

Green IT Fundamentals

Introduction

- An indisputably winning argument behind the implementation of Green IT initiatives is based on business efficiency.
- It is the same reason why businesses strive to be lean (fewer resources and less waste), improve their quality, and reengineer their processes. Thus, while many reasons exist for why an organization should become green, the one reason that is beyond reproach is that “A green business is synonymous with an efficient business.”
- A close synergy exists between a lean and a green business. Synergy between lean and green has immense potential to benefit both, the business and the environment.

- Green IT (also referred to as Green ICT or Green computing) has been defined or described by several sources but it is the definition of Murugesan (2008) that is particularly comprehensive: “the study and practice of designing, manufacturing, using, and disposing of computers, servers, and associated subsystems (such as monitors, printers, storage devices, and networking and communications systems) efficiently and effectively with minimal or no impact on the environment.
- It's definition can be interpreted as serving an organization's attempt to achieve economic viability and improve system performance and use, while abiding the social and ethical responsibilities.
- Lamb (2009) simplifies this definition: “Green IT is the study and practice of using computing resources efficiently.” Thus, Green IT includes the dimensions of environmental sustainability, the economics of energy efficiency, and the total cost of ownership, which includes the cost of disposal and recycling.

- Increasing the value and reducing the costs, the hallowed mantra of a lean organization, is investigated deeply only to discover that reduction in carbon, in so many ways, is closely aligned to reduction in costs.
- Seen from a better business perspective, carbon consciousness can be incorporated as an integral part of the mainstream business strategy, rather than as an “add on” to the core business.

The Environment Today

- Whether human activity is the cause of change in the environment or not becomes a background conversation to improving business and achieving environmental outcomes in the process.
- It is this business-driven collaborative path that opens opportunity for corporate action.
- While the cause for climate change can be investigated it in itself need not be the deciding factor in undertaking Green IT initiatives.
- For example, if only the facts are considered (and not necessarily the philosophical discussion as to who is creating this climate change), then it is plain and obvious that the Earth as it stands (or revolves) now will run out of coal and oil.
- It also implies that the source for plastics and related chemicals will dry up; but the pollution and wastage generated from these plastics will remain with us. Thus, in a way, the closing scene of this play is known.

- What is required is sharp business innovation to see that when the curtain falls the actors and the audience still have food, air, and water.
- IT in business makes use of massive computing and networking technologies that require large and dedicated data centers.
- The location of these data centers and the people who work in them are all socially affected by this use of IT by business.
- Furthermore, as the social fabric gets disturbed, it in turn affects the overall environment in which the society exists.
- Finally, there is also a direct influence of IT on the society and environment—independent of its influence on business.

