Unit-5

CASE STUDIES

Telecom Sector

5.1 ENVIRONMENTALLY RESPONSIBLE BUSINESS STRATEGIES (ERBS)

ERBS is a **business** approach that incorporates environmental factors in it. The major elements of ERBS are:

the business architecture

Green policies

processes that create waste and emissions

enablement of efficient use of resources

metrics for monitoring the greening of the organization

Implementation of environmental strategies.

Environmental sustainability is induced by planning and implementing appropriate strategies and functions like green processes, product developments, energy conservations etc. It is necessary to ensure that all the business aspects such as product life cycle management, operations, Information and technology

are effective enough to preserve the environment. The overall strategies of the company to improve business efficiency must include complete environmental obligations and energy consumption guidelines. Companies must introduce innovative methods to improve Information and technology operations to enhance the performance, without increasing the energy consumption. Also, by minimizing waste, preventing pollution and eliminating health and safety risks, the company saves on operating cost.

5.1.1 Stakeholders of ERBS

The ERBS is a goal that can be achieved be involving the employees at high, mid and low levels. The management must commit itself to foster environmental sustainability. Some of the stake holders involved in implementing ERBS are:

Decision maker

Green consultant

Engineers

Quality Assurance manager

Technical manager

Researchers & developers

Environment regulators

IT consultant

5.1.2 Formulating Environment Sensitive Business and Strategic Plan

The organizations must implement green practices at every levels. It is the responsibility of the top level management

to formulate the business and strategic plans to foster green environment. Some of the important sectors to be attended are:

Understanding current business scenario

The following points are the matter of concerns regarding understanding the overall business trends:

Has a higher power consumption than other similar organizations

Assumes responsibility for its carbon footprints

Measures its carbon emissions accurately

Has a person responsible for environmental matters

Is aware of the importance of Green metrics

Uses devices and/or software to measure carbon emissions

Understanding your business policies with respect to environment:

This deals with the mapping the business objectives with the environmental goals. Some of them are:

Policies for purchase of Green equipment and related services

Policies related to safe disposal of hazardous waste, material, or equipment

Policies for adopting and implementing recycling of equipment

Policies for optimizing energy consumption in all business processes

Policies for use of renewable energy (e.g., solar, nuclear)

Policies to influence attitudes of staff toward carbon emissions

Influencing factors of the organization to adopt Green policies

The following are the factors that plays prominent role in adopting green policies:

Government rules and regulation in implementing environmental measures

Customer's demand or pressure for Green policies and Green products

Pressure from society (physical/electronic groups) to adopt Green policies

Self-initiated implementation of environmental policies

Energy consumption in your organization

Carbon footprint in your organization

Operational costs in your organization

Environmental goals of the organization to adopt Green policies

Reduction of energy consumption in your organization

Reduction of carbon footprint in your organization

Reduction of the operational costs in your organization

Improvement of the reputation of your organization

Meet government regulations and legislation

Meet the sustainability goals of your organization

Increase revenue and profitability due to Green initiatives

Some of the Green ICT practices:

Videoconferencing

Telecommuting/Teleworking

Fleet and field force management

Web and use of collaboration tools such as e-mails

Mobile phones/PDAs

5.1.3 Technical Strategy and Planning

The organizations practices regarding energy saving data centres and equipment are deals under technical strategy and planning. Some of them are:

Energy saving choice when purchasing new ICT hardware

Reducing energy used by data centres (ICT)

Uses open source system software (ICT) and applications

Machine/Server Virtualization (ICT)

Counts and monitors ICT devices for emissions

Replaces conventional devices with environment friendly devices

Reduce the use of paper and related materials (e.g., ink or toner)

Reduce use of hazardous materials that can damage the environment

Reduce number of high power consuming equipment

Use of alternative energy source such as wind, solar

Monitor emissions and evaluate on a regular basis

Provide training to employees to implement and enhance Green practices

Separately monitor the electricity consumed by the data centre

Encourage product innovation and environmentally conscious design

Life cycle assessment of energy consuming equipment

Maintain equipment and instruments in good condition to reduce wear

It is very important to measure the carbon emissions. The tools that aid in that area are:

Dashboard displays attached to the devices to display emissions

Mobile gadgets attached to devices for measuring emissions

Surveys of employees and other stakeholders

Inventory of the organization to identify unused goods

Interviews of employees and stakeholders to ascertain carbon emissions

5.1.4 Procurement and Supply Management

The green practices must be followed in procurement of raw materials, processing them and their storage organization etc.

Supply management procurement

Adheres to environmental criteria for approved suppliers

Requires or encourage suppliers to undertake environment certification

Builds environmental criteria into supplier contract conditions

Incorporates environmental conscious staff on sourcing team

Keeps record of supplier environmental questionnaires

Records and evaluate supplier environmental audits and assessment

Modify the current ERP system to meet environmental challenges

Buy a new ERP software package that will meet environmental needs

Seek external help for training and implementation of Green ERP

Apart from greening the supply chain management, periodical audits must be done to check whether the environmental goal are met.

Compliance audits

Well-documented model for carbon emissions that can be audited

Regular updates and modification of environmental parameters

Standard approach to accessing government rules and regulations

Provides feedback to the government on carbon emission

Periodically checks environmental documents of the vendor

5.1.5. Strategic Measures for Reducing Emissions

The mission for reducing emissions is very essential to reduce the harmful impact. **Some of the measures are:**

Use of ICT in minimizing the organization's environmental footprints

Government regulations that require organizations to limit carbon emissions

Implementing monitoring methods for carbon footprints in an organization

Use of alternate source of energy such as solar/wind energy

Costs involved in implementing Green initiatives

Formation of an executive body for overall responsibility for environment

Documented targets for carbon footprint reduction

Investment funds dedicated to incorporate Green policies

Training plans and budgets to help employees understand Green issues

Seek external help for upgrades to a Greener business system

Modify the current business processes to incorporate environmental needs

Create power management policies to reduce energy consumption

Methodology to undertake suitable and defensive power consumption

Use of power management software

One of the option in reducing the impact of carbon emissions is deploying cloud computing technologies. Software as a Service (SaaS) can be used. Also other devices that can be used to foster green ICT

Use of SaaS in reducing carbon emissions

Use of process reengineering to reduce waste

Use of Cloud computing to implement environmental policies

Use of new ICT initiatives as part of a strategy to reduce power consumption

Use of devices that provide real time statistical data

Use of devices that configured and managed from central services in an organization

Use of devices that configured in any designated boundary in the organization

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5.5 APPLYING GREEN IT STRATEGIES AND APPLICATIONS TO THE TELECOM SECTOR

TellUs is a hypothetical, large telecom company operating in the African region. This responsible for the core telecom infrastructure in the region, in addition to offering some land-based and **mobile services. Main focus of TellUs's business** has been the creation of the telecom platform that provides the backbone for communications infrastructure in that geographical region. The customers range from corporate people to **households. Although owned by the government, TellUs's board** is able to control its own directions and also has its own responsibility. The corporate board of TellUs comprises its business leadership(CxO level), representatives from the trade unions belonging to the large workforce and government representatives.

The core business of TellUs (i.e., creation of high-end communications infrastructure) involves technology innovation and adaptations that result in large-scale construction and implementation of physical and wireless communications networks. TellUs is owned by the government under financial as well as legal agreements. However, with the operational independence of the organization, and the receipt of a government directive on climate change, TellUs is now considering extending, embellishing, and putting into practice its environmental plans. Increasing awareness of the environment in the region implies that these corporate customers, including contents and service providers, have started demanding carbon reduction particularly in the networks that are used by them to provide their own contents and services.

An important aspect of this formal approach to the green telcom initiativeis to ensure it is not carried out by reducing business volume and service. The green enterprise transition **directive from TellUs's CEO includes the need to syner**gize between the carbon and cost efficiencies. This synergy between environmental and business benefits is expected to be achieved by optimizing the business processes of TellUs with the help of information technologies and systems.

