4.3 GREEN ENTERPRISE TRANSFORMATION ROAD MAP

Green Enterprise Transformation (GET) is a program undertaken by an organization to change its structure and dynamics that would change its carbon footprint for the better. This transformation brings about the changes to the structure and dynamics of an organization. This may hinder normal operations and also its relationship with its customers and suppliers. Detailed analysis should be done to provide definitions for activities and tasks, deliverables and roles that can be used to achieve the goals of that transformation along with metrics and measurements. Such transformation is further augmented by a competent suite of metrics and

The GET has four phases:

Diagnosis

Planning

Enactment

review based on metrics

GET framework forms a matrix of the four phases and the four dimensions along which these phases get applied. The organization is viewed in a detailed GET through its various internal verticals such as its business portfolio, its networks and other IT infrastructure and, its people, and their attitudes. The enterprises should adopt a framework called **Green point method** that is an IT-specific Green framework encompassing equipment lifecycle, the end-user devices, the data centres, and servers within, and IT as enabler across the organization. There are two types of frameworks:

Green ICT framework and its various elements that help understand and model the Enterprise.

GET process framework that is used for undertaking the transformation process.

There are three elements that brings transformation namely cost, carbon, and customer priorities.

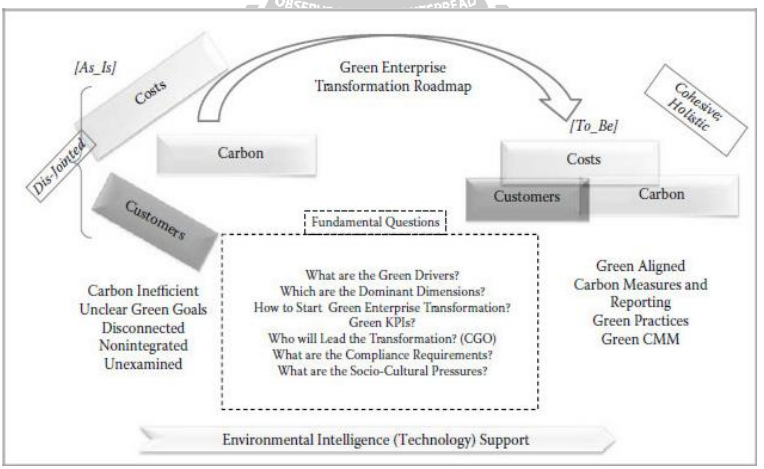

Fig 4.7: Process of Green Enterprise Transformation

The GET process must be able to identify the business goals, the current structure and maturity of the business and steps to be undertaken to become anew, cohesive, agile, efficient, and collaborative green business. A GET is planned and executed along the following four dimensions of an organization facilitate its transformation from where it is to its future green state:

Economic

Technical

Process

Social

A business can be modelled and understood in various ways and through multiple dimensions as a part of its transformation. The modelling should consider he associated risks and its advantages. The prominent factors that have to be considered are people, process and technologies.

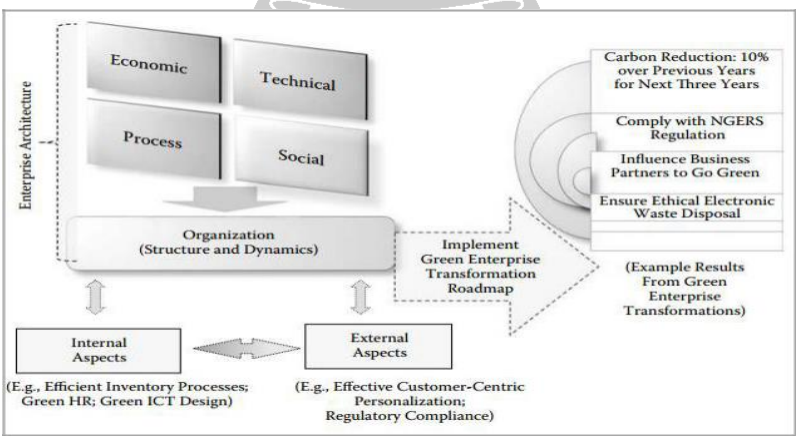

Fig 4.8: Four dimensions to achieve GET

These dimensions are foundations for achieving GET. It is also essential to include the current and future business trend as a part of the model. All the effects caused by GET will be placed under internal (eg: inventory) or external aspects (eg: CRM). Key Performance Indicators (KPI) will be the metric to measure this transformation process. This transformation process framework investigates scopes and incorporates these dimensions within its transformation phases.