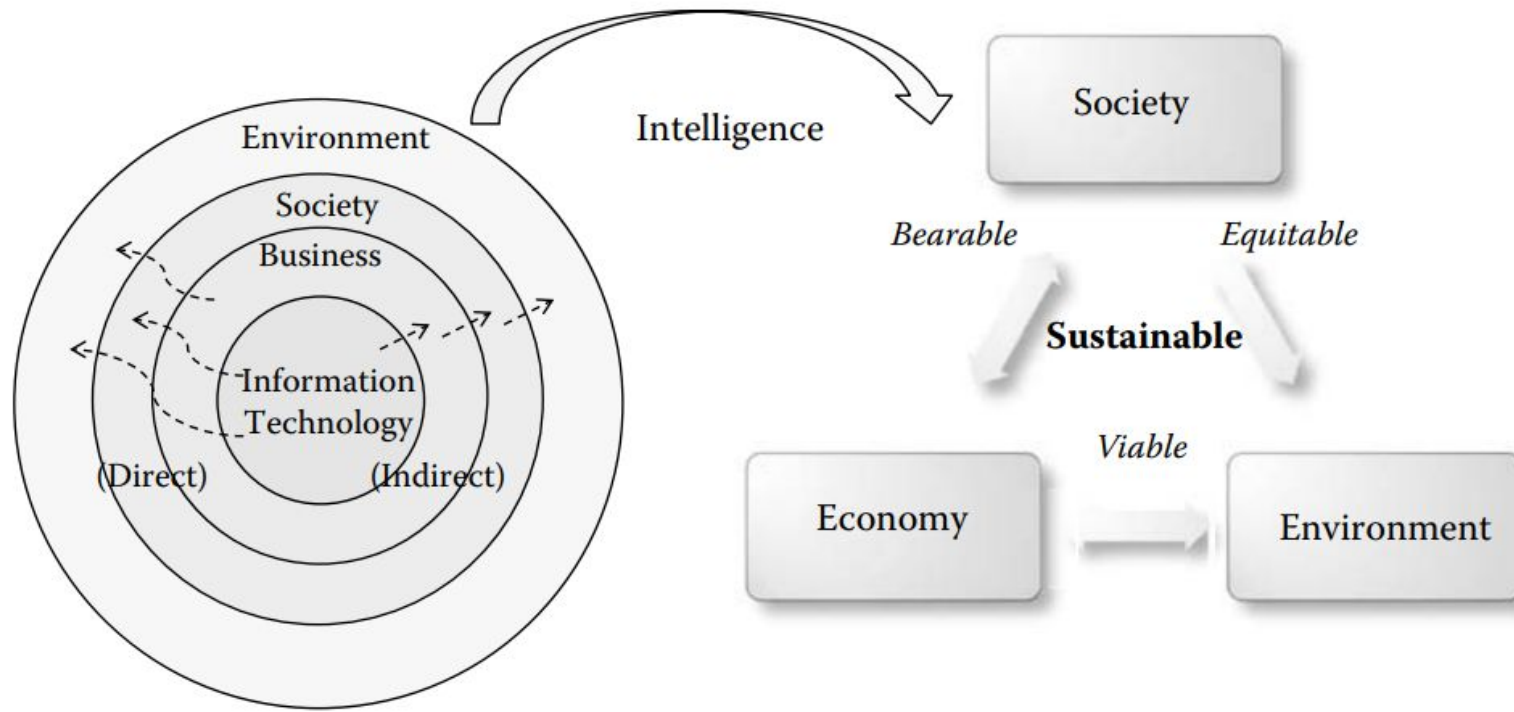


Figure 1.1 Information technology influences business, society, and environment—lead up to the sustainable triangle.

- This direct influence of IT is seen in the massive proliferation(growth) of household gadgets, use of computers in schools and hospitals, the popularity of social networking, and the high level of communications technology (such as a GPS) in vehicles.
- Businesses that generate carbon and pollute the atmosphere are unlikely to be sustainable in the long run, whereas green businesses that use IT intelligently add substantially to their risk management repository and are most likely to be successful businesses both now and in the future.
- This viewpoint is depicted on the right side in Figure 1.1, wherein the sustainable triangle of an organization is shown to be made up of a balance between society–economy (how much can the society bear?), economy–environment (is the environmental initiative usable?), and society– environment (is the environmental consideration impartial?).

- This holistic, balanced approach to the business and the environment is strongly repeated through the thought processes of various consulting practitioners and researching academics.
- The varied viewpoints in that handbook range from the need to optimize supply chain processes, switching off computers when not in use, and designing low-carbon emitting microprocessor chips to creating long-term awareness about the environmental protocols and standards, and changing attitudes of users and employees through education and training.

- The following are some of the specific ways in which a comprehensive Green IT strategy is beneficial to an organization:
 - Incorporates environmental issues within the business strategies in way that is complimentary to each other
 - Demonstrates the importance of environmental issues as one of the “core” business issues rather than merely “good to have” add on.
 - Explores the possibilities of enhanced green performance to discover and develop new business opportunities.
 - Expands the technologies of Business Intelligence for the purpose of reducing the organization’s carbon footprint—leading in to what is called Environmental Intelligence (E I)
 - Discusses the importance of people, their attitude, and approaches to Green IT that would bring about a positive change without condemnation
 - Expands on the role on Green HR including the training and positioning of roles and responsibilities in the green space

- Expands on the vital role of business leadership in bringing about positive green change across the organization.
 - Incorporates the use of mobile technologies and smart metering for real-time measurements and use of carbon data
 - Outlines the approach to Green IT audits for reporting and compliance
- As is seen by the above list, a Green IT strategy offers a lot more value to the organization that goes beyond the confines of IT per se.

Information Technology and Environment

- As mentioned earlier, IT is an inseparable, integral part of modern business. In fact, IT is so closely intertwined with business processes that it is difficult to imagine any modern core business process without IT.
- In addition to being an integral support to business processes, IT particularly with communications technologies, is a creative cause for many new and wide-ranging business interactions
- It is impossible to imagine a typical banking, insurance, and hospital or airline process without IT.
- The synergy between business and IT implies that growth in business also implies corresponding growth in IT. This, in turn, also implies greater IT-based carbon generation.

