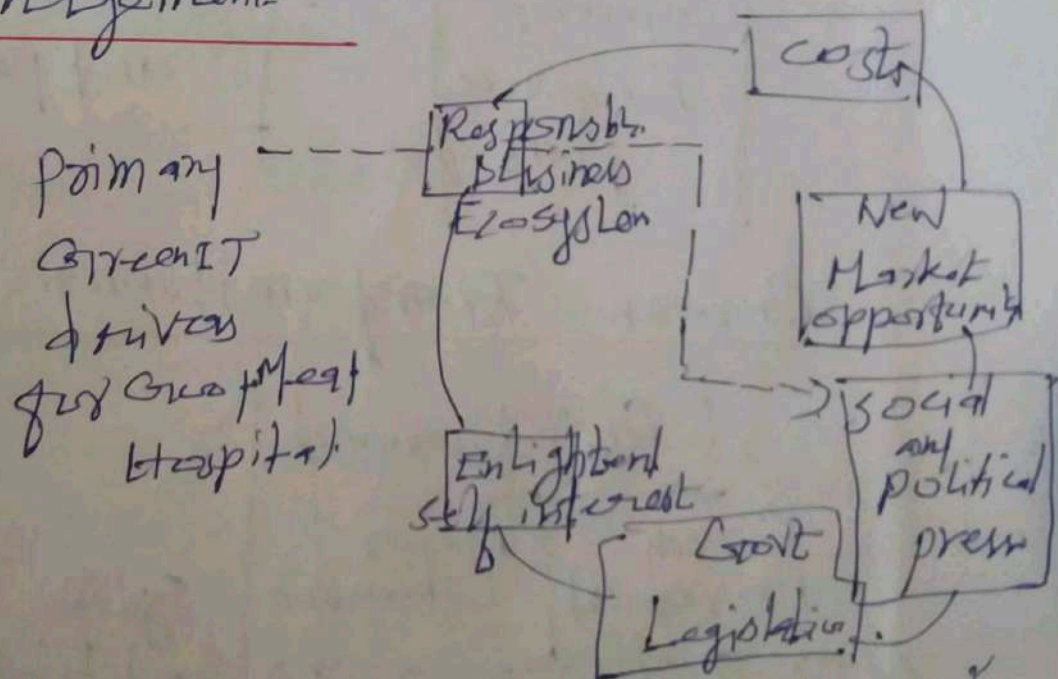
→ Reduction in carbon emissions across all departments and processes of organization.

SWOT of Good Mead Hospital.