Impact of Economic Dimension on GET

The major economic changes in Green transformation in terms of financial steps is changes in budget, product portfolio and Return On Interest (ROI) estimation.

This transforms the perception of business, investment strategies, customer relationships and partnering ventures.

This brings about great change in the business model.

Impact of Technical Dimension on GET

Great changes are needed to transform technologies right from hardware, software, databases, ICT based security protocols, networks and its infrastructure based on the carbon emission ratings.

A best way is to adopt virtualization technologies which can greatly reduce the carbon footprints.

The real metric for assessing the technical impact is the reliability and ease of use of the new technology.

These green technologies should be validated, passes the quality assurance with proper testing.

Also these products must be agile, so that they can adopt to changing business circumstances.

Impact of Process Dimension on GET

This deal with how the business conducts its transactions including both internal and external processes of the organization.

GET changes the manner in which the business interaction happens with its customers, customers and various collaborations.

The success of GET in this dimension can be measured by reduction in carbon emission without compromising the quality and value.

Impact of Social Dimension on GET

The social dimension of GET deals with the sociocultural changes that occur in the GET business transformation.

The transformation must focus on the interest in the people aspect of transformation including clients, employees and business users.

Changes to work culture by adopting telecommuting, telemarketing can greatly impact the people and bring about socio economic change.

Senior managers and leaders of the organization have a substantial effect in changing the attitude of individuals within the business.

These organizational changes can take time to be implemented. Proper training, motivation and aspirations will positively contribute to the success of GET.

A balance between the performance and functionality needs to be maintained during transformation.

Effects of advertisements, value systems of the customers, ethical business practices, and adherence to **the industry's code of conduct are also part of the** social dimension.

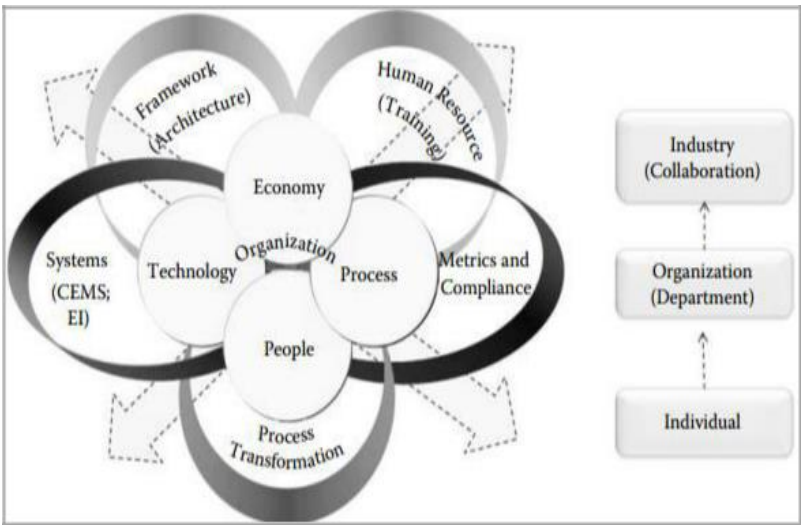

Fig 4.9: Overall framework of GET dimensions

4.3.1 Transforming the Individual, Organizational, Collaborative Processes

Transforming the individual, organizational and collaborative process are three main aspects of the GET. In addition to this, the supporting metrics, and the actual operation

of the organization also undergoes change. The GET transformation requires a diagnostic approach to identifying and documenting the current state of the organization, followed by the vision of the organization. This will affect all the projects, technologies, processes, and demands redefinition of roles. Also, identifying the current and future state, outlining the path to complete the gap and executing the GET requires a combination of internal and external skill sets. Inviting a full-on consulting group for this exercise can include costs, and risks associated with the potential lack of knowledge of the core operations of the organization. Using only internal resources has the risks of not knowing the external legislations, consortium-based actions, and available technologies and resources for GETs. The green metrics for the transformation is given in fig 4.10.