- Study conducted in 2011 specifically indicate the various levels at which IT affects the environment.
- An initial level of impact is associated with production, use, and disposal of IT hardware that affects the environment directly. The subsequent level of impact is caused by the effect of IT on the changes in structure and behavior.
- Verticals such as financials, travel, and hospitals are all affected fundamentally by IT and its emissions.
- While these industries are themselves not IT, still there is hardly any transaction in them that can be conducted without IT being an integral part of it.

- The process of getting a quote for an insurance cover, the process of buying an airline ticket, and the process of checking the availability of a doctor all have information and communications technology at their base.
- Each process requires an underlying database (or data warehouse), a means of communication (the Internet together with all its add-ons), user interfaces, data and transaction security, and the overall user experience considerations. Therefore, modeling, examining, and optimizing any of these processes requires due considerations of all IT elements.
- Changes to the technical systems and database aspects of these processes impact the business aspect of those processes.
- In fact, it is increasingly becoming difficult to segregate the IT aspect from the pure business aspect of these processes. Therefore, many thinkers believe that the IT industry has a significant role to play in reducing GHG emissions

- The necessary ingredients to bring about reduction in IT's carbon emissions are political will and appropriate economic initiatives—which can in many cases be facilitated by appropriate government policy
- To start with, this indicates that a reduction in overall carbon footprint of the organization can be effectuated by specifically tackling IT-based emissions.
- Reduction in IT-based emissions—such as the data center and the end-user monitors—will have an immediate and positive impact on the overall carbon footprint of the organization.
- Thus, in discussions on business efficiency and effectiveness, IT considerations are integral and mandatory.
- It thus follows that these IT-led business interactions are directly correlated with the production of carbon and related GHGs

- The greater the interactions between IT and business, the more are the amount of carbon pumped in the environment. Therefore, it follows that investigation and amelioration of IT related processes leading to GHGs will lead to reduction in the overall carbon footprint.
- Figure 1.2 attempts to depict this ongoing interplay between the business and the environment.
- The IT cover that encompasses the business is shown on the left
- Any business activity that involves IT—and most does—impacts the environment.

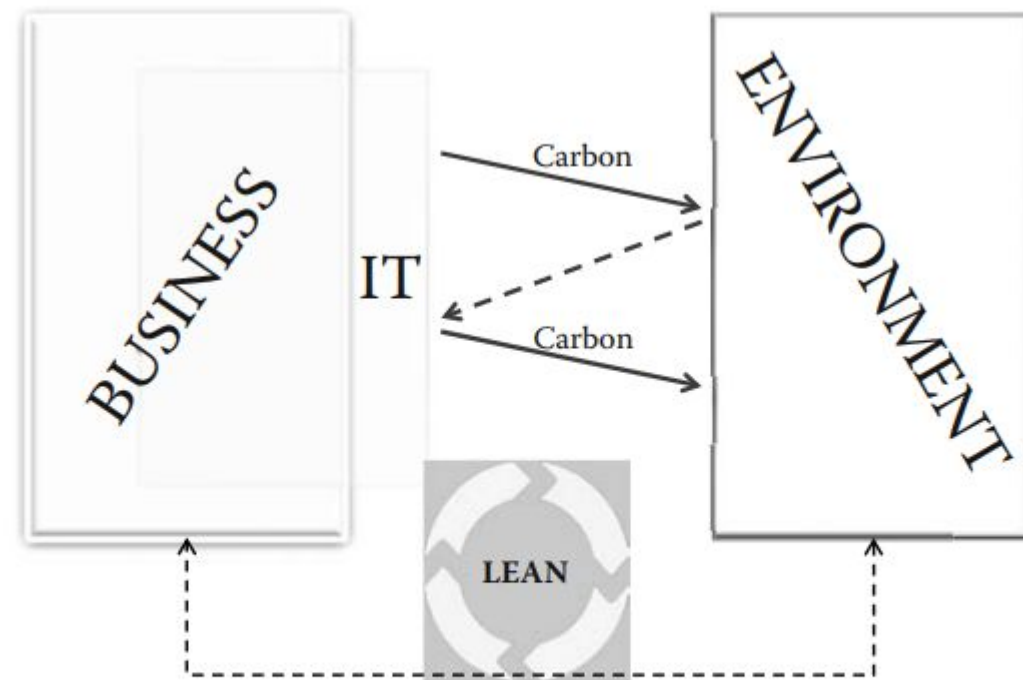


Figure 1.2 Interplay of business and environment through information technology.