Strategic concerns of

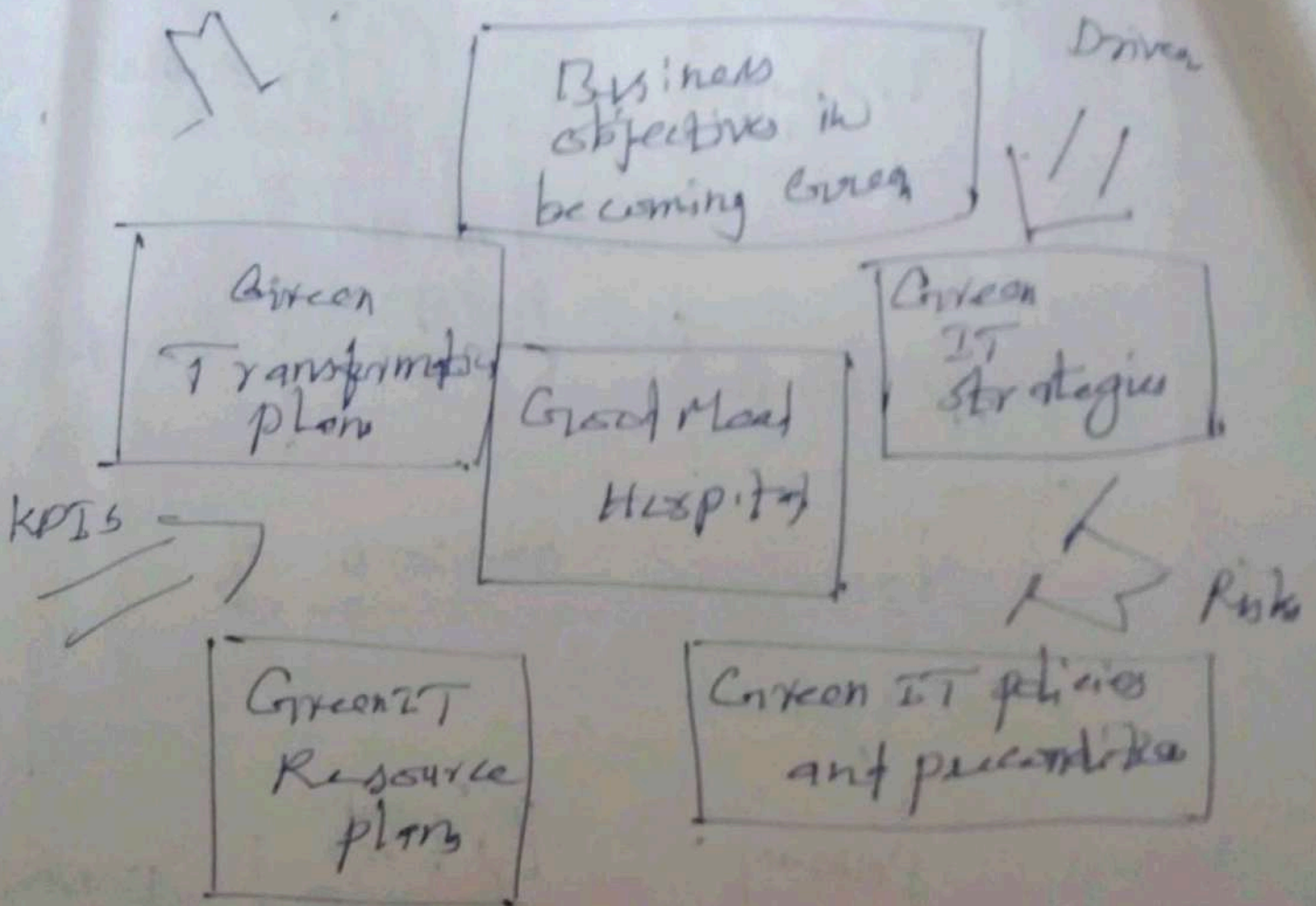
Management:



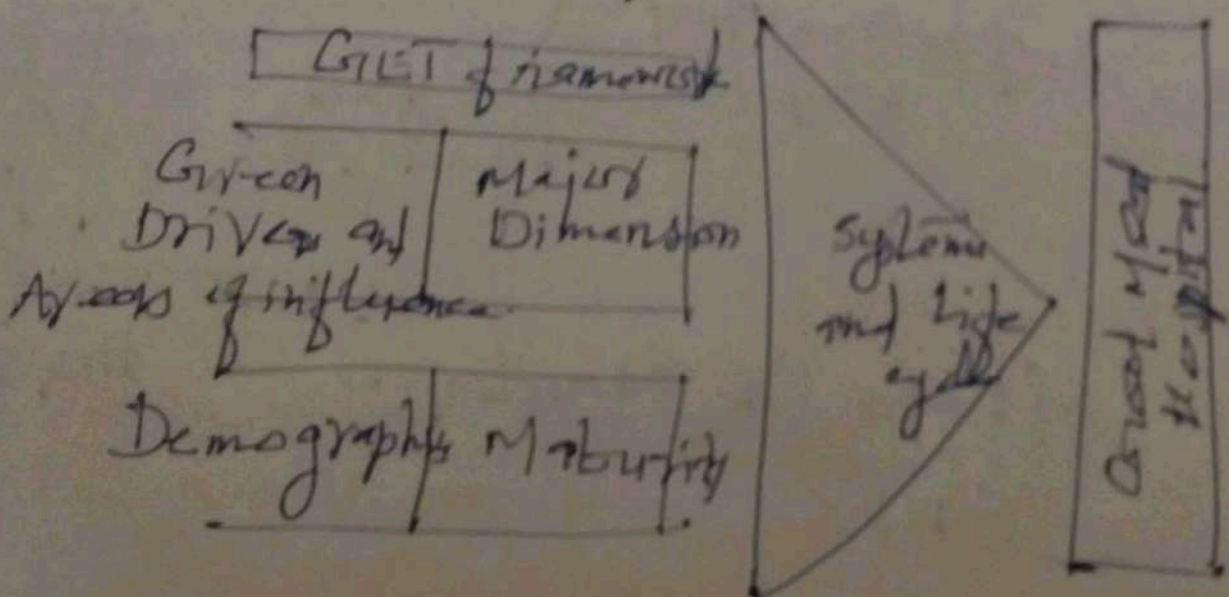
Steps in developing a hospital's

ERBS.