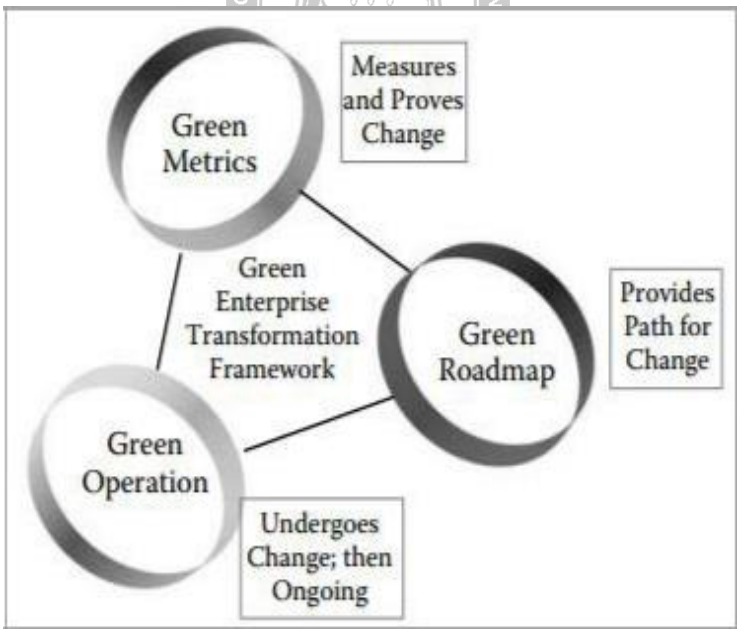

Fig 4.10: Green metrics and supporting roadmap

4.3.2 A Green ICT Framework

Green ICT is the application of technologies and practices that materially reduce resource consumption and harmful emissions in Information and Communications Technology (ICT)life cycles. It involves practice of using computers and telecommunications in a way which maximizes positive environmental benefit and minimizes negative impact.

The GET mainly focus on the state of the organization than the transformation process. The framework given in Fig 4.11 includes major areas of an enterprise from the Green IT perspective. It is actually a is made up of a matrix of four vertical **—pillars‖ and five horizontal —rows.. The pillars depict** the areas within an organization that will undergo change: equipment lifecycle, end-user computing, enterprise, and data centre and ICT as a low carbon enabler across the organization. The horizontal rows includes attitude, policy, practice, technology, and metrics.

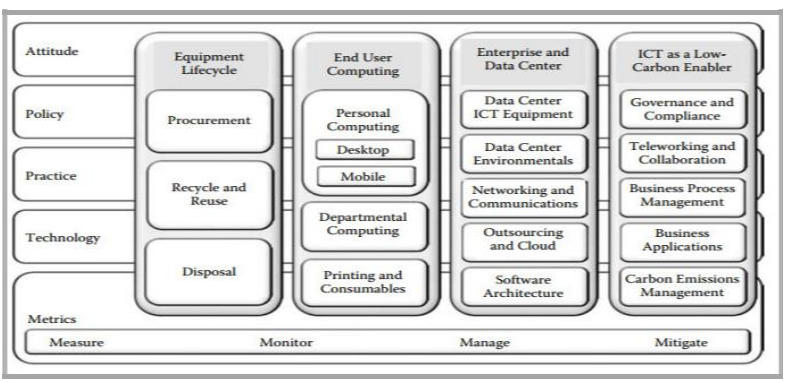

Fig 4.11: Green ICT framework

4.3.3 Equipment Lifecycle

Equipment lifecycle deals with the procurement, recycling and reuse, and eventual disposal of all equipment within the organization.

