1.Why is green IT subjective? What can be done to convert the subjective?

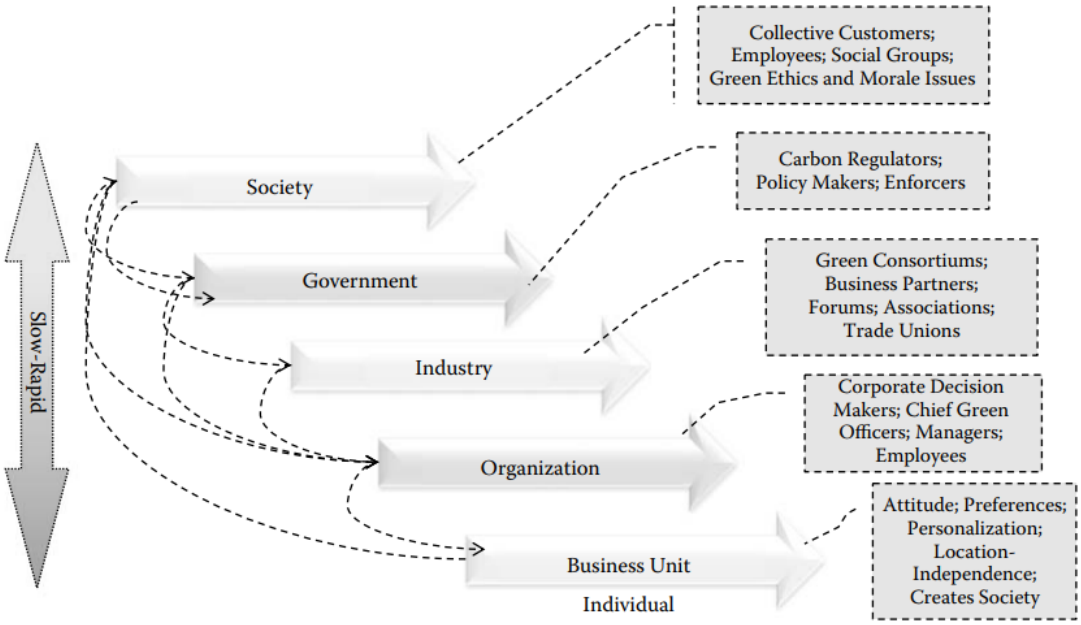
The term "green IT" is often used to refer specifically to the use of information technology to reduce the carbon footprint of businesses, organizations, and individuals.

The subjectivity of green IT comes from the fact that it is a broad and complex field, and different people and organizations may have different definitions of what constitutes green IT. Some may focus on the environmental impact of the manufacturing and disposal of computer hardware, while others may be more concerned with the energy consumption and carbon emissions of data centers and other IT infrastructure. Additionally, different approaches to green IT may be more or less effective in different contexts, depending on factors such as the size and nature of the organization, the specific IT needs of the organization, and local environmental conditions.

For example, those employees with families and who need to travel significant physical distances in peak hour traffic may make extensive use of remote access and mobile computing to work from home. HR will enable separation and definition of these roles based on the familiarity of individuals with this mode of work as well as identification of roles within the organization that are non customer facing. multiple stakeholders have different interests, are operating at different levels, and progress at varying speeds. Socially, the rate of change in terms of Green I T for these stakeholders is a subjective element of the transformation.

Steps:

1. development of Green IT policies with consensus and their practice right from the leadership of the organization down to departmental heads and team leads becomes important.
2. Effectiveness of green transformation changes depend on this leadership changes
3. Set clear sustainability goals: Defining specific and measurable sustainability goals can help organizations prioritize their efforts and track their progress towards becoming more environmentally friendly.
4. Use standardized metrics: There are several standardized metrics that can be used to measure the environmental impact of IT systems, such as the carbon footprint of data centers or the energy efficiency of computer hardware. Using these metrics can help organizations compare their performance to industry benchmarks and identify areas for improvement.
5. Use third-party certification programs: Third-party certification programs, such as the LEED (Leadership in Energy and Environmental Design) program for buildings or the Energy Star program for consumer electronics, can provide objective assessments of the sustainability of IT systems.
6. Engage stakeholders: Involving key stakeholders in the decision-making process, such as employees, customers, and suppliers, can help organizations consider the full range of environmental, social, and economic impacts of their IT systems.



