



Module VI

Managing and regulating green IT

Xavier Institute of Engineering

Strategizing Green Initiatives

Successfully formulating, implementing and managing green initiatives calls for strategic thinking, strategic planning and strategic implementation.

Strategic Thinking

- As with everything else, you need a strategy to green your IT or enterprise.
- Simply starting to write a strategic plan assumes the end product, rather than clearly defining what the end product should be.
- Many managers, especially those with previous experience in a technical field, tend to dive right into the plan without strategically thinking where the plan should lead; they assume that strategic planning is the same as strategic thinking.
- Formulating and implementing green IT initiatives require strategic thinking, prior to designing the strategic approach and assuming the end state.
- Strategic thinking is the action taken prior to strategic planning, prior to the development of those requirements.
- It lets managers develop the comprehensive green vision they want to attain.
- Strategic planning is a formal process of defining the requirements for delivering a green IT programme – identifying what and how to get from current systems and equipment to future green ones.

- Strategic thinking is a distinctive activity whose purpose is to discover novel, imaginative green strategies that offer value.
- This approach encourages managers to visualize potential future scenarios for the company comprehensively harnessing green IT principles and practices.
- It is proactive rather than reactive in nature.
- The focus is always on a greener future state in relation to where the company is today.
- This is the way to add environmental value to organizations through the selection of high payoff targets, by responding to future new environmental realities and an accelerated rate of change towards green IT.
- Strategic thinking is not necessarily an innate skill, nor is it pure serendipity.
- It is a mental process – arising from personal and managerial experience – that must be enhanced as part of professional development.
- The intent in using strategic thinking is to enhance the organization's position and purpose towards green initiatives, specifically in the area of IT.
- Initially, the IT manager must clearly understand the fundamental business goals that are driving the move to green initiatives within the organization and then think about what it means to be green.
- The goal is to formulate effective strategies consistent with a business and competitive strategy; the means are the examination and validation (and possibly elimination) of policy issues through a long-term perspective.

- The IT manager must focus on finding and developing unique opportunities to create value by enabling provocative and creative dialogue about and with green IT initiatives.
- Following strategic thinking, managers can strategically plan and develop the requirements and processes needed to attain the comprehensive vision of the program utilizing green IT components and systems.

Strategic Planning

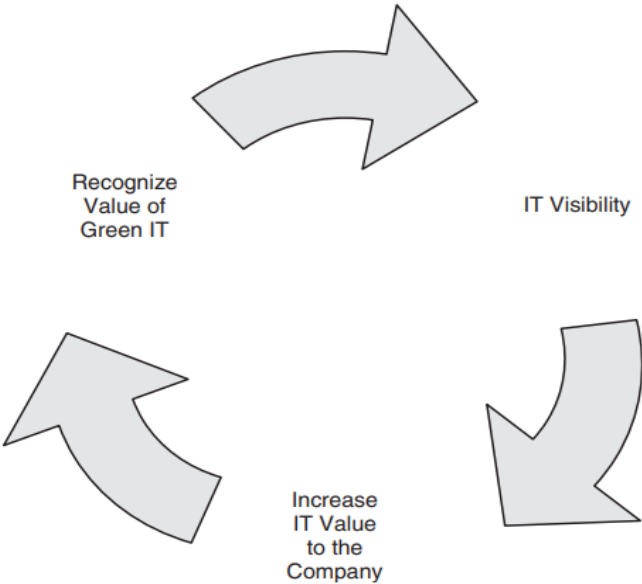
- Strategic planning is an organization's process of defining its strategy or direction, and making decisions on allocating its resources to pursue this strategy, including its capital and people.
- This is the process for determining where an organization wants to be in the short term and in the long term (3–5 years or more).
- Without a clear plan of the direction in which the company wants to move, green initiatives are likely to remain isolated from the rest of the business' initiatives and processes and will not form part of the company's overarching strategy.
- Strategic planning starts with a prior mission statement and a vision and leads to the formulation of goals and objectives.
- The mission statement tells you the fundamental purpose of the organization; it defines the customer and critical processes, and informs you of the desired level of performance.