All equipment in the organization undergo this cycle where in they are procured (POD): Procurement, Operations and Disposal. At disposal of the equipments includes issues relating recycling or reuse. The entire equipment lifecycle is of immense interest in Green ICT as the process of carbon reduction can be initiated right from the procurement phase and continue through its operation and eventual disposal. Supply Chain Management (SCM) and procurement management systems are involved in supporting the optimization of the equipment lifecycle.

4.3.3 Procurement

Procurement makes great impact on sustainability. Focusing the design and procurement of ICT equipment makes a substantial impact on its Total Carbon Cost of Ownership (TCCO). Two major aspects are concentrated:

the nature of the equipment itself

the nature of the suppliers of that equipment.

Energy Star and the Electronic Product Environmental Assessment Tool (EPEAT) should be used before purchase of **any equipment. Supplier's e**nvironmental values in the design and manufacture of equipment and how to measures them, its compliance with relevant environmental laws and codes of practice, and whether the supplier reclaims and recycles old

equipment from customers must also be studied. Energy efficiency, emissions over lifecycle emissions, and the level of waste associated with an equipment are important purchasing factors.

Requests For Proposals (RFPs) and tender documents evaluate suppliers on their environmental credentials and their own green policies and practices.

4.3.4 Recycle and Reuse

Equipments must be periodically replaced. Some equipment have regular refresh cycles, some wait till they have to, and some utilize some sort of continuous update process. This is a natural aspect of the ICT function. Areas of the organization that need newer hardware may be able to share their old equipment to other parts of the organization with less critical processes. Any equipment that complies with the base hardware standards, and that can support the software, is potentially redeployable. Redeployment may also be based on changes to organizational structures, especially when roles are not being refilled.

4.3.5 Disposal of ICT Systems

After extending the useful life of equipment and eventually selling or reusing it, there will can be a situation where it will need to be physically disposed. Environmentally sound disposal practices are vital aspect of Green ICT. The importance of electronic waste disposal has led to the growth of an entire industry around the disposal of ICT and other electronic equipment, often based on the extraction of precious metals from printed circuit boards and other components. The

industry has to be regulated, and there have been legislations, making the environmentally friendly disposal of e-waste mandatory. The manufacturers of computer monitors, printers, photocopiers, laptops, and mobile phones must know what has gone into these products and also understand the repercussion so its disposal in the air, water, and soil.

4.3.6 End-User Computing

End-user carbon efficiencies is very important. End-user computing has the greatest effect on the wider green attitudes **and behavior of the organization's workforce. End**-user computing deals with IT Efficiencies that the end-user has most control over. There are three main areas where Green ICT can be implemented: personal, departmental computing, and printing. The range of technologies where Green IT is deployed:

Desktop computing: Important practices include turning PCs off and various PC power management techniques, and important technologies include thin client computing.

Mobile computing: May have similar power management issues to desktop computers. An array of mobile devices, such as notebook computers, smart phones, and PDAs, may not in themselves use a large amount of power, but there are still a number of Green ICT considerations that need to be taken into account with their usage.

Departmental computing: This computing that is localized to a department and not under direct control of the IT department of the organization.

Printing and consumables: Consume significant energy particularly due to their large numbers and inbuilt inefficiencies.

4.3.7 Enterprise and Data Centre

Enterprise and data centre represent those aspects of an organization that are controlled directly by the IT department. The organizations which are large enough to have a data centre must implement the effective management of the equipment within it and its environmental can be one of the most important aspects of Green IT:

Data centre ICT equipment

Data centre environmental

Networking communications

Outsourcing and Cloud

Software architecture

4.3.8 Data Centre ICT Equipment

The two most important types of ICT equipment in the data centre include servers and storage devices. Servers are usually the biggest consumers of power, and that power consumption continues to rise as more powerful processors are used inside them, and as the number of servers proliferates. Average power consumption of a rack of servers has increased five-fold over the last 10 years when cooling requirements are taken into account. Storage usage is also increasing exponentially—and as prices drop storage devices are often used very inefficiently. Server and storage virtualization has become

one of the key technologies in data centres in recent years. It is often touted as a technology for reducing power consumption, because it reduces the overall number of devices, but in practice most data centre**'s power consumption continues to** rise because the devices are becoming more powerful and use more electricity. The infrastructure of data centre is made up of the following three main aspects:

Power supply: Data centres usually have dedicated power supplies, and very often more than one. Their efficiency varies enormously. Data centres can also generate their own power, and backup power supplies are common for business continuity.