2.What are the various role based views of green IT in an organization? How does the view of a decision maker differ from that of an IT consultant ?

The role-based view of green IT is a framework that helps organizations understand the various roles and responsibilities that different stakeholders have in achieving sustainability in the field of information technology.

According to this framework, there are four main roles that stakeholders may play in green IT:

1. Consumers: Consumers are individuals or organizations that use IT products and services. They play a crucial role in driving demand for sustainable IT solutions, and their purchasing decisions can influence the development and adoption of green IT practices by manufacturers and service providers.
2. Manufacturers: Manufacturers are responsible for the design, production, and distribution of IT hardware and software. They can play a significant role in reducing the environmental impact of IT products through the use of eco-friendly materials, energy-efficient production processes, and responsible disposal practices.

3. Service providers: Service providers are organizations that offer IT-related services, such as cloud computing, data storage, and networking. They can contribute to sustainability through the use of energy-efficient data centers, the adoption of renewable energy sources, and the implementation of efficient resource management practices.
4. Regulators: Regulators are government agencies or other organizations that establish and enforce rules and standards for the IT industry. They can play a key role in promoting sustainable practices through the development of regulations, incentives, and other policy measures.

For example, the decision maker is primarily interested in the ROI on the green initiatives, where an engineer is interested in improvement of design and production process.

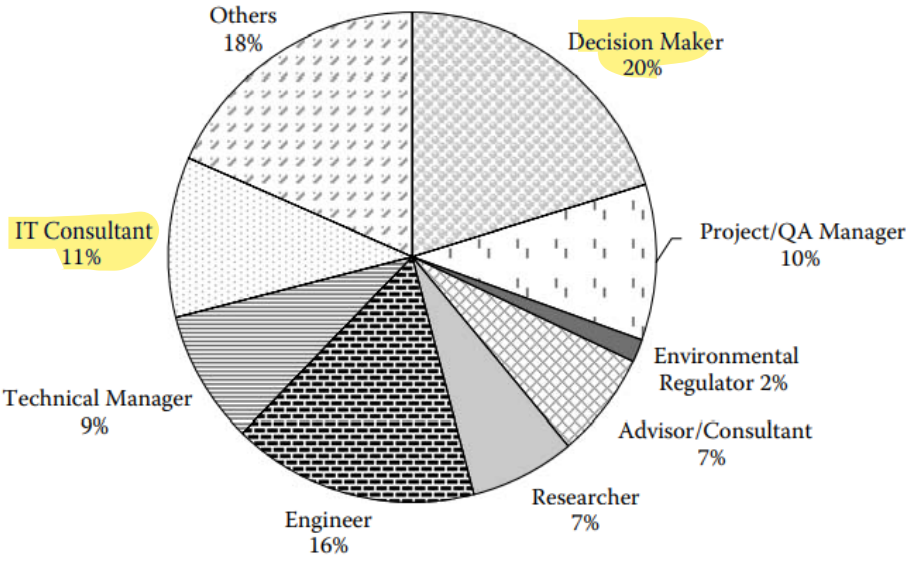


Figure 8.2 Role-based view of Green IT.

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Table 8.2 Roles within Organization and Their Subjective Viewpoint

Role	*Green IT Subjective Viewpoint*
Decision maker (20%)	Major interest in the ROI, as that justifies their actions. Legal, compliance requirements, however, change the balance of their ROI metrics. Green IT strategy formulation, policies. Participation in consortiums.
Project manager/quality assurance manager (10%)	Interested in the implementation of the green program, the steps to be taken for that implementation, and the successful review at the end of the project. Aims to complete the project with minimum time and budget.
Environmental regulator (2%)	Creation of regulatory benchmarks. Compliance metrics, their measurements, reporting of that carbon data. Interested in issues arising out of noncompliance. Participation in standard creation.
Advisor (management consultant) (7%)	Analyses of the organization business processes in order to introduce green environment. How to reduce risks in implementing Green IT. Lean process. Participation in standards compliance.
IT consultant (including Green IT) (11% + 7%)	Model processes, optimize, smart networks, green enterprise architecture (ISO standards).
Engineer (manufacturing/ production) (16%)	Optimize production, improve design.
Technical manager (9%)	Focus on technologies for carbon reduction (as against economy and services).
Researcher (7%)	Undertaking Green IT investigation, pure and applied research. In any or all four dimensions of Green IT.