An important motivati**ng factor in TellUs's board decision** to control and reduce its carbon footprint is that it is a government owned organization that needs to showcase the **government's** carbon reduction commitment. TellUs has the opportunity to impact many comparatively smaller organizations that have to use its platform and infrastructure services.

Such an impact opens up possibilities of reduced work travel across the metropolitan **cities where TellUs's platform is** heavily used and, eventually, large-scale attitude, and behavioral change.
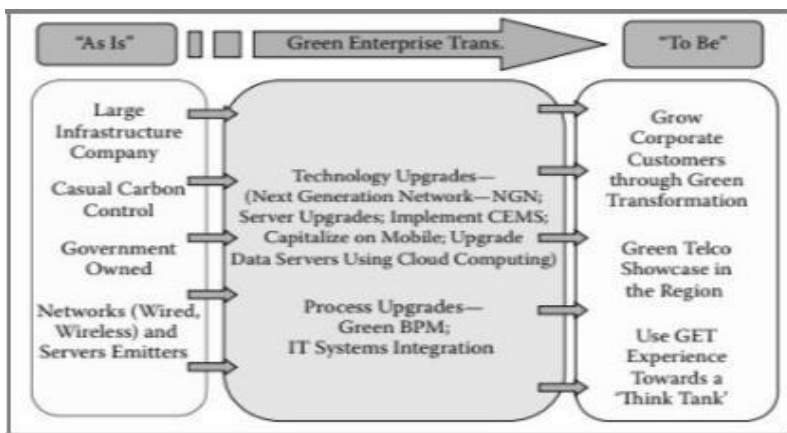

Fig 5. 6: GET forTellUs

The highlights of business and technology advantages of the GET approach of TellUs:

- Growth in business with corporate customers, due to carbon reduction and corresponding boost in the image of TellUs.

- Upgrades of hardware, software, and networks, but now closely aligned with environmental performance.

- Ability to comply with policies, legislative, and regulatory frameworks that are put together by the government as **well as telecom's summit bodies and industrial** consortiums.

- Ability to handle carbon taxes, particularly as a government organization. These carbon taxes are envisaged to be applicable directly to large, infrastructure organizations such as TellUs.

- Preplanning on how to deal with corporate customers in terms of financial models that will enable sharing of carbon taxes between them and TellUs.

- Ability to ensure there are no carbon penalties and fines.

- Capitalizing on incentives. Properly and accurately measured carbon emissions and their subsequent reduction may also create opportunities for government incentives in terms of financial rewards as well as support for growth.

- Make good use of mobile technologies and services which, while requiring additional power to operate, also create opportunities to significantly reduce carbon.

Ability to enhance network efficiency and effectiveness of the communications equipment.

Create and promote policies to help the corporate customers with their own Green IT strategies, such as recycling of handsets.

Ability to dynamically create and manage policies through sophisticated CEMS.

5.5.1 Strategic Approach to Green ICT

The infrastructure of TellUs have substantially large numbers of data servers, communication switches, and related networking equipment, large physical buildings across multiple regions. TellUs has service-oriented interfaces with the IT systems of the energy vendors. The setup is different from hospital or manufacturer of packaging industry. The end-user is not directly visible. The major carbon emissions come from the power consumed by the overall infrastructure including communications network and data servers rather than individual user devices. Device level power management systems as well as training the users canbring about reduction in carbon emissions. Power-smart add-ons to manage the operating systems of these devices will also enable improved measurement and control of carbon through these large number of end-user devices.

The carbon produced by the organization is primarily through its infrastructure platform and related services. These are large-scale communications services across the region consumed by corporate customers and content providers. The strategies for carbon measurement, reporting and control need to

focus directly on these large-scale infrastructures like communications towers, telecom switches, wired and wireless relaying equipment, associated routers, data servers and the many IT supporting hardware. Specialized software will also be equipped with these infrastructures. These systems enable the business to operate but, at the same time, generate carbon that contributes to the overall carbon footprint of the organization. Siloed data in these applications, which requires continuous interaction amongst these data bases, is a source of major, wasteful carbon.

With an infrastructure organization likeTellUs, the strategies for Green IT are brought forward in time as compared with the generic suggested timelines. Thus, the strategies that are created, in a generic Green IT approach for 3 years,are hurried forward and brought to bear results within an year. The long-term 5-yearstrategies are brought closer in time to around 3 years.

From a technology viewpoint, the focus should be on the data centre and IT systems right at the outset. The longer-term strategy of Green IT for the organization, in a 3-year period, will be re-architecture and design of the communications infrastructure. While this communications infrastructure is of immense value in the GET for TellUs, the actual transformation of the network is likely to take 3–5 years. This network redesign will closely involve both business and technology expertise as it will require an investment that goes beyond that only for a GreenIT project. The GET of an infrastructure company such as TellUs will include substantial influence on all its customers and partners. Changes will include implementation of TCCO metrics even to servers and New Generation Network (NGN) across its

operating life. Green collaborative architecture of its systems through a web services based portal with underlying data warehouse. These long-term Green IT strategies also incorporate dedicated use of renewable energy sources.

5.5.2 SWOT Analysis of TellUs

Strengths

Government owned and supported organization that is aware of the upcoming legislations in the carbon context.

Excellent channel relations including corporate partners and government representatives.

Influential, monopolistic organization with no competition in infrastructure.

Ample opportunity for steady revenue that frees the organization to focus on its Green IT eff ort.

Weaknesses

Inflexible infrastructure as is expected in a large telecom in a developing region

LargeIT systems that are based on past, legacy databases and applications.

Bureaucratic decision-making process, that is invariably a part of a government owned body; but such decision making creates challenges in terms of timings and follow up actions as the organization transitions.

Physically dispersed infrastructure, with buildings, communications towers, and supporting data servers, all

physically spread across the geographical region, making coordination extremely challenging.

Opportunities

Combining business with green transformation will lead to show casing of the Green IT strategy created by the CGO that does not discount one goal over the other.

Business shift to mobile platform resulting in reducing needs for physical wired connectivity and corresponding reduction in the required infrastructure.

Growing content and service providers who will need the increasing sophistication of theNGN platform.

Threats

Resistance to change.

Long time for visible results of the GET

Total inexperience in GET in the region as this would be the first large project of its kind that will bring together the knowledge and expertise of Green It with that of telecommunications. External, overseas consulting help will be required to ameliorate this risk.

5.5.3 Motivators and Dimensions

Developing and influencing a responsible business ecosystem, together with reduction in cost of operations is emerging as a major motivator for TellUs to undertake GET. Other motivators includes government legislation and social pressure. This telecom company by upgrading its technological platforms, will not only grow its corporate customer base but

also influence all its partners in its business ecosystem to be carbon compliant.

The technical nature of the challenge, particularly the communications networks, also indicates that the Green enterprise transformation will be best achieved by immediate focus on technologies. These technologies include the IT systems and hardware, as well as the communications networks. **The company's corporate board has sanctioned the formation of** the GET board. The current CTO (chief technology officer) has been appointed as the CGO for the transformation. Knowledge of the inner working is very crucial for technological upgrades. The CGO, together with select members of the Greenenteprise transformation board, has extracted the existing, information Green IT strategy and has created a full programme to undertake transformation.

The diagnose, plan, enact, and review are the four phases also established in business transformation. These transformation phases are interspersed with metrics that help in stating the goals (KPIs) as also measuring whether the stated goals have been achieved or not.

5.5.4 Diagnosing of the TellUs

The current carbon footprint and its carbon readiness is being conducted by the Green Enterprise Transformation Board.

This activity is authorized by the corporate board after in-depth discussions with the trade unions representing the large workforce of the organization.