- A vision statement outlines what the organization wants to be or how it wants the world in which it operates to be; it concentrates on the future as a source of inspiration and provides clear decision-making criteria.
- If a company is comprehensively moving towards a green environment, it should be identified in the vision statement.
- Even if only the IT aspect is going green, identifying that vision here identifies that at the highest company level, green is critical, which greatly strengthens the IT department's position to accomplish its green objectives.
- Every IT department should have its own strategic plan that supports that of the company.
- In this mission statement and vision, the move towards green IT should be prominent.
- This plan should be approved by your upper management for full comprehensive support and then circulated throughout the management team and to all employees of the IT department.
- This informs everyone of the direction in which IT is moving (i.e. towards green), and encourages them to be a part of the change, thus getting the critical buy-in needed for success.
- A company's management at the highest level must support the move towards green IT.
- Success is based on a blend of technology and business acumen.
- The CEO and the CIO must work together to authoritatively mandate the acceptance of changes and must persist until all adapt and accept the changes.

Strategic Implementation

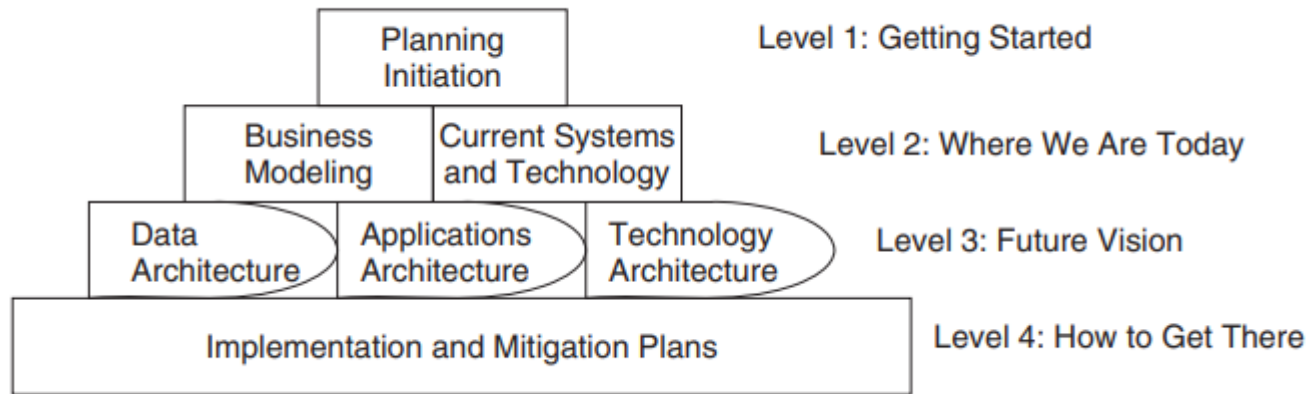
- IT should be recognized as a strategic resource, one that can make a difference and actively support the company.
- Peers and partners cannot always see the best ways to leverage IT as a strategic resource, so the IT manager must make it part of his or her job to ensure that IT is seen in this light, as these actions will also increase IT visibility.
- This increased visibility then allows the IT manager to demonstrate how green IT can have a positive value impact for the company.
- Some valuable processes can actually hinder some green initiatives.
- For example, turning off computers and power strips at the end of the day prevents patches from being automatically pushed.
- This should not be an impediment to the greening action; IT needs to change the process of pushing patches by looking for other options, such as asking the user what time they would like the patches to be pushed or pushing them prior to the computer shutting down.
- New habits need to be developed that produce both real and perceived value, which means a new set of rules for IT management also.
- To build a green environment you must modify or abolish many old and familiar ways of doing business.
- There is no silver bullet or single vendor solution for IT to magically become green.

Enterprise Architecture Planning



Increasing the value of green IT.

- EA is a methodology for developing a series of architectural frameworks – current, intermediate and target – often known as as-is, to-be and the mitigation plan.
- These frameworks detail all relevant structures within the organization, including business, application, technology and data.
- They are a rigorous taxonomy and ontology that clearly identify what processes a business performs and give detailed information about how those processes are executed.
- The result is a set of artifacts that describe, in varying degrees of detail, exactly what and how a business operates and what resources are required to run the components with maximum efficiency and profits.
- Moving towards a comprehensive green IT environment can be compared to remodelling a house.
- Firstly, the objectives and strategies of the company must be known and incorporated into the strategic planning for the new green environment.
- What should the new green house achieve? For example, lower energy costs reduce the carbon footprint.
- Most IT managers do not have the luxury of starting from scratch, throwing out all the old equipment, networks and systems and buying all-new ones, so a plan is needed.
- Enterprise architecture planning (EAP) is the process of defining architectures for the use of information in support of the business and the plan for implementing those architectures.
- The business mission is the primary driver, followed by the data required to satisfy the mission, then the applications are built using those data, finally followed by the technology to implement these applications.