A decision maker is likely to prioritize the overall goals and objectives of the organization, such as reducing costs, improving efficiency, or meeting regulatory requirements. An IT consultant in green IT, on the other hand, would focus on identifying and implementing technology solutions that reduce the organization's environmental impact and carbon

footprint. While both parties may have the organization's best interests in mind, their perspectives and priorities may differ based on their respective roles and areas of expertise.

3.What are the two different aspects of green enterprise frameworks?

Green enterprise transformation (GET)

Information and Communication Technology (ICT)

ing two types of frameworks: Enterprise framework & Process Framework

(a) Ā e Green ICT framework and its various elements that help understand and model the enterprise—in its "as is" and "to be" state. Ā is framework is similar to the popular enterprise architecture frameworks such as Zachman (1987) and TOGAF (2010). Ā is is a relatively static model of the organization that shows the structure and dynamics of the organization.

(b) Ā e GET process—this is also a framework, but a process framework that is used for undertaking the transformation process; this process outlines the activities and tasks and

deliverables and roles of the organization that are involved in the transformation process. Ā is is a dynamic, flowing model that describes how to engender change.

While the above two types of frameworks are interdependent, they are not the same. Each framework needs to be treated separately and then considered together in practice. Ā e Green ICT framework on its own is an excellent mechanism to model the green enterprise; the transformation framework is the basis for the roadmap to undertake transformation.

An enterprise framework is a set of principles and guidelines that an organization follows to integrate sustainability into its operations and decision-making processes. A process framework, on the other hand, is a set of structured steps or activities that an organization follows to achieve a specific goal or objective.

In the context of green IT, an enterprise framework might include guidelines on how to incorporate sustainability into the organization's IT strategy and policies, while a process framework might outline specific steps for implementing eco-friendly practices in areas such as data center management, hardware procurement, or software development.

Both enterprise frameworks and process frameworks can be useful tools for helping organizations achieve sustainability in the field of information technology. Enterprise frameworks provide a high-level roadmap for integrating sustainability into the organization's operations, while process frameworks provide more detailed guidance on how to achieve specific goals related to green IT.

4.what is the importance of equipment lifecycle as compared with data center efficiencies?

The equipment lifecycle and data center efficiencies are both important considerations in the field of green IT, and they are often interrelated. The equipment lifecycle refers to the entire lifespan of a piece of IT equipment, from its production and use to its disposal. Data center efficiencies, on the other hand, refer to the energy efficiency and resource utilization of a data center, which is a facility used to house and operate large numbers of servers and other IT equipment.

One of the key ways that equipment lifecycle and data center efficiencies are related is through the energy efficiency of IT equipment. Energy-efficient equipment can help reduce the overall energy consumption of a data center, which can in turn lead to cost savings and reduced environmental impacts. On the other hand, using inefficient equipment or operating a data center in an inefficient manner can lead to higher energy consumption and greater environmental impacts.

It is also important to consider the disposal of IT equipment at the end of its lifecycle. Proper disposal of equipment can help minimize the environmental impacts of e-waste, which is a growing problem worldwide.

In summary, both equipment lifecycle and data center efficiencies are important considerations in green IT, and it is important to consider both in order to minimize the environmental impact of IT systems.

Ā e equipment lifecycle deals with the procurement, recycling and reuse, and eventual disposal of all equipment within the organization. Ā e primary interest, in this lifecycle, is of electronic equipments (such as desktops and servers) that produce emissions. However, the equipment lifecycle is interested in all equipments. All equipment in the organization undergo this cycle wherein they are procured (or manufactured), sold, used (and reused), and ultimately disposed. Ā at disposal of the equipments includes issues relating recycling or reuse. Furthermore, there are also important issues relating to ethical disposal of the equipment. Ā e 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 typically involved in supporting the optimization of the equipment lifecycle. Ā is equipment lifecycle is part of bigger, organizational lifecycle.