This diagnosis phase examined the data centre, the communications networks, the equipment lifecycle processes and the supporting H R function.

TellUs's as-is business processes were not modeled or optimized. Due to lack of formality associated with modeling and documentation of business processes there was substantial wastage and resultant carbon emissions.

The current investigations are into the assets such as networks infrastructure, information systems, and data bases also indicated a close nexus between the unoptimized business processes and these technology hardware and software.

Formal diagnosis phases also revealed that the transformation of the telecommunication networks and information systems to achieve green maturity has to be closely aligned to business model to ensure that it is not achieved at the cost of business growth.

Green IT strategy for TellUs includes transformation of communications networks, IT hardware, I T systems, and business processes.

The organizational culture has to also undergo change, which will be brought about through training and education.

TellUs will undertake transformation in Strategy, Infrastructure and Product (SIP) processes as the seare the most technology-intense processes.

These changes in these processes will also change other processes and affect the internal staff as well as people from the corporate customer groups.

Starting with the strategic aspect of the lifecycle, the GET will then undertake changes and alignment to infrastructure lifecycle management and eventually product lifecycle management processes.
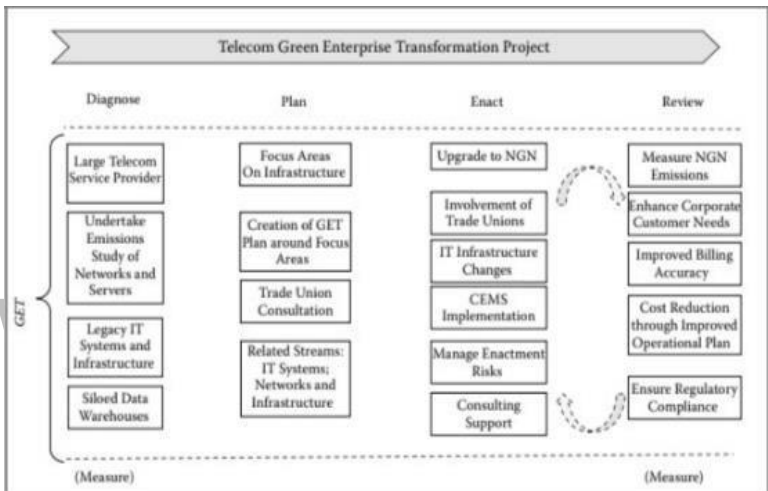

Fig 5.7 GET for TellUs

Green IT metrics and measurements apply to all of these enhance telecommunication operations map (eTOM) based processes.

The transformation of IT systems and resources provides opportunities to measure the KPIs of the TellUs processes supported by the IT systems.

Optimization of the process also ensures cost- and time-effective delivery of services.

Training and education will lead to carbon consciousness throughout the organization.

This implies clear understanding among the staff.

Changes to the IT systems and applications include review of the database, setting up of integration interfaces through SOA and accurate reporting in terms of both carbon and non carbon data.

5.5.5 Planning for GET

eTOM provides an excellent and comprehensive reference model for the telecom sector.
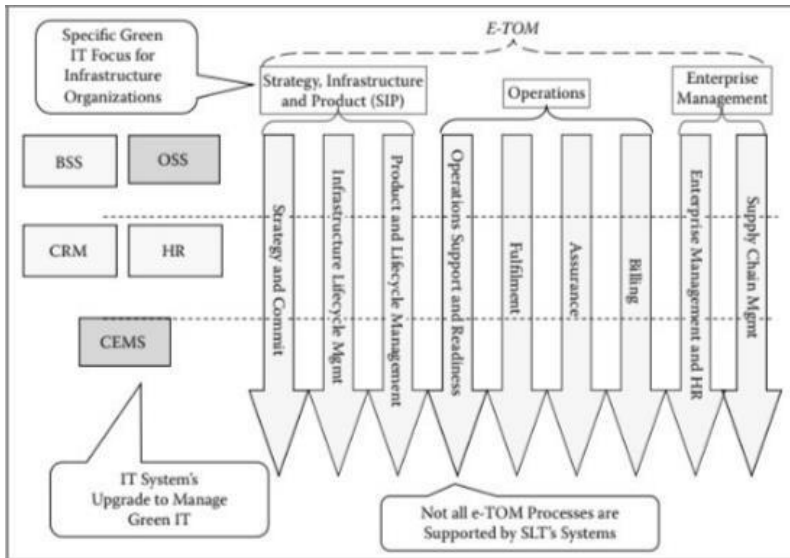

Fig 5.8: eTOM model for TellUs GET

The strategy and commit, infrastructure lifecycle management, and product lifecycle management are the major areas of focus.

The processes that support and align with these major areas are the marketing and off er management, service development and management, resourced envelopment and management, and supply chain development and management.

These processes derived directly from eTOM are supported by the various IT systems and applications of TellUs.

The proximity of technology-based changes with the process dimension.

In large, infrastructure-based GET, such as in TellUs, all four dimensions are involved.

Thus though one dimension, such as the technology dimension, takes lead, other dimensions immediately follow and support the transformation.

The modernization effort is aimed to not only reduce carbon but also optimize processes for its corporate customers, including content providers.

Planning for green process reengineering will involve **grouping the processes based on the —operations‖ group**. The process groups formed during planning phase will continue during enactment and review.

5.5.6 Enterprise Data Centre Transformation Plan

TellUs has two large data centres in two major cities in the region.

Both data centres operate on a24 × 7 basis as it needs to support the corporate customers, service and content providers, as well asinternal HR.

Together, there are 12 high-end servers, with four additional servers as backup servers for emergency.

The data centre does not currently have a space allocation strategy and the data and application requirements are growing at the rate of 1Gig per day.

The data centre director has made some attempt to measure PUE (power usage effectiveness) and the results are a PUE of 2.4.

There are a few local servers within the organization.

Implementation of CEMS will include incorporation of the aforementioned KPIs that bring together carbon and **measurement of IT system's performance.**

The reduction in data usage, duplication, and storage will also reflect corresponding carbon reduction.

Processes associated with content and service providers will enable them to use the upgraded communication platform in new and innovative ways.

The Green ITstrategies of TellUs will align the transformation to the NGN with the business strategies of the content and service providers.

Increase in contents and demand for greater network coverage—especially on the 3G networks implies need for high-capacity networks. NGN, providing some

capacity, needs to be balanced with the carbon footprint of NGN.

TellUs's cost consideration in GET project includes costs of network upgrades, costs associated with formation of the project, and cost of procuring and implementing CEMS.

Data servers in the current setup at TellUs have been left running irrespective of usage.

Manual control is also used to reduce their emissions when they were not in use.

Post-GET server management will have to be automated through power management software.

TellUs is in a position to influence handset manufacturers as well, as a part of its influence on its business ecosystem, to put together plans for take back of mobile devices.

Mobile devices need to be recycled, ensuring regulatory policies that make the manufacturers responsible for taking back devices that would be e-waste.

5.5.7 Enacting GET for TellUs

The suggested timeline that considers two major iterations for enactment and review.

The first enactments and review focus on initial changes to the network.

Changes to the enterprise architecture based oneTOM and the procurement and implementation of eco

Governance as the CEMS is also happening during this enactment.

IT systems and applications need to be mapped to the reengineered business processes—occurring in the second part of enactment.

Changes to the IT applications will impact the collaborative business processes of partners such as the content and service providers.

5.5.8 Data Centre Changes in GET

The actions in data centres arebased on the planning for GET discussed in earlier section:

Implement integrated blade servers that will consume less power.

All new servers that are procured will be low carbon emitting blade servers that will have inbuilt virtualization capacity.

TellUs will actively seek renewable energy sources such as solar and gas, which can be combined with the current coal-based power generation.