Dimensions



Green Transformational Elements



The Green Transformation project

- > First quarter
- > Second quarter
- > Third quarter
- > Fourth quarter
- > fifth quarter
- > sixth quarter

• Social dimension in Hospital GET

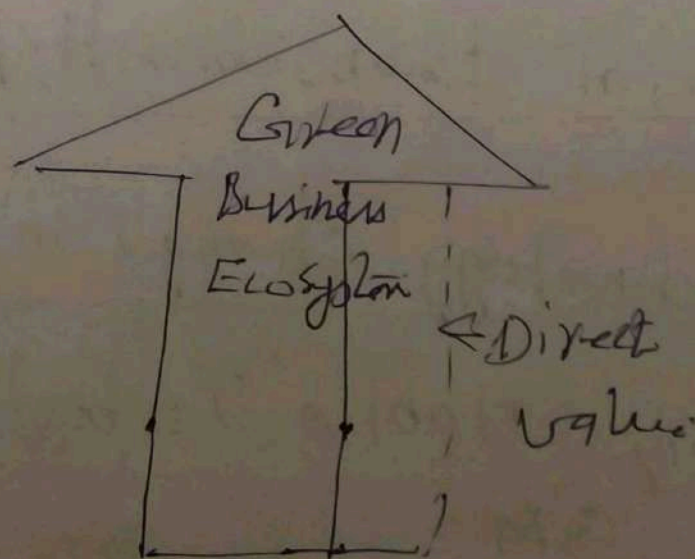
• Technology changes in Hospital

Applying Mobile Technologies
in GET

- Doctors
- Nurses
- Patients
- Suppliers

Case Study in Applying
Green IT Strategies to the
packaging Industry.

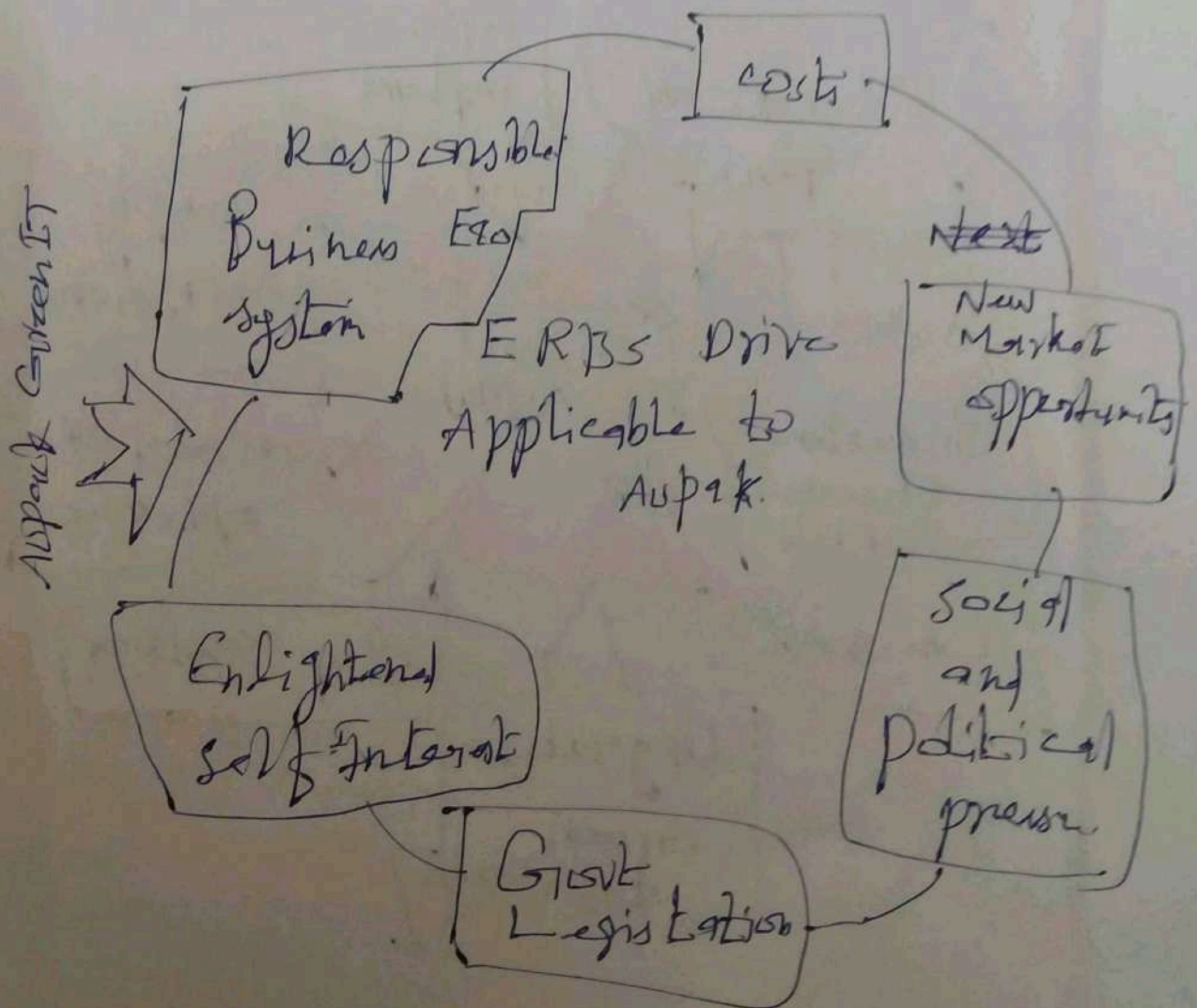
- Aupack scenario
- Aupack's Green IT strategies