As was discussed in Chapter 5, the three phases to the equipment lifecycle are—procurement, operations, and disposal (P-O-D). Each of these phases can be approached in a creative manner that reduces the carbon footprint of the organization. Disposal—predates the concept

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5.describe the four dimensions of green enterprise transformation along with its supporting diagram.

1. Economic dimension: This dimension refers to the financial impacts of sustainability efforts, including cost savings, revenue generation, and competitive advantage.
2. Technical dimension: This dimension refers to the technical aspects of sustainability, including the design, production, and use of eco-friendly products and processes.
3. Process dimension: This dimension refers to the processes and systems that an organization puts in place to manage sustainability, including policies, procedures, and metrics.
4. Social dimension: This dimension refers to the social impacts of sustainability, including the well-being and prosperity of employees, communities, and other stakeholders.

By considering these dimensions, organizations can ensure that their sustainability efforts are well-rounded and address a range of economic, technical, process, and social issues.

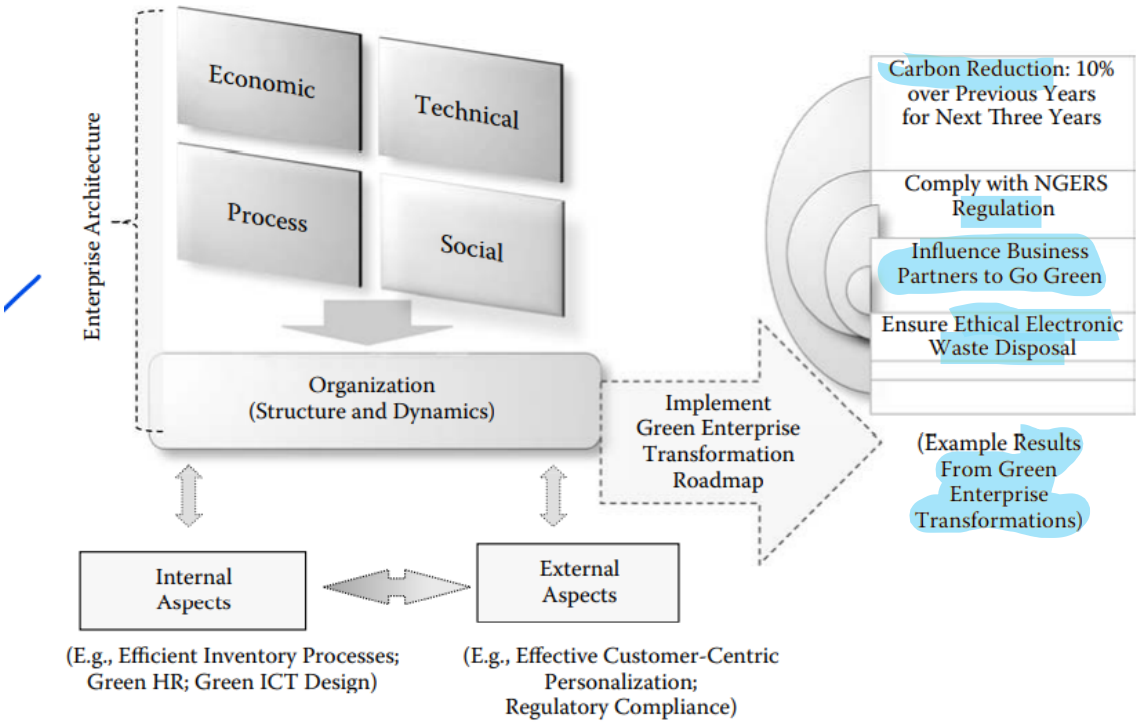

Figure 9.2 Applying the four dimensions to GET.