Integration of connectivity among the servers within and across the cities, outsourcing of some of the hardware maintenance aspects of the data centre to ensure highly optimized services.

Implement natural cooling for data centre.

Optimization of signals creating opportunities to reduce demands on the servers, which in turn would reduce

power consumption for the servers and corresponding air conditioning

Implement eco-friendly air conditioning for the servers.

5.5.9 Next-Generation Networks in GET

Complete the implementation of NGN within TellUs's
entire communications network. This implementation is expected to take between 3 and 4 years to complete in the region where TellUs operates. This change to NGN will result in strategic reduction in carbon due to improved network efficient, intelligent routing methods, and consolidation of switching centres. This reduction in power consumption is envisaged to be effective even if there is increase in network traffic as expected over the coming years. The Green IT metrics used in the return on investment (ROI) calculations needs to consider not only the replacement costs of the network and equipment, but also the drop in emissions per user over increased number of users.

5.5.10 Equipment Lifecycle

The entire lifecycle of TellUs is subjected to Green POD. The activities relating to material and equipment lifecycle that will undergo change include carbon reduction consideration in current POD practices within the organization. The new servers will be procured based on their power consumption ratings as well as their total carbon cost of ownership. The disposal of IT hardware is through a series of ranked options including giving it to employees, then charity, and fi nally for safe disposal.

The business infrastructure of TellUs, such as its buildings and car fleet will be accounted for in the updated financial systems where Scope 1 emissions can be calculated and updated. Enacting changes to t he procurement-operation-disposal process will be based on following considerations:

All procurement to be based on EPEAT/energy star based ratings

Highly optimized processes that would support procurement of IT hardware as well as communications equipment

Incorporation of carbon calculations and Green credentials to support procurement of the NGN.

Renegotiation of SLA with hardware and network equipment suppliers

Optimized operation of network, servers, and associated IT hardware

Apportioning operational carbon over the life of the equipment to arrive at TCCO

Ethical disposal of existing legacy network hardware

5.5.11 Attitude and Training

The following measures are essential to provide necessary training to the employees and bring a change in the attitude of the employees:

Creation and de livery of brief 2 -hour seminars on the relevance of Green ICT.

Detailed training to IT managers, network managers and data centre managers

External training to Green enterprise transformation board on the transformation process.

5.5.12 Review and Measure

There are two specific reviews after each iteration of enactment.

A significant learning that has happened is the need to understand the politics and underlying motivation of individuals participating in the transformation project.

The age-old management understanding of the risks associated with change hold utterly true in this transformation.

Quality assurance and testing activities were also required to be formally carried out on the new and integrated IT systems and content management.

5.3 APPLYING GREEN IT STRATEGIES AND APPLICATIONS TO A HOSPITAL

5.3.1 ABC Hospital

ABCis a hypothetical large hospital in a metro city, providing public sector medical services. The services includes out patient department and various specialities. After the preliminary Green IT audit of the hospital, it has been revealed that the hospital had a significant carbon footprint. Significant reviews of patient management processes, management of Electronic Patient Records (EPR), laboratory equipment management, medical drugs and material management, and management of equipment and buildings were undertaken.CGO was appointed and suggested that optimization was possible in

all these areas of the hospital that will reduce its carbon footprint. The cost-**effectiveness and efficiency of the hospital's** service processes is as important as its carbon efficiency. Further to the attention on processes in terms of their carbonreduction, the initial investigation also highlighted that ABC has a significant investment in a data centre. Also, the building and infrastructure of this data centre is now more than 10 years old,and the server machines themselves are averaging 4 years in use.By Green enterprise transformation(GET), the hospital can influence many of its partnering organizations such as labs, pharmacies, and suppliers.

The Return On Investment (ROI) of the hospital's

attempt to transform to a Green hospital is meant to go beyond the carbon focus and into the overall business optimization arena. Thus, the hospital leadership is keen to make effective use of new fund allocations that have been indexed to carbon reduction.

Preliminary Green Investigation

The green audit was done by CGO. The CGO, with theIT auditors, departmental heads, and the CIO sought input into the current state of the hospital. The framework for this audit was based on the four dimensions of GET namely Economic, Technical, Process and Social. The findings were:

The hospital has to undertake action in terms of measuring, reporting, and reducing its carbon emissions.

The hospital has significant opportunity to influence its partnering organizations.

OPD (out-patient department) of the hospital is a large and complex department that operates out of its own separate building and infrastructure. This department has 220 stationary desktop machines, 100 mobile laptops and PDAs carried personally by the staff and numerous supporting IT devices like printers. This department alone accounts for 60 to65 kT (kilo Tonnes) of carbon emissions of the hospital

Additional desktops, printers, fax, laptops and PDA are present in other departments as well. These devices amount to 20 kT of emission sat this stage.

Printers are heavily used for writing of scripts, printing of patient records and reports and related documentation. On an average, the hospital prints 5,000 pages of normal paper and consumes corresponding ink and printer time.

Hospital has an attached pathological laboratory that conducts diagnostic blood and related tests. The lab equipment is aging.

The data stored in the hospital's servers that provides that information to staff on the results from the tests is also significant consumer of power and generates carbon emissions.

Pre and post surgical activities requires electronics equipment and IT support

The hospital has to need to product substantial amount of legal documentation.

The hospital collaborates with external pharmaceutical organizations, manufacturers and distributors of drugs and hospital equipment.

Staff rostering is not optimized, leaving the administrative staff to occasionally use physical notepads, whiteboards, and diaries to book availability of doctors.

Scheduling system for patient appointments, surgical procedures and human relation (HR)is also not optimized and requires a major upgrade. Scheduling patient consultations, scheduling work rosters for nurses and administrative staff is many times happening manually.

A comprehensive multimedia data warehouse project is underway.

With the availability of a multimedia database, there is opportunity for optional extensions to the project is to incorporate possibility of remote consulting by doctors through audio and video media using high-speed connectivity.

Security of access and privacy of patient's data (EPR) is of top priority and is not to be compromised under any circumstances.

Internal administrative systems

There are provisional inventories that are in excess.

5.3.2 Green Business Objectives

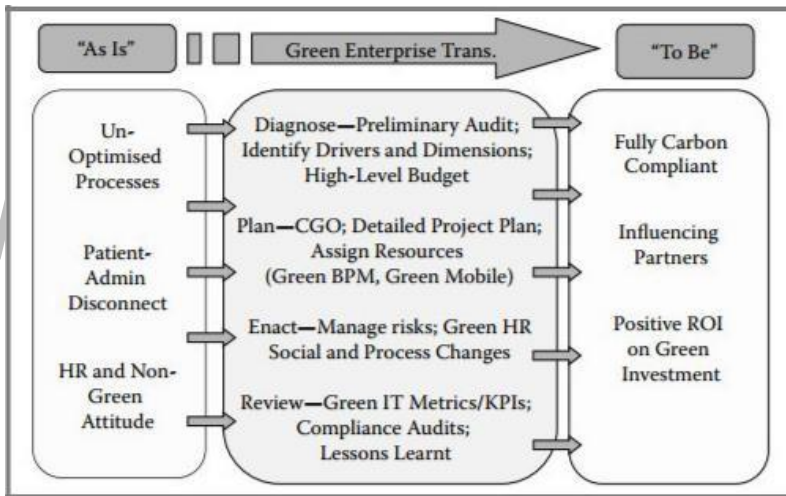The green objectives provide the basis for the transformation plan.