SWOT of Aupack in Green context:

1. Strength
2. Weakness
3. Opportunities
4. Threats

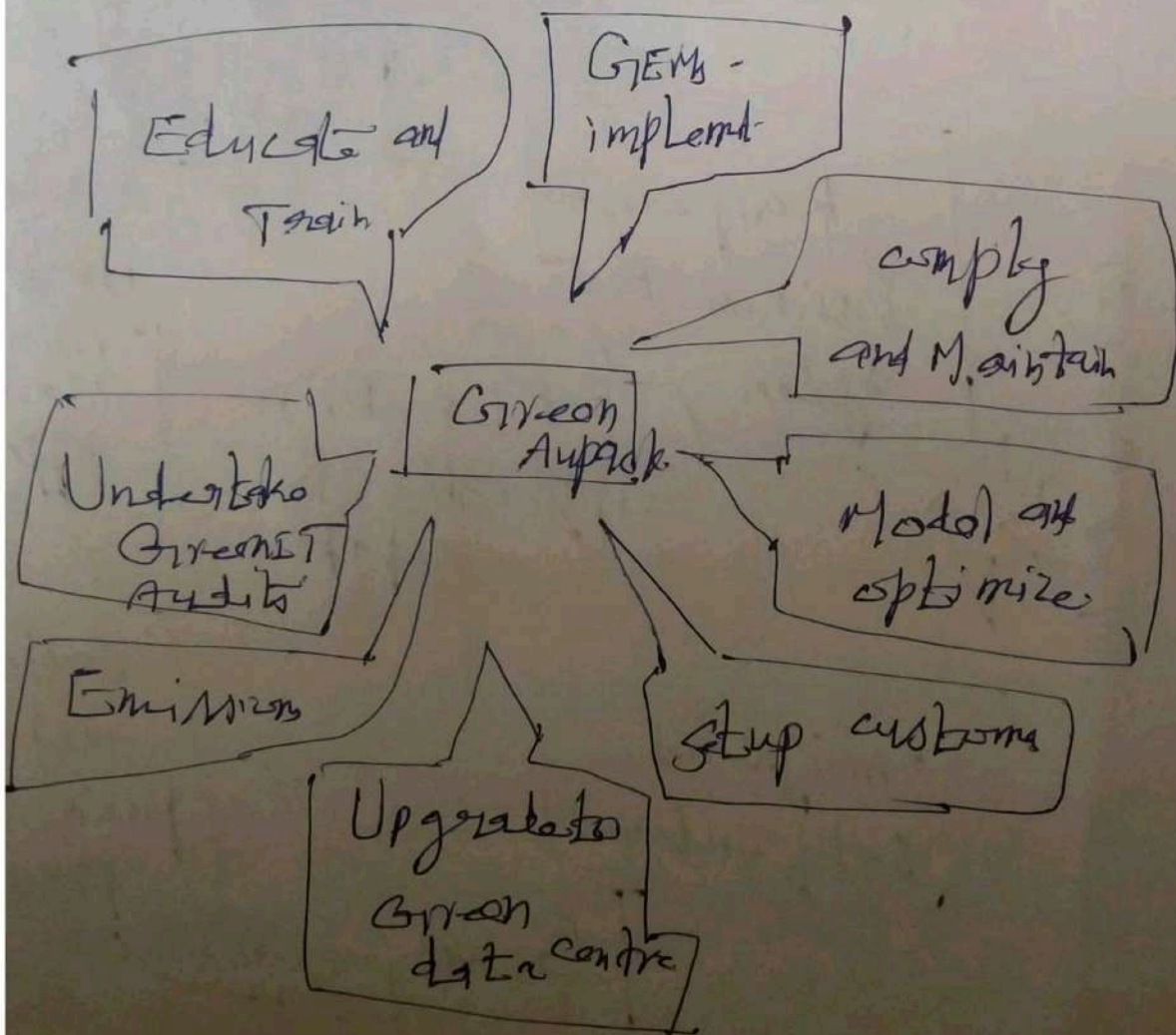
Diagnosis in Aupack.