new, cohesive, agile, efficient, and collaborative green business. A GET is planned and executed along the four dimensions of an organization facilitate its transformation from where it is to its future green state. To bring about that change, a business can be modeled and understood in various ways and through multiple dimensions as a part of its transformation. An earlier study by Arunatileka and Ginige (2003) had identified the factors influencing business transformations and the risks and advantages associated with them. Ā ese factors were based along the lines of people, processes, and technologies. Ā ese factors were also identified, extended, and separately applied by Arunatileka, D., Ghanbary and Unhelkar (2006) in undertaking business transformation and by Unhelkar (2009) for transforming mobile businesses. Unhelkar further discussed and defined these factors as economic, technical, process, and social in the mobile enterprise transformation framework (Unhelkar 2008) as a means for undertaking mobile business transformation. Ā us, these four dimensions, described earlier in Chapter 2, form the areas along which Green transformation can take place.

Ā e four dimensions along which an organization transforms are shown in Figure 9.2. Ā us, these dimensions provide the backdrops for creating a Green enterprise architecture that would model the two "as is" and "to be" states of an organization. Unhelkar and Ginige (Unhelkar and Ginige 2009) have extended and applied the use of enterprise architecture in modeling the current and future expected state of the business as well as how to reach there. Ā e effect of these

dimensions can be broadly grouped into internal and external effects—as shown in Figure 9.2. Ā e internal processes such as the inventory and HR processes are updated to green processes; and so also the external processes, such as the CRM processes to Green CRM. Transformation of the internal and external processes of the organization is coupled with the development of the Green IT portals (Chapter 6). Ā e internal and external transformation of processes an organiza-

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6.write a short notes on :a) Green ICT framework b)Green transformation process

ICT Framework

Ā is Green ICT framework, shown in Figure 9.5, is made up of a matrix of four vertical "pillars" and five horizontal "rows." Ā e vertical pillars depict the areas within an organization that will undergo change—and they are the equipment lifecycle, end-user computing, enterprise, and data center and ICT as a low carbon enabler across the organization. As will be seen later, in Figure 9.7, these pillars evolve into work areas, or focus areas for transformation. Ā e horizontal rows, in this Green ICT matrix, are made up of attitude, policy, practice, technology, and metrics. Ā ese horizontal rows form the elements of change. Ā ese vertical and horizontal elements of this Green IT framework are described next.