Fig 5.1: Green Transformation of ABC hospital

The four major phases of transformation—diagnose, plan, enact, and review—interspersed with metrics, are shown in this high-level transformation framework. Following are the important objectives of ABC in undertaking the GET:

Reduction in carbon emissions across all departments and processes of the organization

Compliance with carbon legislations and related carbon initiatives of the government

Be a leader in carbon management and, thereby, influence many business partners in reducing their emissions

Undertake electronic collaborations with partners, government regulatory bodies for monitoring and reporting

Undertake comprehensive Green BPM program that will enable result in modeling, optimization, and merger/elimination of processes

Aim for a comprehensive and holistic GET that is futuristic

Create positive green attitude across the entire staff through Green HR

5.3.3 SWOT analysis of ABC Hospital

SWOT analysis is helpful in understanding the approach that can be taken for the GET. A SWOT analysis makes it easier to understand how to capitalize on the inherent strengths of the hospital. The areas that will be directly affected by the transformation and bear risks will also become evident in such an analysis. SWOT analysis can help understand the scope and coverage of work during this transformation.

Strengths

Well-known public sector hospital.

Financially w ell supported by government.

Green IT budget.

Reputed teaching and research hospital

Weaknesses

Aging IT infrastructure.

Attitude not conducive to Green IT.

Carbon inefficient processes.

Opportunity

New Leadership (CEO, CIO)

Govt. Focus on Environment

Green Portals integrated with Regulatory

Portals

Uncertainty of Focus

Changing Legislations

Patient Privacy Risks exposure

Infrastructure/Change Management

Threats

Lack of collaboration with partners.

IT inexperience (new technologies).

Uncertainty of focus.

Changing legislations.

Patient privacy risks

Infrastructure/change management.

5.3. 4 Strategic Concerns of Management

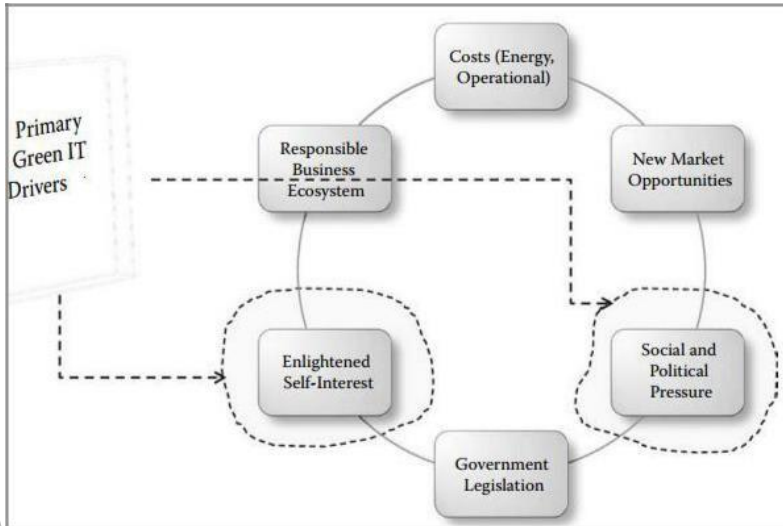The drivers of ERBS are shown in Fig 5.2.

Fig 5.2: Green IT drivers

Sociopolitical pressure:

The hospital has a substantial standing in the community. There is significant social and political pressure on the hospital to demonstrate its environmental credentials. This pressure comes from the general community that views the hospital as a symbol of good service-based organization and cross-section of patients.

Enlightened self-interest:

The senior management of the hospital, the leaders/decision makers are keen to take up the challenge of changing their processes and internal social attitude to a

positive, green attitude. While they are certainly buoyed by the availability of funds dedicated for this purpose, they are themselves realizing the need to undertake this green enterprise wide transformation to enable them to remain as a leader in the upcoming carbon economy.

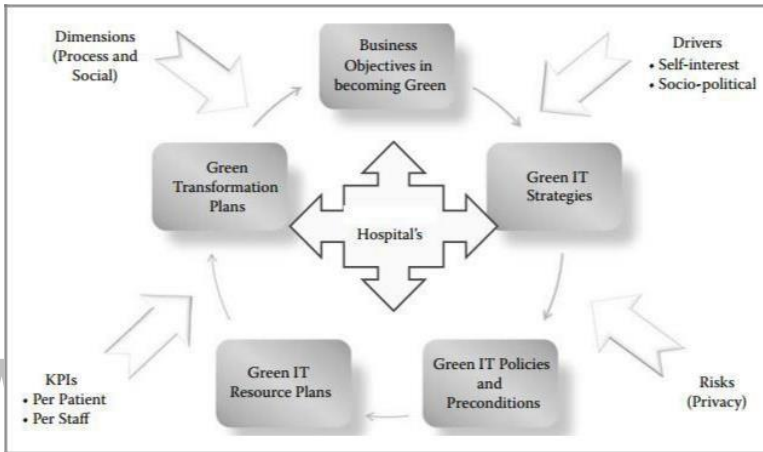### 5.3.4 Steps in Developing a Hospital's ERBS

Fig 5.3: Development steps of ERBS

The business objectives of the hospital in becoming a green hospital were identified earlieron. These objectives and visions provide the initial direction for the hospital in its strategy formulation. The d rivers for the objectives are enlightened self-interest and sociopolitical pressure on the hospital.

Green IT strategies: These are the medium terms strategies that are driven by the CGO and that are based on the drivers and objectives of the organization. Strategies for Green IT also contain elements of risks or threats, as were identified during the SWOT.

Green IT policies and preconditions: These are the policies that are formed at the departmental level and are implemented by department heads.

Green IT resource plans: These include details of resources required in undertaking transformation.

Green transformation plans: These are the business transformation and change management plans that will focus on the dimensions and the work areas.

5.3.5 Green Transformational Elements

These elements are as follows:

The drivers and areas of influence.

The major dimension along with the GET will take place. This is the process dimension also supported by the social dimension for transformation.

The demographics of the organization can play a role in deciding on the type of transformation, its budgets, and its resources.

Maturity of its Green IT performance is very basic.

Some of the transformation measures:

User devices: Measuring, upgrading, and recycling monitors, PCs, laptops, and mobile phones; desktop virtualization; centralized green services

Data centre: Virtualization, optimization; self healing networks; network topology, database design, hardware and software components, security issues, and backup

strategies. Redesign of data centre to include flexibility and agility to enable easy upgrades of future infrastructure

Systems and lifecycle: IT systems supporting hospital processes like booking, consultation, diagnosis, treatment, prescription, and education; Equipment procurement, installation and usage; integration of supply chain with local as well as overseas pharmacies and drug suppliers. Interaction with government and other regulatory bodies should also be enabled electronically.

Wastage: Electronic waste resulting from unused or broken devices; also, due consideration is given to areas of bio waste.

Attitude: Undertaking training and consulting programs for staff and promoting it amongst patients and business partners. Internet-based system to facilitate global management of the administration, rosters as well as the most HR functions. Change management for telework and telehealth.

5.3.6 Green Transformation Project

The overall GET project is to last between 12 and 18 months, with the full carbon value realized **over 3 to 5 year's** strategic time period. $ 1 million is the budget sanctioned by the corporate board and the CGO is authorized to undertake this transformation.

The process is divided into six quarters of 3 months each.

First quarter: The hospital transformation is primarily focused on investigation and diagnosis. This work includes identification of the key drivers for green

transformation. The CGO will lead the strategic planning for the hospital, creating a 3 –5year actionable strategic **plan. Ā is plan will also include the return on investment** metricsfor the hospital.

Second quarter: This is the quarter where enactment of the plan created in the previous quarter takes place. The enactment of GET in this quarter deals withthe process dimension of transformation. Therefore, Green BPMcomes into play during this quarter. The process changes require extensive modeling, verification and validation, and tools support. Carboncontent of the key processes needs to be established beforehand.

Third quarter: This quarter of GET is dedicated to transformation ofthe social dimension. Therefore this quarter focuses on the attitude and behavior of individual staff . Social dimension also becomes important in a service organization as the output of the organization is the service to the customer (patient in this case). Thus while the employees are equipped here with training that enables them to tap into the environmental data, information and knowledge within the organization, the patients, and the society in general is updated with the changes occurring within the hospital. Metrics and measurements associated with the social dimensions come in to play.