Planning of GET

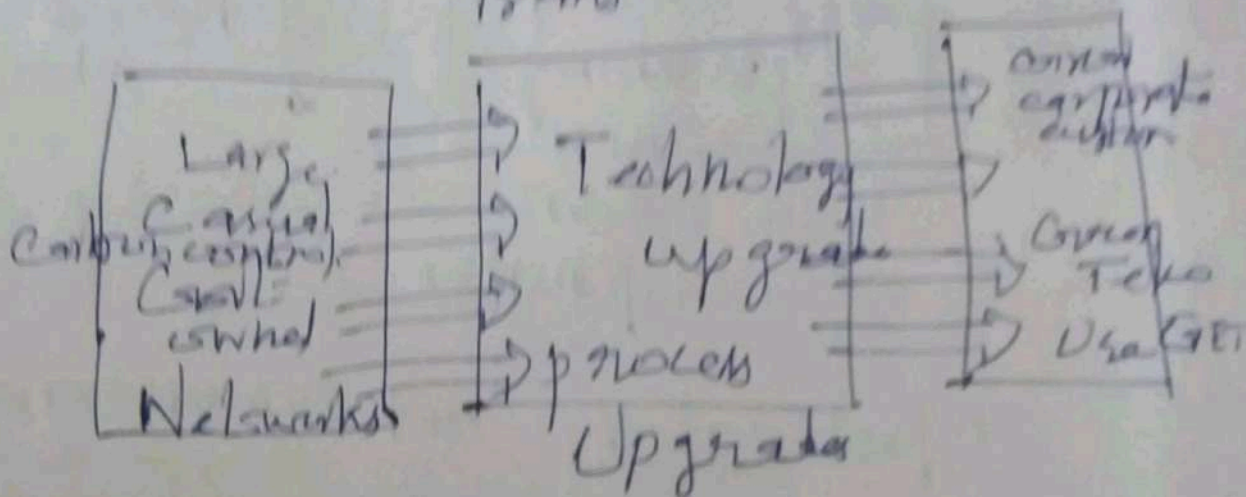
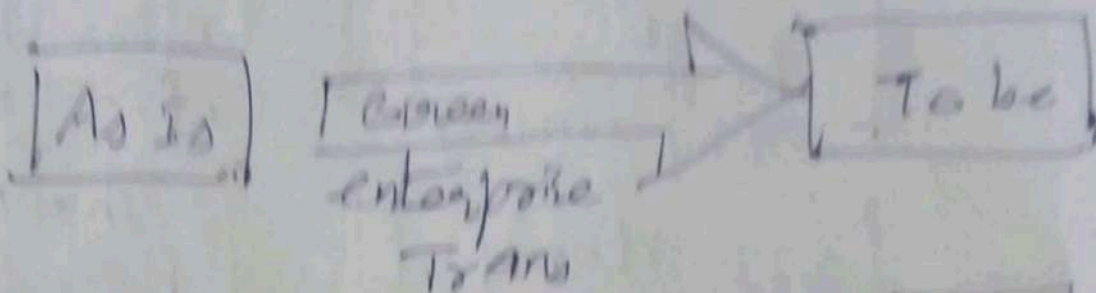
- > customers and partners
- > IT systems and applications
- > A new carbon emissions Management software.