- The carbon impact is shown by an arrow from left to right. This impact of business activities through IT on the environment has to be understood in three ways: from the length of time, the depth of activity, and the width of coverage of the carbon effect.
- The greater the intensity of business activities, the higher is the carbon generation. The awareness of environmental issues, in turn, influence the way in which IT is structured and operated (as is attempted here).
- This effect, in turn, would lead to an improved IT sheath that would be optimized and efficient.
- The lean approach to business is thus easily applicable to the Green IT strategies; as a lean business would also have a corresponding lean IT—opening up the idea that lean is green.

- Developing an understanding of the intertwining of business and IT, together with the concepts of lean business in the background, helps in ascertaining the areas of business that are particularly carbon intensive.
- Consider, for example, a simple web-enabled process for paying insurance premiums. The manual process of payment was by posting a cheque (check), whereas payment can now be performed using BPAY or credit card either online or on the phone.
- This electronic process will generate carbon that is direct result of use of IT in the process. The more this insurance business grows and expands across regions, the greater will be the number of transactions and, in turn, the intensity and width of coverage of IT in their processing. Greater the BPAY transactions, more will the use of IT systems and their associated hardware, software, networks, and communications.

- While IT provides the necessary fuel for conducting and expanding the existing and new business processes, it also forms the basis for increasing carbon emissions.
- Growth and expansion of a business, such as the said insurance business, will require further investments in IT.
- The environmental angle to those IT investments now starts coming into play. The databases, the business rules, the user interfaces, the security and privacy, and the overall customer experience predicted by the business has to now consider the carbon costs.
- While costs themselves were earlier justified if they provided enhanced customer experience, they can now no longer be justified as independent of their carbon contents. In fact, an well educated customer base may not accept a good customer experience if it is highly carbon intense.

- The attempt of an organization to apply lean principles gets translated and applied here to become lean-green principles. The process elements that support lean ensure that this is not achieved at the cost of the green credentials.
- Table 1.1 summarizes the major IT areas that influence the environment through their incorporation in the business.

Table 1.1 Major IT Area Influencing Environment

IT Areas	Major Environmental Influence
End-user devices (desktops, laptops, mobiles)	Large numbers of these devices, together with their rapid disuse that depends on factors other than their usefulness. Aim to reduce the number of devices and the emission per devices.
Data center servers	Growth of business associated with greater transactions invariably requires greater number of servers. Together with their backups, security, and mirroring requirements, these servers substantially impact the carbon generation.
Communications equipment (switches, networks)	These equipment, usually part of the data centers, increase in numbers and usage with growth in transactions. New networking technologies, self-healing networks, and use of mobile networks over wired ones can be part of the Green IT strategy here.
Risk management	Includes risks associated with not controlling emissions. Also includes the risks that may come due to green enterprise transformation.

IT Areas	Major Environmental Influence
Infrastructure (buildings, towers)	Greater the number of servers and office machines, more is the office space required. This increase in physical facilities and infrastructures have their own carbon impact that contributes to the carbon footprint. Building architecture and design, policies and practices for its operation, and maximum use of space as well as location are of importance here.

Business and Environment

- As established earlier in this chapter, the business and the environment interact with each other primarily through IT.
- IT has served businesses well by enabling them to expand their capacities, providing them with global customer reach, and enhancing their customers' experience.
- IT has also enabled businesses to optimize their internal processes such as inventory management and HR management and cut their operational costs through process automation
- The provisioning of IT resources, in particular, is not just limited to the databases or the application servers. Instead, IT is integrally embedded in business processes making them cost efficient and/or enabling businesses to grow and expand. Care in the use of IT to ensure minimal carbon footprint is now becoming a priority for both business and IT

- Global initiatives, such as the Copenhagen summit, on GHGs, focus more on the political and legal aspect of carbon emissions.
- Technological advances, particularly in the information and communication domain, are seen in terms of the value they add to business. Consider, for example, recent developments in IT (e.g., high-end data servers, sophisticated desktop computers with their low-power using monitors and varieties of laptops), telecommunications (e.g., broadband Internet, mobile devices, transmission towers, switch gears), and associated technologies (such as the ever improving gadgetry of the ubiquitous photocopiers and shredders).
- These technologies have been used by businesses but an argument can now be made for those businesses to pay attention to the use of these same technologies to reduce their overall contributions toward GHG emissions.