Fourth quarter: This quarte**r is for the ―Review‖ phase** of the transformation. There is heavy focus on measurements based on the earlier defined metrics: the Green KPI. The KPIs can also be fine tuned for ongoing and continuous improvement in the future. Review phase can include Green ITaud it to ascertain the maturity of the organization. Reduction in complexity of processes, improvement of quality of service and compliance with legislative requirements are included in the criteria for success.

Fifth quarter: If the Review phase indicates success in terms of GET, then the organization needs to immediately focus on providing the transformation support to its partners. These are the pharmaceuticals, laboratories, equipment suppliers and, various patient-related bodies such as medical insurance providers.

Sixth quarter: This is the quarter where feedback from the transformation will have a substantial effect on the next steps by the hospital. Formal external Green IT audits are conducted in this quarter and compliance with the regulatory requirements can be formalized. This quarter starts an ongoing journey for environmental program management for the hospital that will work closely with the Green HR function in ensuring Green IT specific roles are maintained, and individuals working in those roles are motivated and trained. Two important aspects to be noted here are

GET is closely tied with the profits

GET will lead to increase in the overall performance.

5.3.7 Social Dimension in Hospital GET

Changes to the social dimension of the hospital is particularly brought about during the third quarter of the transformation. These changes include the following:

Creation and delivery of training programs for staff at all levels

Review of attitude toward Green IT through quick surveys and feedback

Use of IT systems support to reduce the routine pressures on doctors beyond the needs oftheir own specialist or generalist skills

Implementation of metrics to provide real-time feedback to users on their daily carbon footprint.

Creation of telework program for support functions

Telehealth

Development of a Green HR function that includes training, reward, and growth structure, particularly for admin and support staff, in terms of Green IT.

5.3.8 Technology Changes in Hospital

Replacement of servers to the low-carbon emitting servers in the data centre.

Gradual replacement of devices to low-carbon devices.

Changes to the current backup, including off -site backups of data on the data servers.

Upgrade of IT systems to automate processes.

Upgrade to the EPR by implementing a strategy to move it on the Cloud. EPR can enhance medical record documentation and optimize the consulting process of the doctor with the patient.

Paper-less medical reports to reduce not only the paper wastage, but also time and effort in maintaining the manual records is saved.

Collaboration with partners

Green BPM for processes, including ordering and retrieving laboratory tests, prescription writing, consultation or referral notes, and billing.

CEMS will be involved in recording carbon data that corresponds to various clinical activities.

User devices changes includes end-user devices such as PCs in the consulting rooms, examination rooms, nursing workstations, and administrative hardware.

Communications and network equipment

Non-IT equipment and their lifecycle has to be subject to the Green Production, Operation and Development. These equipment, such as are used in operating theatres or X-rays or in the pathological tests may not come directly under IT domain, but are still significant contributors to carbon emissions.

Electronic wastage policies and procedures.

5.3.9 Applying Mobile Technologies in GET

A large number of hospital staff use mobiles to connect for both work and social networking. The following are the advantages from the perspective of carbon reduction:

❖ **Doctors:** Mobile technology can reduce carbon **throughout the physician's work and social processes. They can use handheld tools dedicated to a physician's**

routine which can provide instantaneous data and information to the doctor. This improves health-care services to patients, eliminate geographical distances and reduce carbon content of the service. ABC hospital is providing dedicated health-care mobile tools and

supporting technologies to all doctors that will enable them to serve the patients most efficiently, engage in

conversations and conferences through their devices, and **have fast access to patients' data. The actions taken by**

the physician are also documented through the device, enabling easy tracking of actions when a staff member hands over the care of a patient to another member.

Nurses: The use of mobile technology is also helps the nursing staff to coordinate with the doctors andthe patients on a re gular basis. This helps in improving the consulting/advisory roles that nurses play and the record keeping activities.

Patients: Use of mobile technology has given greater flexibility for thepatients without being physically go to the hospital for check up. The mobile technology has reduced patient movement, patient queuing and has provided location-independent advise to patients where

they needed it most. Additional mobile gadgets that monitor patient data remotely, provides it to the hospital and also raises relevant alerts has optimized the processes and reduced their carbon contents.

Suppliers: Mobile technology improves receiving and ordering processes between hospital and its drug supplier. It also provides better management and storage system.

5.3.10 Important Lessons Learned in Implementing Green IT Strategies

Following are the lessons learned as a result of the GET initiative for the hospital.

Strategic reduction in carbon will require significant changes in the social, process, and also technical dimensions of the business.

Service organizations are particularly influenced by customer expectations. The patients and the society in general was more keen to see the hospital becomea green hospital, as compared with the internal staff and administrators.

Telework and telehealth are likely to play a significant role in not only improving the business processes of the hospital, but also its carbon emissions record.

Operational carbon reduction is more effective when processes are to be changed as compared with the changes to the procurement and disposal cycle.

Training and education play a significant role in carbon reduction in a hospital and similar service organizations. They bring about a change in attitude and approach to Green IT restructuring to Green HR is also a significant boost to the carbon reduction effort from asocial angle.

Changes to IT systems that support business and technical processes should be made with the backdrop of environmental intelligence. Simple carbon data mining will not provide strategic value of directions for a transforming organization.

Ongoing monitoring of risks associated with GET should be planned for enacted. These risks are not restricted to only the main dimension for transformation but can emerge from any of the four dimensions.

5.4 APPLYING GREEN IT STRATEGIES TO THE PACKAGING INDUSTRY

B4Pack is a hypothetical organization in the business of manufacturing packages and containers. This is medium sized industry, that has established itself over the last decade as a reliable, honest organization. B4Pack has around 10,000 workers and corporate board led by young CEO. 4Pack is keen to move forward in the area of Green IT. The carbon emissions from its production lines are on the rise, and also the electronic and other wastages. The wastages, are not just restricted to the organization but are occurring at an alarmingly high rate with

the end-users of the contents of the packages. The local **regulatory authorities are also showing interest in B4Pack's**

carbon footprint. The products of B4Pack include variety of packages that are made up of materials such as cardboard, foam,

plastic, choir, and rubber. These packages or containers are sold to other manufacturers who use them to wrap, store, and distribute their own products, including food medical drugs, equipment, and electronic goods. The containers produced by B4Pack, therefore, need to range from boxes, tubes, and bubble-wraps through to tin cans and jars. Manufacturing of the packages requires materials to be sourced, planning of the production process, inventory of produced packages, and a customer management system.

A recent internal audit revealed that the organization has around 350 desktop machines, close to 100 laptops, and two large data servers in a small, backend data centre. Most PCs have been inuse for 5 or more years, have cathode ray tube (CRT) monitors, and are used by accountants, production shift managers, and administrators. Connectivity for most machines is provided through internal LANs and WANs and externally using a combination of virtual private network and the Internet.

The hardware of the organization is used to run variety of **applications including B4Pack's assets and inventory**

management, customer service, financial management, procurement, and HR/Payroll. Data corresponding to these applications is stored in the underlying data warehouse of B4Pack on the two servers. A significant part of the production and inventory data is collected from the shop floor automatically and updated in the data warehouse.

Following are the current observations of the CEO together:

> Raw materials for packaging are available in abundance. There is excessive availability of raw materials particularly from the regions where B4Pack is located.

Workers are dedicated to the company. However, most workers have had very basic education, and in some cases no education at all. While expert in particular production process, these workers had no current interest in Green IT or carbon reduction.

Wide customer base from both developed and developing region with the business from the developing regions on the rise.

Network of transporters who partner with B4Pack to bring in raw materials as well as deliver blank, ready-to-go container packages, typically to the corporate customers.