Enactment of GET for Aupack

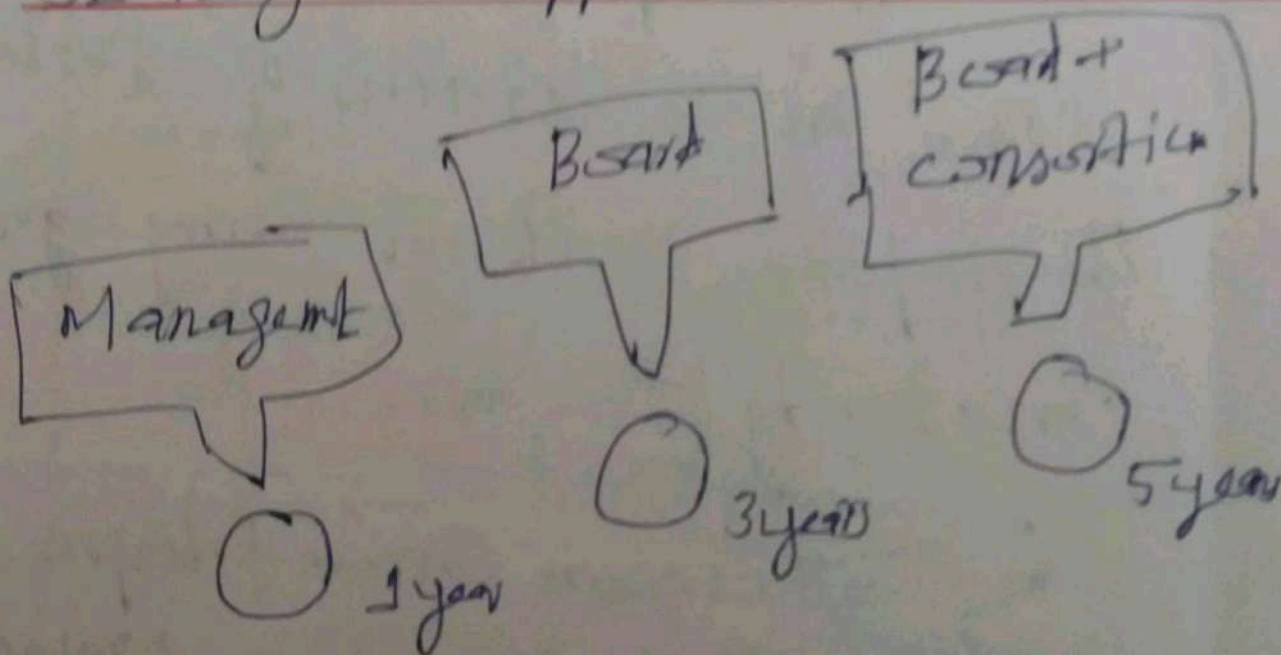


Review of GIS for Airport

54. Zeebel Telecom Solutions



Strategic Approach to Green IT



SWOT of Zotel - Environment

Context:

Strength
Regional
Infrastructure

Weakness
Inflexible
Infrastructure

Opportunity
Combining
Business
with Green
Transformation

Threats
Resistance to
change

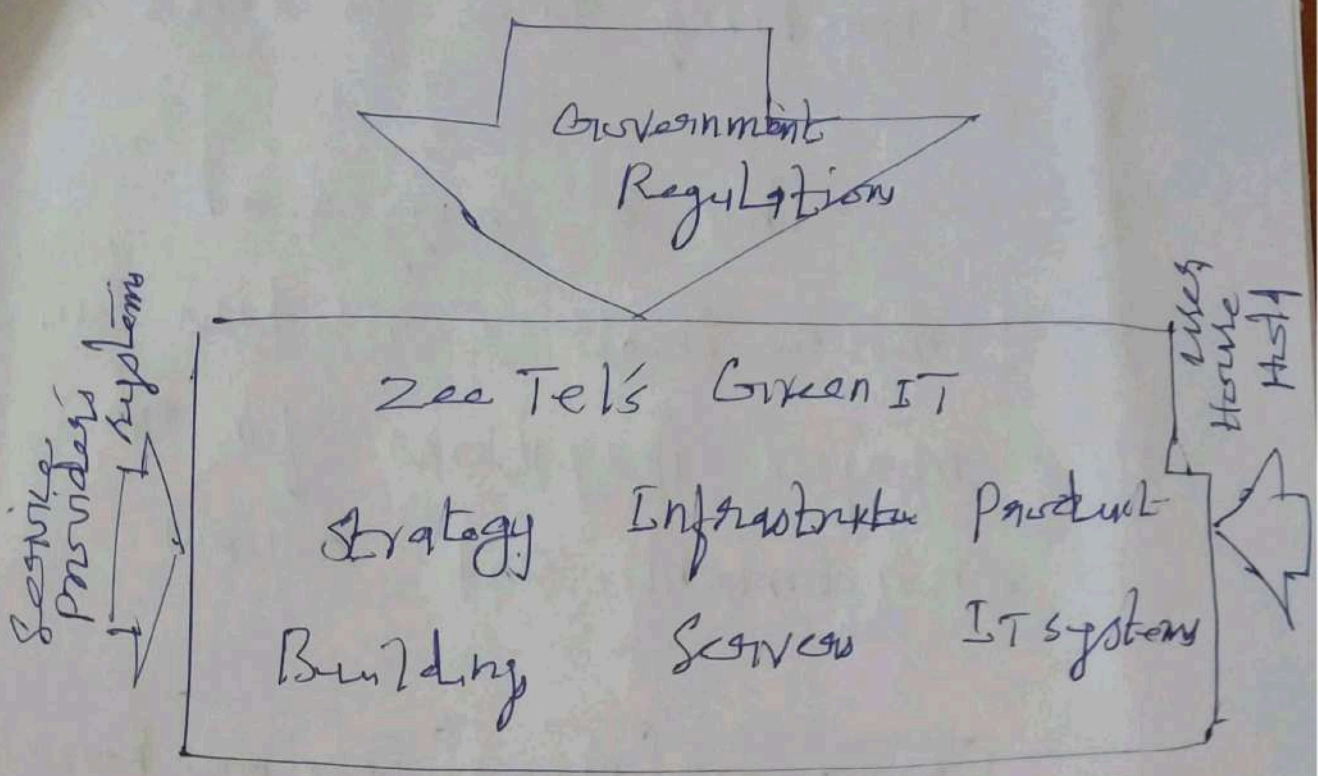
Motivators and Dimensions

Diagnosing the 'As is' state

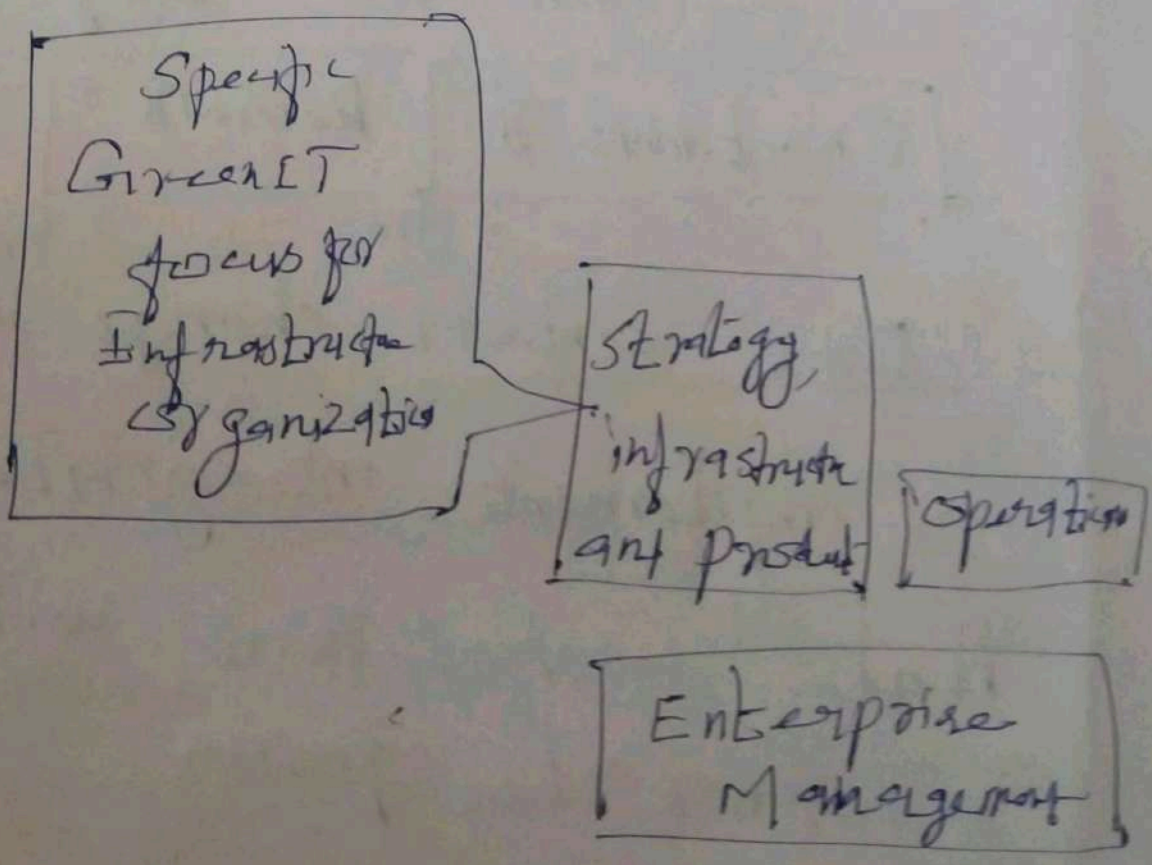
The as is status of Zotel is therefore without any green maturity.