Cooling and lighting: Modern ICT equipment typically demands significant amounts of cooling, either air cooling or water cooling. there are many design and implementation issues that affect power consumption. Lighting is also a factor.

Building that houses the data centre: It may be a dedicated stand-alone facility, or it may be purpose-built within a larger facility, or it may be retrofitted into existing premises. Whatever the case, there are a number of aspects of the built environment that will have an effect on power consumption, such as insulation.

4.3.9 Networking and Communications

The area where Green ICT can be implemented in networking:

Local area networking: Many organization's LANs and data centre networks consist largely of collection of cables that consume large amounts of power and which

add to cooling requirements. More efficient cabling design means lower power consumption.

Wide area networking: Many organizations use leased data lines or VPNs over the Internet. While they do not have direct control over these networks, their inefficient usage adds to overall power consumption and increases the overall carbon footprint.

Wireless communication: Wireless will never wholly replace cabling, but it is becoming more widely used and it does have a major role to play. But wireless communications can be very inefficient, especially when transmitters and receivers are left on when they are not being used.

4.3.10 Outsourcing and Cloud Computing

Outsourcing has been one of the big issues in ICT since the industry began. The main issues here are cost and capability. The outsourcing vendor has economics of scale and availability of skills. Many facilities management companies are now highlighting their green credentials and building energy-efficient data centres that they say will enable users to lower their overall carbon footprint. The key issue is the measurement. It is impossible to tell if outsourcing is a good deal or not financially **if you don't know the real cost of what is being outsourced.**

4.3.11 Software Architecture

Computer systems consist of software running on hardware. Software is the system, and hardware is simply an enabling technology. Most discussion about Green ICT refers to

hardware, but software is also a factor. Software architecture often determines the hardware architecture, which in turn may have a significant effect on the amount or type of hardware used—with all the consequences of the energy consumption of those systems. A software that preinstalled on new devices, come bundled with other downloads, or are injected into your system through malicious sites are bloat wares. Systems can be developed from scratch, adapted or borrowed from other software, or purchased off -the-shelf. Each approach has consequences for energy consumption.

4.3.12 IT for Enterprise

A vital aspect of Green IT is its use in reducing the carbon footprint as the whole organization. It is generally agreed that IT emissions are mainly through the usage of electricity which in turn comes from carbon emitting power stations. The real potential benefits of Green IT are in using IT as an enabling technology to help the organization, and the wider community, reduce its carbon emissions.

4.3.13 Governance and Compliance

Publicity about climate change and related issues has greatly raised the profile of sustainability, and virtually all organizations are attempting to boost their green credentials. In some cases they do it because they are forced to. Many organisation sincerely wants to do the right thing. Corporate governance is the processes by which organizations ensure that they are properly managed, not only in terms of meeting their regulatory obligations, but to ensure that they do the right things by all their stakeholders. This also includes management, shareholders, and staff , and is extended to include business partners and others in

the organizations extended supply chain. This extension is based on a growing awareness that, when it comes to the environment, everybody is a stakeholder, and that good corporate governance also includes good environmental management. Green ICT is in many ways a management and governance issue.

4.3.14 Teleworking and Collaboration

Teleworking is a range of technologies and practices that have to do with working at a distance or working remotely. The carbon reduction benefits of teleworking are mostly associated with reduction in personal travel obviating the need to drive a car or catch a plane reduces the carbon footprint of that activity by the amount of fuel generated by that travel. Teleworking also opens up opportunity to collaborate more than in the physical world. Collaboration tools and techniques enhance the capability of a group of people to work together. There are a great many ways to do this, but all of them entail being able to share **documents, processes, and information. Ā is showing makes the** business processes more efficient and reduces the need for physical contact.