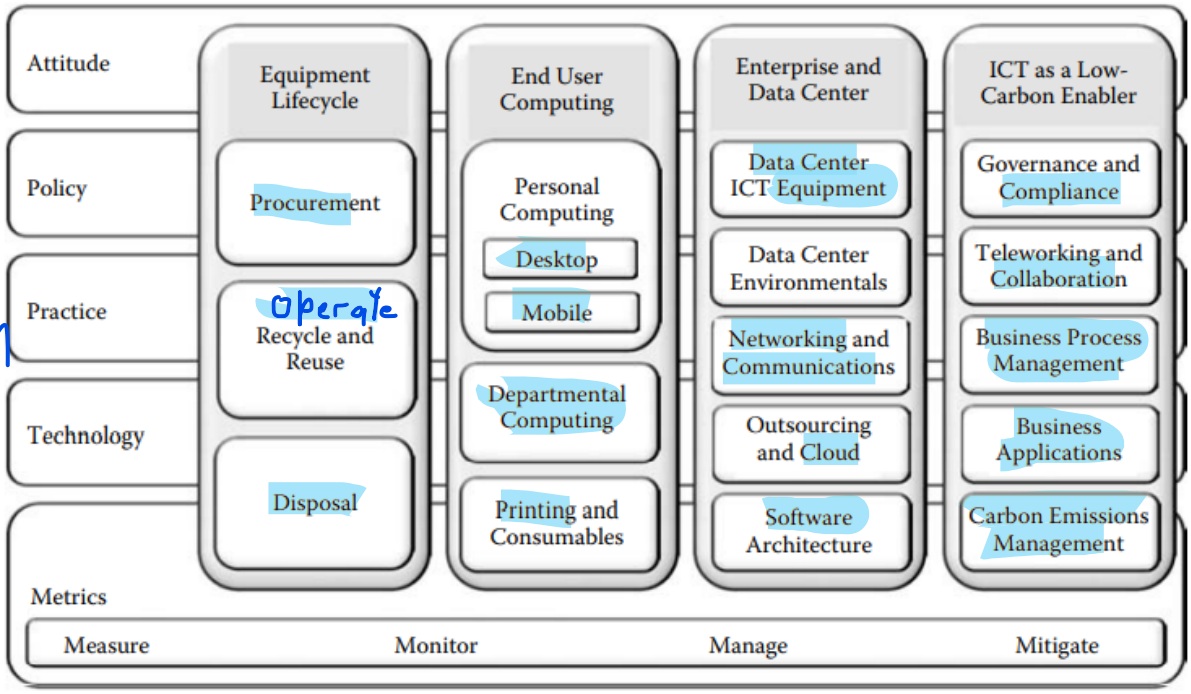

Figure 9.5 Green ICT framework. (The Envirability-RMIT Green ICT framework is reproduced with permission from Connection Research).

The basic Green transformation process is made up of 4 + 1 phases: diagnose, plan, enact, and review—interspersed with metrics and measurement.

The eight focus areas of any business transformation, applied here to GET are as follows: business model, product and service portfolio, customers and partners, ICT systems, applications and databases, operational, organizational, business processes, networks and infrastructure, and regulatory.

Types and size or the organization affect the GET process.

As m entioned e arlier, t ransforming to a G reen en terprise i s actually a business transformation program. Project from various dimensions in the business, infrastructure and systems area make up the transforming program. Figure 9.6 shows a ba sic Green transformation process. Ā e four major phases of transformation are shown here as diagnose, plan, enact, and review. Ā is figure a lso sh ows t hat w hile t hese fo ur p hases ap pear sequential, in reality they are iterative; with the number of iterations required for a successful transformation to be decided by the chief green officer (CGO) together with the person responsible for GET.

Figure 9.6 The basic Green transformation process.

7.Discuss the ways in which standards in environmental management can be enhanced

Ā e ISO 1 4000 family of standards, discussed in the previous chapter, are also evolving. For example, the ISO 1 4001 standard, which specifies the requirements of an environmental management system, does so in the context of a specific product or an organization. However, this standard does not contain requirements for that would handle environmental practices associated with collaborative organizations—especially if these organizations are collaborating dynamically. Either the ISO 1 4000 series of standards need to be upgraded to include dynamically collaborating businesses or a new set of standards are required to cover the environmental practices of such collaborations. Furthermore, environmental governance standards that deal with embedding environmental management within corporate governance structures (based on ITIL and CoBIT, for example) are also required. Standards that can dictate, from an environmental perspective, the use of aforementioned emerging technologies, are also required. Finally, the use and deployment of the standards themselves need to make use of the Cloud and be SaaS based—reducing the overheads associated in complying with them and their related reporting. Such standards would incorporate emergent technologies, practices, and methods of development and deployment of software applications and services.

There are several ways in which standards in environmental management can be enhanced:

1. Regular review and updating: Standards should be reviewed and updated regularly to ensure that they remain relevant and effective in addressing current environmental challenges. This may involve seeking input from experts, stakeholders, and the general public.
2. Strict enforcement: Standards should be strictly enforced to ensure that organizations are held accountable for their environmental performance. This may involve the use of fines, penalties, or other enforcement measures.
3. Promote transparency: Standards should be developed in an open and transparent manner, with input from a wide range of stakeholders. This can help ensure that standards reflect the needs and concerns of different groups and are widely accepted.
4. Incentivize compliance: Organizations that meet or exceed environmental standards should be recognized and rewarded, through incentives such as grants, subsidies, or other forms of support.
5. Promote education and awareness: Raising awareness about environmental standards and their importance can help encourage compliance and support for environmental protection. This may involve education and training programs, public outreach efforts, and other forms of communication.

By taking these steps, organizations can enhance the effectiveness and credibility of environmental management standards and help drive progress towards a more sustainable future.

8.what is collaborative environmental intelligence ?Discuss two ways in which collaborative EI can be applied in today's organizations to reduce carbon footprint.