Telecom Green Enterprise
Transformation project

Diagnose Plan Enact Review

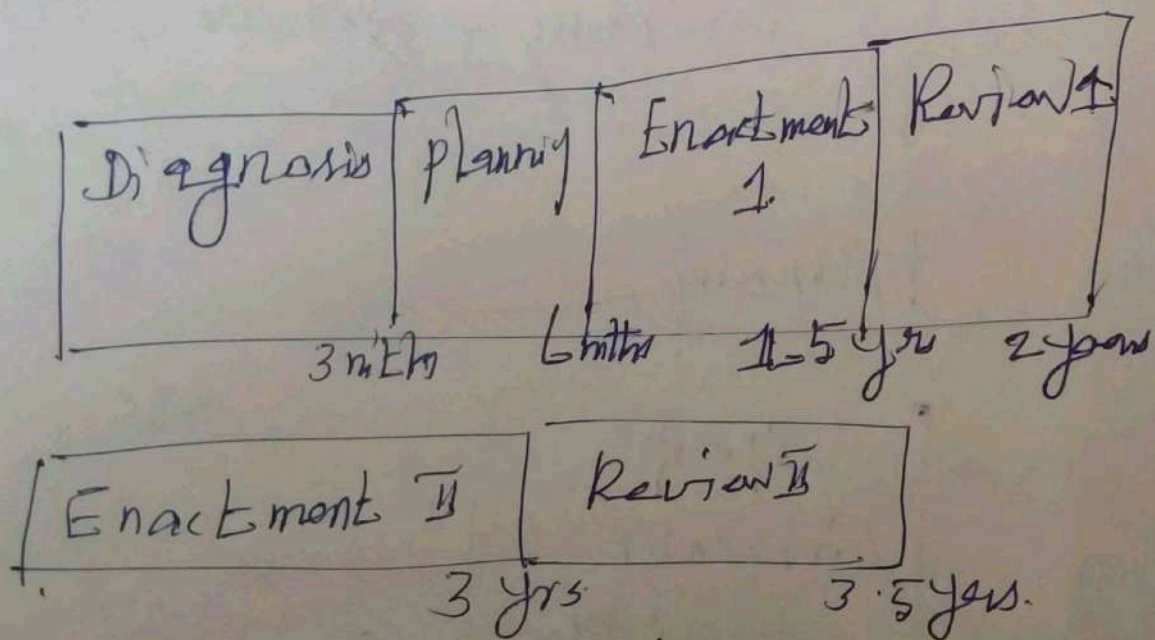


Planning



Enacting GIES for 2eabel

This is suggested timeline that considers two major iterations for ~~en~~ enactment and review.



Data center changes in GIES

> implement integrated blade servers that will consume less power.

Next Generation Networks in GFT

- Complete the implementation of NGN within 2010s entire Communications Network.

Equipments life cycle.

- The entire life cycle of equipments used within 2010s will be subject to the

Green Proc.

- Enacting changes to the procurement - operation - disposal process will be based on the following considerations.

> All procurement to be based on EPEAT / energy star based ratings especially for the servers.

> Ethical disposal of existing legacy network hardware.

Attitude and Training.

> Creation of and delivery of being 2-hour seminars on the relevance of the Green enterprise transformation program to update the large number of employees.

> CEHS training - configuration and use.

Review and Measure

- There are two specific reviews after the each iteration of enactment
- The age old of management understanding of the risks associated with Change hold the only true in this transformation.
- Quality assurance and testing activities were required to be formally carried out on the new and integrated IT systems and contents management.