4.3.15 Business Process Management (BPM)

Business process management is the process of improving the ways an organization or an individual does things thus making them more efficient, with fewer steps or greater effect. Green BPM identifies five phases relating to a process: design, modeling, execution, monitoring, and optimization. A Green BPM refers to the managing and improving of all business processes from their carbon perspective. Environmental intelligence has a major role to play in Green BPM.

4.3.16 Business Applications

ICT-based business applications include financial management systems (FMS), enterprise resource planning (ERP), supply chain management (SCM), and customer relationship management(CRM). Many organizations also run customized applications that are specific to their industry that would provide them with competitive advantage.ICT is very important in each of these applications, which essentially support BPM. Green BPM seeks greater efficiencies in every phase of every process. Even small improvements can have a significant effect on carbon reduction, because of the scale of the operation and because of flow-on effects further up the supply chain. Green ICT has a very important role in improving the efficiency of many industrial and commercial processes specific to individual industries, paving the path for their leanness.

4.3.17 Carbon Emissions Management

Carbon emissions management is an emerging discipline that focuses on the management and ultimately the mitigation of **an organization's carbon e**missions. This includes the use of ICT systems specifically designed to reduce the carbon footprint, rather than doing so as a by product of greater efficiency. A key ICT application is CEMS, which provide a compliant and consistent format for presenting greenhouse gas emission data to executive management and regulators. As the carbon emissions regulatory framework continues to evolve, CEMS is becoming an increasingly popular tool to manage the carbon emissions lifecycle.

4.3.18 Attitude

Though attitude is intangible trait, it is a major part of the subjectivity in the social dimension of GreenIT. Much of the success of GETs depend on the attitude of the people within the organization. It is also very subjective. Attitude can be understood as a desire and a commitment to change by the individual that is based on honest belief in the ensuing results. Having a positive attitude toward Green IT is at the heart of the transformation as it is depend on individuals. And, as is often the case in business, those attitudes are most effective if they come from the top. Management buy-in is an essential part of any Green IT program.

4.3.19 Policy

Policies help set the direction for the organization and provided basis for action. Communication of policies is also vital and needs to take the HRs in confidence. Examples of policies affecting the entire organization include the organization shall only provide goods and services from certified, green vendors; users will be encouraged to not take separate, individual backups of their databases.

4.3.20 Practice

Practices are the things that are carried out in the organization. Practices implement policies. They are the techniques, the behavior that is expressed by the individuals and organizations. An interesting aside to practice is that they, like processes, involve alteration of habits and change of mindsets (attitude) rather than procurement of new equipment. This is involves training. Examples of practices include switching off

computers when not in use; implementing virtualization of all services; replacing existing high carbon emitting equipments with new, green ones; and ethically disposing of electronic waste.

4.3.21 Technology

Technology is the hardware, databases, and network and systems aspect of Green IT. Green IT techniques of using thin clients, ritualizing data servers, and using duplex printers are all examples of technology-based changes in the organization that lead it toward Green IT. Procurement of new, low carbon emitting equipment is an investment that needs to be considered in the long term in the context of the TCCO metrics. The costs associated directly with a new equipment also needs to consider the waste inherent in disposing of the old equipment—especially if that equipment is still operational. An ideal way to approach equipment replacement is to balance out the change and incorporate the practice of Green IT as part of the normal equipment replacement cycle.

4.3.22 Metrics

Green IT metrics deal with measurement of carbon emissions of the organization in its state. Metrics also determine the future state has been achieved or not. Choosing the right tools to measure, monitor, and potentially mitigate power consumption and carbon emissions, both inside and outside the IT department, is critical in the GET. Good set of green measures ensure that Green IT projects receive maximum business commitment and are proven to be successful over time. Only with adequate measurement can progress be proved. Hence, metrics need to be supported by smart metering.