- The key to creating Green IT strategies for business is to treat the entire organization holistically
- While the practical implementation of those strategies will mostly be based on different levels of sophistication within departments and user groups, still a unified strategy will enable the consolidation of organization wide effort. Therefore, the starting point for a green business is the organization itself.
- Indeed, during the execution of the green enterprise transformation program, the organization will be divided into many smaller, departmental level manageable chunks; the Green IT strategy itself cannot be for a single unit of the business. Instead, unified strategy will apply to the entire organization as an entity. This unified approach provides valuable checks and balances in the Green IT efforts of the organization.

- An individual, or a single department, can always attempt to become green by applying its own procedures and practices so long as the effects of these changes is not to increase in carbon and costs elsewhere.
- The increasing impact of legislation also implies that the directors and leaders of the organization would become responsible for the carbon emissions of the organization
- This responsibility of the directors is close to the responsibility of the directors for the financial performance, governance, and reporting of the company's financial data.

Green Enterprise Characteristics

- The discussion thus far stresses the various levels and ways in which IT affects the carbon footprint of an organization.
- At times, IT is the cause of carbon emissions—therefore, switching off computers when not in use produces immediate effect in terms of reducing those emissions. At other times, however, IT is a key enabler of many business processes; therefore, in those cases, IT has to be used in a creative way to bring about reduction in the overall business processes of the organization, such as supply chains and inventory management.
- Figure 1.3 shows these various levels at which IT affect an enterprise.