Continuously changing needs of customers—as their products are changing too.

Other departments of B4 Pack, that are under the direct influence of these changing requirements are sales, financial, customer service and legal department.
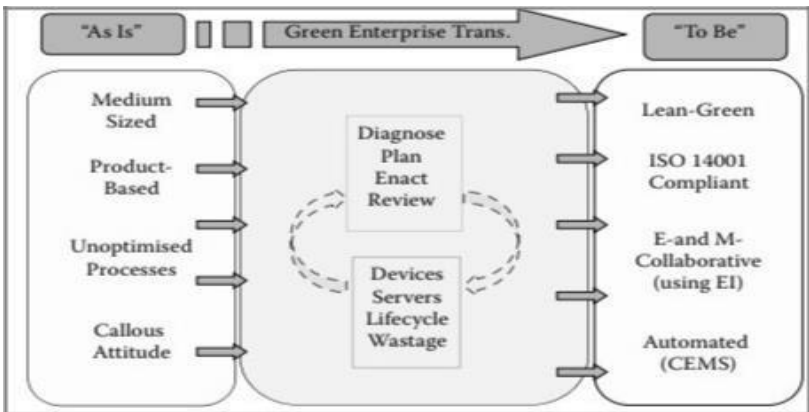

Fig 5. 4: GET for B4Pack

5.4.1 B4Pack's Green IT Strategies

Focus on use and capitalization of technologies with the creation of a Green IT portal. Use of the portal itself for reporting on carbon compliance by the organization.

Launching of a GET program that is going to enable compliance with ISO 14001 standard.

Understand the g rowing environmental awareness of all its customers

Extend the current process optimization initiative to make it a formal Lean process implementation that will also be measured and reporting for corresponding greenness.

Form a consortium of likeminded businesses in the region and provide leadership through initial experience of GET.

Influence and be influenced by customers and suppliers in terms of carbon compliance.

5.4.2 SWOT of B4Pack in Green Context

Strengths

Visionary leadership through the new CEO and corresponding CGO

Growing business with sufficient funds enabling easier green IT initiative

Material-savvy region, with more than a decade of experience in packing/container production

Strong distribution network—particularly overseas customers

Weakness

Aging infrastructure—especially technical assets such as computers

Workforce only experienced in package production—not necessarily IT literate

Non-serious attitude of most workers toward carbon footprint

Noticeable wastages in packaging products and IT

Opportunities

Leadership in packaging materials and designs

Potential to leap-frog in terms of computing technologies by directly using the latest, low carbon emitting machines and servers

Acceptance of ideas by partners—customers and suppliers—thereby creating leadership in the Green IT/carbon compliance space

Threats

Attitude of majority of staff

Differences in compliance requirements of the developing region versus the developed regions where customers are located

Inexperience in undertaking GET in the region

5.4.3 Diagnosis in B4Pack

The CEO of B4Pack realizes that the reduction in costs and optimization of processes will be an ideal driver for the Green IT initiative of the organization. Carbon reduction for its own sake may not provide sufficient motivation for the organization. A good sustainable approach for B4Pack will include optimization of processes, consolidation of its information technology hardware and software and thereby reduce its costs and carbon together. Cost reduction is an excellent driver for Green IT in B4Pack.

Regional environmental legislation requires B4Pack to monitor and report its overall carbonemissions. These are the operational emissions from the package production process, supporting IT systems and infrastructure and the distribution transport network.

B4Pack has many partner organizations both locally in the geographical region of the developing country where it operates and overseas, where its customer base is growing rapidly. The visionary leadership of B4Pack is keen to capitalize on these myriad associations with its collaborating organizations and influence them in terms of their carbon footprint.

5.4.4 Planning for GET

The sections that get affected by GET are the customers and business partners, the IT systems and the Regulatory areas:

❖ **Customers and partners**: Changes to these relationships will be based on changes to the way

improving the customer information systems to get ongoing sales from customers.

IT systems and applications: Upgrade of CAD/CAM computers to high powered computers that are networked in a way to reduce the interactions required through the various systems and applications.

A new Carbon Emission Management Software (CEMS) together with an optimized manufacturing system that would support new and existing business.

Changes to Service Level Agreements (SLAs) with partners as the organization transitions as also changes to governance structures with greater focus on environment.

External and internal business processes supporting the manufacturing as well as sales/ distribution of the packaging products will be optimized.

Operational organization and green HR resulting from changes to the people structure as a result of green initiative.

5.4.5 Economic Dimension in B4Pack

The economic dimension involves reduction in cost and increase in profit.

This is done by creating value for customers through reduced carbon footprint in the packaging product.

The availability of funds to undertake the transformation is a strength of the organization.

It also includes responsibility on part of the CGO to ensure there is return on this investment in the next 2–3 years.

Direct and positive involvement and interest from the CEO is extremely helpful as the organization moves along this economic dimension.

As a result of green transformation, the CGO anticipates growth and expansion of the packaging product business.
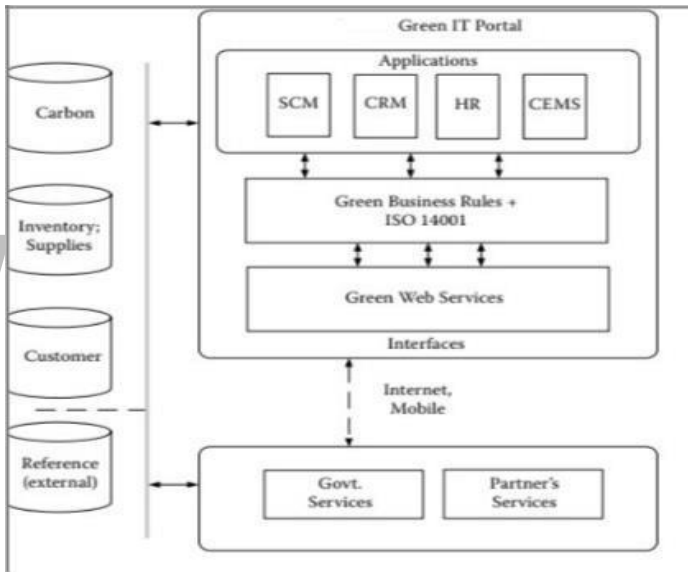

Fig 5. 5: B4Pack Portal

5.4.7 Technical Dimension in B4Pack

A simple CRM package is used for managing technical dimension. Current carbon related data, that was use din the initial investigation is maintained in Microsoft Excel spreadsheet. There is no access to this and such information that

resides on the company's servers to most of the employees.

B4Pack investigated and has decided to procure a CEMS from Microsoft business solutions and form a Environmental Sustainability Dashboard. This product will be integrated **withB4Pack's existing ERP applications to enable tracking of** energy consumption and carbon emissions. This is a measure to decrease the carbon emissions with cost savings. The CEMS will create opportunity for the staff at all levels to understand, in real time, the carbon emissions of B4Pack. Also, the dashboard provides information to all users on their desktop and laptop machines within the organizati**on's** firewalls. A Green SOA will ensure that the new CEMS is properly integrated with the existing applications. The collaborative business partners will be **able to tap into the organization's** systems and receive as well as provide feedback.

5.4.8 Process Dimension in B4Pack

This deals with creation of process models that reflect both existing and new green processes. The modeling of the processes can be undertaken using the use cases and activity graphs various roles within and outside of B4Pack. The process dimension of GET has to consider collaborative customers, who will be interacting with B4Pack electronically. The services provided to these corporate customers can be enhanced and optimized to not only add value through accuracy and timeliness but also reduce the overall carbon associated with the collaborative processes.

5.4.9 Social Dimension in B4Pack

The social dimension of the GET is involved with the changing of the attitude of its staff and, also, the changing Green

HR function. B4Pack has to move toward creation of a social networking site. Awareness of the carbon issues and the way they will impact the future of not only the organization, but the country and the global business can bring about a change in attitude. Green HR brings about changes to the organizational structure. This change starts with the appointment of the CGO and the subsequent formation of the green transition project team.