Collaborative environmental intelligence (EI) is the process of collecting, analyzing, and sharing environmental data and information in a way that promotes collaboration and decision-making within and among organizations. Collaborative EI can be applied in various ways to help organizations reduce their carbon footprint, including:

1. Sharing data and information: By sharing data and information about their environmental impacts, organizations can learn from each other and identify opportunities for improvement. For example, an organization that has successfully implemented energy-efficient practices may share its experience and data with other organizations to help them reduce their own energy consumption.
2. Developing environmental performance benchmarks: Collaborative EI can help organizations develop environmental performance benchmarks, which can be used to measure and compare the environmental impacts of different products, processes, or services. This can help organizations identify areas for improvement and set goals for reducing their carbon footprint.
3. Collaborating on sustainability initiatives: Collaborative EI can also facilitate collaboration on sustainability initiatives, such as the development and implementation of renewable energy projects or the adoption of eco-friendly supply chain practices. By working together, organizations can leverage their collective resources and expertise to drive progress towards sustainability.

Collaborative intelligence is described by Unhelkar and Tiwary (Cutter 2010) as a technical platform where multiple organizations are collaboratively sharing their business intelligence for the win-win outcome without compromising their own market position and differentiation.

Developing and formalizing the collaborative EI capabilities will provide collaborating organizations with market differentiators in the environmental space

Collaborative EI brings collaborations and EI together—thus helping the business world to get ready for the carbon economy without going through the rigors of "reinventing the wheel." For example, through collaborative EI, noncompetitive carbon data. and analysis can be shared easily amongst organizations and governing bodies.

Ā is sharing of carbon capabilities can also extend to sharing of many basic environmental systems components such as security, access, and authentication. Such sharing of technical components can play a positive role in the compliance of security and privacy requirements related to the environment.

Following a re specific to pics of interest and future investigations in relations with collaborative EI:

- Collaborative carbon data for trend plotting—carbon data and information from multiple sources and many organizations is required to create an industry-wide picture of carbon trends. Interfacing data warehouses will create environmental insights that are not possible with single, organizational data base.
- Collaborative data warehouses—will reuse common, noncompetitive, sharable carbon data that will reduce replication of data and corresponding processing.
- Collaborative EI using Cloud computing—collaborations in the Cloud will enable improved and consolidated carbon data and device management. For example, smart meters can collect and transmit data not to single organization but to the systems and facilities in the Cloud.
- Collaborative EI with mobile technologies. Results in a mobile data warehousing, OLAP, and data mining that come from business Intelligence and are applied to environmental intelligence. A carbon data warehouse is a large repository of data collected from operational data sources that deal with environmental information. OLAP and data mining techniques can be used to identify and interpret patterns from such collaborative organizational data.
- Collaborative EI and Green Blogs—provides opportunities for free exchange of information and ideas on the environment. Ā is advantage of such Green blogs and discussions is that they remain stored for future reference, can be indexed and researched into and provide collaborative opportunities beyond regular journals or magazines. Blog-based communication facilitate greater exchange of ideas between organizations, facilitate sharing those ideas in real time and enable customers to voice their preferences.

- Collaborative EI and Web 2.0/Web 3.0. Ā e new version of the web set new trends in the communication technologies that go beyond the basic task of communication (Unhelkar and Trivedi 2009). Ā e characteristics of these technologies are rich user experience, ability of the user to not only glean information but also execute services, enable dynamic content, and enable scalability. Ā e instant collection of carbon data and information, and instant feedback through applications that run on the new web platforms, provide the management and leadership of the organization to make instant decisions regarding the direction of the collaborative organizations. Implementation of Web 2.0 technologies on the mobile devices will reduce the energy use as mobile gadgets consume less energy than desktop computers as well as virtualizes the server resources leading to a sustainable and environment friendly system.
- Collaborative EI and GRID computing—the GRID of computers, connected via a network, is the precursor to today's Cloud computing. A computing GRID was basically interested in sharing otherwise unused computing power (Unhelkar 2004)—as against a Cloud that also brings in business rules for sharing and paying for the resources. However, the GRID is a known paradigm for computer connectivity and should be certainly explored for the possibilities of reducing the overall global computing needs. For example, a wireless GRID may offer the opportunities to completely sidestep the need to build a physical communication network—saving the carbon footprint of a physical infrastructure.