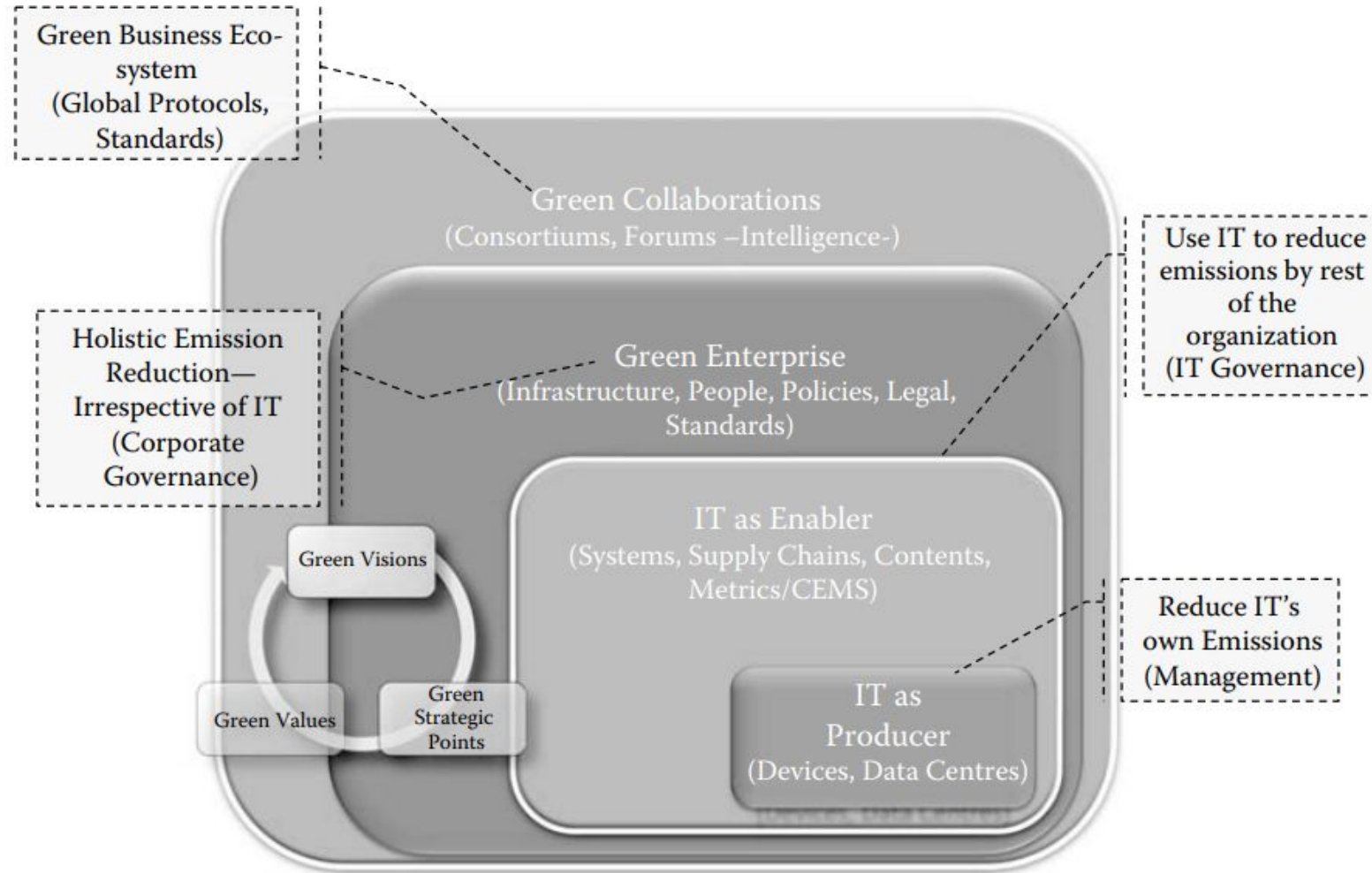


Figure 1.3 Envisioning green enterprises—beyond Green IT.

Figure 1.3 shows four encompassing layers of a comprehensive Green IT vision of an enterprise, as follows:

- IT as a Producer:
 - This very first attempt by an organization at Green IT is to handle the emissions produced by the IT gadgets themselves.
 - This, as shown in Figure 1.3, aims to reduce IT's own emissions that is based on the end-user computer emissions as well as those from the data centers housing the servers and communications equipment
- IT as an Enabler:
 - This area of IT includes its use to enable reduction of emissions across all areas of an enterprise.
 - Thus, IT systems, supply chains, contents, and metrics together with specific CEMS play a role at this level of a green organization. IT governance also plays a role in controlling the procurement and the disposal of IT equipments.

- Green Enterprise:

- This is the level of an organization that is holistically applying environmental strategies to all aspects of its business—irrespective of IT.
- While IT remains a vital part of this initiative, a green enterprise also deals with infrastructure and buildings, people and attitude, legal and standards, and marketing and sales—areas that may not be directly IT but are supported by IT.

- Green Collaboration:

- Going beyond a single enterprise, this is a collaboration of green enterprises that may come together due to their belonging to a common vertical market, or providing collaborative services using web services on a global scale.
- These collaborative organizations are consortium-based approaches to green enterprises that aim to reduce carbon emissions across multiple organizations.
- While they are the most challenging and complex Green IT effort, they have a far more long-lasting effect than that of a single organization.

- Green enterprises exhibit characteristics that show their awareness in terms of their carbon emissions that covers all dimensions and all departments of the enterprise. Furthermore, green enterprises also show clear business strategies and policies that are integrated with their carbon reduction effect.
- Astute and visionary corporate leadership and enhanced preparedness in risk management that identifies and deals with the strategic pressure points of the organization can also be seen in these green enterprises.
- The Green enterprise and the Green collaborations are the end result of effort that is long term and strategic
- Green enterprise characteristics are evident in their individual employees' attitude, in the end-user gadgets, in the way the data centers are organized, the changes to their supply chain systems and the use of CEMS for data collection and reporting.

- Green enterprises are not only managing and optimizing their emissions, but are showing preparedness for the eventual carbon trade that is likely to dominate the coming decade.

Green Vision

- Green vision is the development of a suitable global strategic vision for an enterprise. This vision, based on the arguments thus far in this chapter, has to be necessarily holistic.
- A sectional or fragmentary approach to the vision will not lead to a green organization which benefits from the carbon reduction effort in the long term.
- It is expected that the CEO, together with the board, will understand and analyze the trend of environment factors and review the positioning of the enterprise as well as the industry in the context of these trends
- Presentation and discussion with the employees and the incorporation of their viewpoints also needs to be incorporated in this green vision. This green vision can encompass the future of the organization in the carbon economy.