In addition to the CGO, there is an external consultant with expertise in GET, two department level managers fully dedicated to environmental management and 6 supervisors to support them. All of them are involved in diagnosis, planning, enactment, and review phases. Green IT auditor is an additional support role which is also involved in creation, validation, and use Green IT metrics and measurement. Staff will be trained to use the CEMS. Smart meters will be fitted to most equipment involved in the production line to calculate directly the emissions from those production lines.

The social dimension of GET also takes responsibility for management of the changes to the designations and responsibilities of line managers, legal implications a rising from the changes, possibilities of telework, and related privacy issues.

5.4.10 Enactment of GET for B4Pack

The following are the specific highlights of the enactment:

CEMS—Implement and integrate with the existing systems.

Comply and maintain ISO 14001

Model and optimize green processes

Setup customer/partner portal collaborations through electronic web services

Upgrade to green data centre

Emissions reporting through web services to government portal

Undertake Green IT audits (internal and external)

5.4.11 Review of GET for B4Pack

The review phase deals with verifying and validating the stated outcomes of GET for B4Pack.Green IT audits that have already started during enactment. The formalized findings are reported.

Furthermore, the outcomes need to be measured and studied not only for the new business, but also for the new environment in which the business is now oper**ating. B4Pack's** Green IT outcomes are slightly different to the stated goals. This was expected as the business itself was changing and growing during the period of GET. Evaluation of the outcomes include reviewing in accuracy of CEMS, the way in which it collects and reports data and undertaking sample tests to run through the CEMS. Furthermore, green process models are subjected to walkthroughs and inspections to ascertain their accuracy and value in GET. Potential changes to organizational structures and business models are internally audited to ensure they do not adversely affect the business.

These measurements are incorporated in the feedback by the Green Transformation Cham-pion (GTC) to the boards responsible for the green transformation as also to the business stake-holders. Thus, the review process not only ascertains the achievements of the GET but also opensupdoors for further improvements with partners. The Service Level Agreements (SLA) has to be revisited and necessary modifications has to be made.

5.4.12 Lessons Learned in GET for B4Pack

B4Pack as a product organization with supporting IT systems had to focus on the end-user and its processes.

GET is a comprehensive business transformation process that includes people, processes, technologies, and return on investment (ROI) calculations.

Attitude change for people working on production lines is not achieved only through training. A manual process such as one using whiteboards on the shop floor was as valuable as the implementation of CEMS.

Data centre upgrade required coordination with the production processes that are heavily dependent on the production applications.

It is difficult to measure the overall carbon reduction by optimizing the design of a package, since the carbon footprint of a package is made up of its usage and eventual disposal.

Compliance with ISO 14001 is easy to implement in a production shop, but maintaining that compliance proved to be more challenging.

5.2 CASE STUDY SCENARIOS FOR TRIAL RUNS

New Bank Carbon Scenario

New Bank is a hypothetical bank with head office in a large city on the Eastern coast of Australia. The bank has strong customer base and about 24,000 employees. The bank is equipped with good Enterprise Resource Planning (ERP) software. This bank is perceived as a model bank by the Australian government. The bank is aware of the upcoming legislations regarding carbon emissions. The top management of the bank has incorporated Green IT as an integral part of business. The leaders believe that:

undertaking a transformation of the bank to a Green bank

putting in place environmental strategies that align **closely with the bank's business strategy.**

New bank plans to grow through acquisition. A well-known home loans vendor is in the process of being acquired.

There are approximately 650 branches across Australasian region.

The acquisitions are not evaluated for their carbon footprint at all.

The bank is already above the 150 kiloTonne carbon emission threshold, and is going to berequired to report its carbon data to the government in the next few months.

Bank has recently appointed a chief green officer (CGO)

The bank maintains a fleet of approximately 300 cars— 50 of which are diesel engine cars.

10% of the banks car fleet is usually —hired‖ through a large car rental company (Hybris).

Fifteen percent of the employees need to travel by air to **manage the bank's business across allcities in Australia,** New Zealand, the Asian region, and globally. This averages out to approximately 5000 km per year per employee depending on the global economic climate, **bank's business and need for management.**

Following Is the Result of the Initial Green ITAudit Undertaken by the Bank.

Desktop Machines

Numbers: 2 0,000

Value (current $): $1,200,000

Status: Most conventional PCs are between 2 and 3 years old

Emissions data (as a rough estimate based on spreadsheet): 1,777,500 watts per hour

Conventional = $12,000 \times 110$ w = 1,320,000 w

Laptops = $7,500 \times 60$ w = 450,000 w

Thin clients = 500×15 w = 7500 w

Mobile Devices

Numbers: 2 6,000

Value (current $): $250,000

Status: 2.5 years

Emissions data (estimate): 10 w per day $\times$ 26,000 = 260,000 watts per day

Printers and Peripherals

Numbers (total across the organization): 1000

Value (current $): 500,000

Status (how old/new, etc.): average age 4 years

Emissions data: could not be estimated during the Green IT audit

Data Centre IT and Communication Equipment

Numbers (total across the organization): $12 + 4 = 16$

Value (current $): N/A

Status (how old/new, etc.): 2-year old equipment

Emissions data (if available—or estimate): 16×0.5 kW ph $\times 24 = 192$ kw per day

Network Devices; Routers

10 devices, 50 routers and 20 switches

Challenge: Apply Green IT strategies to New Bank to transition it to a green bank—with statedgoals of 10% carbon reduction over every previous year for 3 years.

Bluewaters Travel Agency Carbon Scenario

Bluewaters is a small to medium travel agency operating out of New York. The company has an excellent, elite client base. The company is well-controlled and well-managed single-owner enterprise with approximately 25 employees. At any one time, the company has about eight computers running, together with associated paraphernalia. In addition, there are copiers, faxes, and shredders in the main office. Some employees do **occasional telework, especially when they don't have** to face a client.

OpenAir Airline Carbon Scenario

OpenAir is a medium, regional airline operating out of the Asian region. The airline has been vulnerable to oil costs during most of its operation. However, with improved opportunities to fly to further destinations than the local region comes the challenge of controlling, reporting, and reducing the carbon footprint. Following are the notes based on an initial investigation commissioned by the corporate board of OpenAir, in the context of carbon emissions: Economic viability of OpenAir is no longer independent of its carbon footprint. Passengers are expecting a m uch greater role from OpenAir in

terms of carbon reduction than merely offering carbon off sets to passengers, e specially a s it expands be yond the Asian region.

While electronic ticketing and check in has been introduced with some success, the board sees a need for mobile ticketing and check in. IT as well as carbon costs for introduction of mobile technologies has not been carefully estimated. Need for sophisticated IT systems on the rise,

especially in supporting the growth in passenger travels, **especially in the business market. Ā e airlin**e has also been launching new products that are based around premium

economy seats, luggage-free, or slow-luggage flights, choices of food and beverage on long flights, and so on. The IT support for these processes required substantial changes to the data centre hardware, operating systems, and the applications themselves. There are still, however, many nonstandard IT systems that are not integrated with each other. Fuel efficiency metrics are not tied to carbon metrics. Scheduling of flights, variations to those schedules, and rostering of staff (pilots, stewards) is not optimized. Besides, there is practically no telework culture within the organization. There is some understanding within the organization about carbon emissions from airline fuel, but hardly any acknowledgment and understanding of internal IT emissions.

OpenAir has about 2000 desktop computers, 300 laptops provided by the organization to the employees, and unaccounted **mobile devices. Ā ere is a single** data centre catering to all the

IT systems requirements, with a non-real time off site backup that is **a major risks to the airline's** business.