- Therefore, this vision can include not only what a carbon efficient organization will be, but also new avenues of business in the new green markets.
- The green strategic vision will need acceptance and support across the organization
- Furthermore, customers and business partners who will be invariably affected by the future changes need to be taken in confidence in the development of a green vision. These external stakeholders can also provide valuable input to this vision, especially if they have themselves experienced change due to their own green enterprise transformation

Green Strategic Points

- The operational behavior of an organization cannot be plotted as a flat or a linear graph.
- Operationally, an organization's performance can be viewed like a seismograph that will show ups and downs at many different spatial-temporal points within the organization. These up and down points are the ones at which an organization feels stressed—in terms of its carbon performance as relating to this discussion
- These are thus the strategic points of an organization that impact the structural and dynamic aspects of the organization.
- The organizational structures— especially in the global organizational context—have challenges, pressure points, and obstacles that are spread across the entire organization

- For example, the human resource (HR) department has the challenge, in a large organization, to maintain hierarchies and levels of staff ; but the continuously changing business processes subsume the effort of maintaining the hierarchies.
- These changes result in an unsettled workforce that may not have the right attitude or the desire to gain a positive attitude relating to carbon emissions.
- At other times, the dynamic, process aspect of an organization creates pressure by having wasteful processes with slack in them, requiring action by management. Temporally, the organization may do well at one time in one area of business but not so well at others.

Green Value

- Green enterprises need work on the premise that the effort in transforming into a green enterprise has to create and maintain lasting value for the organization. The creation of green strategies and their implementation is eventually meant to produce this long-lasting green value for the organization.
- This value is a combination of tangible and intangible benefits to its employees, customers, and shareholders
- As mentioned earlier, overbearing and visible motivation for businesses to undertake green initiatives is business efficiency and effectiveness
- While this can be a wide-ranging area of work, the fact that the business derives value out of green initiatives is of immediate importance in this work. This importance of green value to business has to be measured through appropriate ROIs and promoted within an outside of the organization.

Green IT Opportunity

- The strategic approach to Green IT views the carbon challenge as actually a green opportunity. Environmental issues have a long-term and strategic impact on the overall business decision making process on the organization
- This also implies that the search for Green IT opportunities should also be at the strategic levels, rather than merely at the operational levels.
- Business opportunities that include sensitivity and response to market conditions, legislative needs, reengineering of business processes, a realignment of information exchange, integration of unified communication, and, above all, changing the business model to align with evolving business trends and market opportunities are the ones that will provide maximum green value to the business
- This, of course, leads to the direct involvement of business decision makers in the Green IT initiatives of the organization.

- Initial involvement of this business leadership in the Green IT initiative can encounter a fundamental challenge that proceed from a possible viewpoint of the leadership that carbon efficiency and cost efficiency are competing against each other
- Effective use of green metrics and the resultant ROI indeed take a small step, but in the right direction, to demonstrate that costs and carbon efficiency are indeed aligned along many dimensions of the business
- However, effective green metrics are achieved only with increasing level of maturity of the organization and effective use of CEM
- For example, the purchase of a CEMS or upgrading the data center of the organization will help it ascend the green maturity ladder, but these precise actions need investments that need upfront justification

- In order to reduce the pressure on the strategic points of an organization with respect to its green challenges, it is recommended that the intersection between the business priorities and the environment priorities be studied right at the beginning of the initiative. The areas where the two overlap should clearly be the areas where the initial attempt at Green IT initiatives is focused
- As shown in Figure 1.4, these intersecting area are where the primary opportunity for Green IT success lies

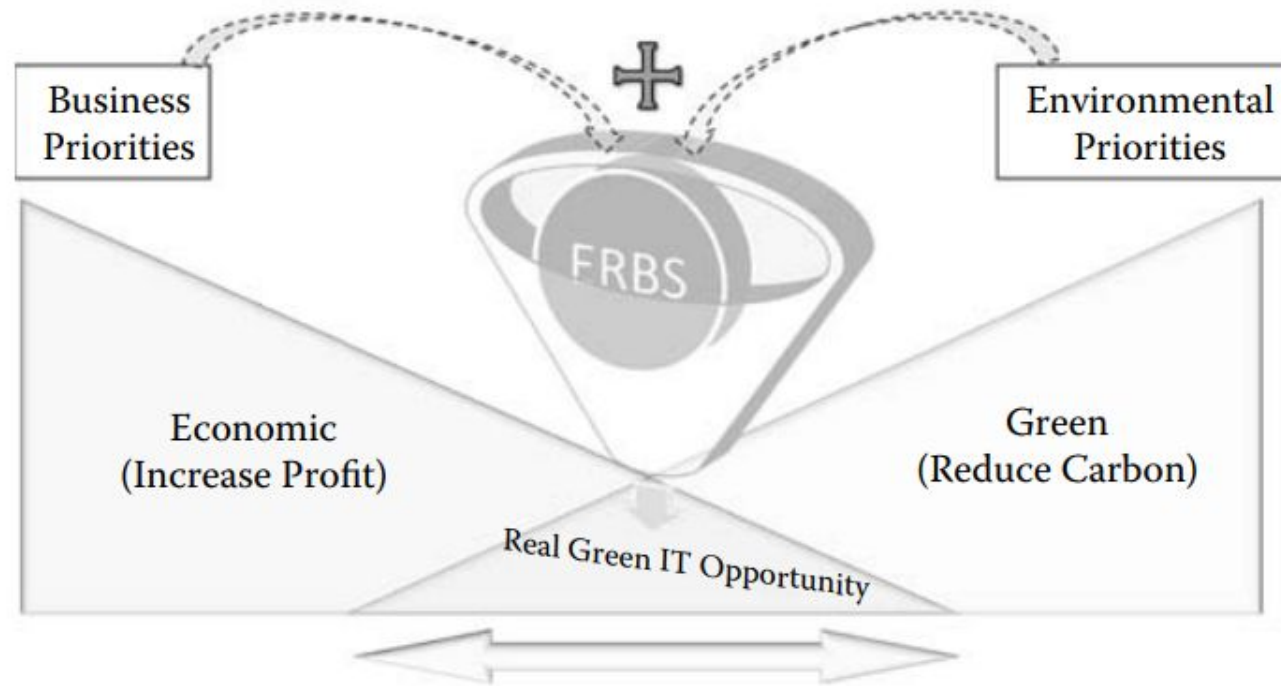


Figure 1.4 The real Green IT opportunity exists where the environmental and business priorities are complimentary to each other.

- This challenge is also help to the classic CAPEX (Capital Expenditure) versus OPEX (Operational Expenditure) issue. Green IT's strategic approach requires CAPEX but in order to do so, this initiative has to start demonstrating savings from OPEX
- Strategically, once the organization moves into the overlapping areas shown in Figure 1.4, the challenges it faces from its Green IT initiatives start becoming more manageable as they are also better understood by the entire organization
- These overlapping areas shift the focus of IT to being a utility infrastructure that is used and applied as an assembly line for knowledge workers
- For businesses to significantly change their environmental footprint, all of the issues around incumbency (e.g., time, scale, integration, cost, expectation) need to be addressed, while supporting both existing and future requirements of IT and business.

- The aforementioned overlapping areas of business and IT encompass many significant activities of an organization. For example, an environmental initiative by a business can include reduction in use of paper and electricity, improved use of buildings and facilities, revised data center management, efficient end-user computing, supply chain optimization, up-skilling and training of people (including dealing with their attitude, concerns, and reporting structures), dealing positively with trade unions, complying with legislations and other regulatory elements, and handling public opinion.
- In almost all of these areas of activities of a business there is an element of IT that is integrally embedded. The areas where IT and the rest of the business intersect are the areas that offer maximum opportunity for initial success in a Green IT initiative by business. Thus, the intersection between the economic and the green priorities in Figure 1.4 is the area of strategic points for Green IT transformation.

- This viewpoint as a basis for creation of an ERBS can also be justified by interpreting an audit by the Australian Computer Society (2007) on the amount of carbon dioxide generated by Australian businesses in their use of IT.
- This survey indicated that IT as an industry is responsible for 1.52% of the total carbon dioxide emissions, as compared with road transport—12.6%, metal production—2.3%, and the cement industry—1%.
- These figures indicated that it is the combination of IT and the non-IT aspects of a business that is together responsible for creating the carbon footprint
- These figures and the discussion in the aforementioned report also underscore the need to handle environmental issues by creating an organization-specific environmental strategy rather than an IT focused one.

- While the emissions that can be attributed directly to the IT gadgetry such as the monitors, laptops, and data servers can be reduced by switching them off , the true value of a Green IT strategy will emerge only when IT is considered as a Green IT enabler across the entire organization. Such a strategic and long-term approach focuses on the architecture, processes, people, and technologies to bring about substantial reduction in carbon emissions over a number of years.