Enterprise architecture planning levels.

- **Layer 1 – getting started:** This planning initiation layer leads to producing an EAP work plan and stresses the necessity of high-level management commitment to support and resource the subsequent steps in the process. Planning initiation includes decisions on which methodology to use, who should be involved, what other support is required and what toolset will be used.
- **Layer 2 – the vision of where we are today:** This layer provides a baseline for defining the eventual architecture and the long-range migration plan. It consists of business process modelling, which is a compilation of a knowledge base about the business functions and the information used in conducting and supporting the various business processes. It also consists of current systems and technology, a definition of current application systems and supporting technology platforms.
- **Layer 3 – the vision of where we want to be:** This layer delineates the data architecture defining the major kinds of data needed, applications architecture defining the major kinds of applications needed to manage that data and technology architecture defining the technology platforms needed to support the applications.
- **Layer 4 – how we plan to get there:** The implementation and migration plans define the sequence for implementing applications, a schedule for implementation, a cost–benefit analysis and a clear path for migration.

A successful move to a comprehensive green IT environment will start with and continually utilize EA to ensure that a strong compatible structure is built

Implementation of Green IT



Initiating green IT management involves four key components:

1. Adopt a bottom-up or top-down approach. If you are part of the company's management team, initiate discussions on what you would like to do. If reception is poor or minimal, start with engaging with the users and getting their suggestion and initiatives that quickly demonstrate the value of green initiatives.
2. Understand the complexities and interdependencies of how products, architectures and operating procedures impact green initiatives.
3. Understand the trade-offs, the architecture and what will be required.
4. Use point solutions associated with comprehensive plans and sound architectures.
 - Computers and the IT infrastructure consume significant amounts of electricity and contribute to greenhouse gas emissions.
 - IT hardware poses severe environmental problems during production and in its disposal.
 - These are just some of the major environmental issues that an IT manager must take into consideration when initiating the change to green IT.
 - One must consider how to make the IT infrastructure, products, services, operation, applications and practices environmentally sound while creating a sustainable environment.

- While developing green initiatives, consider what employees can do personally.
- Simple actions such as turning off power strips are easily done by the employees both at work and at home.
- By educating employees and encouraging these actions, the company benefits as do the employees through the reduction in energy costs.
- Company-wide, for example, automatic screen savers can be enabled in computers.
- Procurement policies can require buying energy-efficient, environmentally computers and other hardware meeting specified Electronic Product Environmental Assessment Tool (EPEAT) and Energy Star ratings.
- Most people's personal or professional agenda takes precedence over corporate aspirations.
- People often resist change if they are not convinced of the need for change or the potential benefits the change might bring in.
- Whilst the IT manager should have already demonstrated the value of green IT to the company management, he or she should also educate and convince employees by providing them with relevant information and demonstrating the value of the proposed initiatives.
- In order to be successful, users must be active participants. Educate employees on how to save energy, and get them involved.
- Seek employee's feedback, address their concerns and encourage them to participate.



- Involving and engaging employees in green initiatives will strengthen the move to green and, if managed correctly, will create a wave effect.
- Telling people there will be an impact from utilizing a screen saver is not the same as showing them said effect and having them personally connect to it.
- This action will then encourage them to accept (or at least try) the next green item, and whether it is cloud computing or a new computer, the wave of acceptance and successful greening has started.

Return on Investment

- It is the responsibility of the IT manager to identify and deliver value, and then communicate to management what value has been added.
- How that value is determined is the responsibility of the technical staff – ensuring that there is a tangible or intangible value is your responsibility.
- If you can demonstrate the value, especially initially, you create success for your team and for your goal.
- This success can then be built on as you move to the next phase, because you will start with the confidence of your management team.
- Effective IT leaders not only manage well, but also help business counterparts play their roles in making good decisions that produce operational and financial improvements in business performance.
- For example, more energy-efficient desktops reduce energy consumption.
- The reduction in the use of energy reduces the costs of running the building, supporting that manager.
- But the IT manager can assist the facilities manager even further through the investigations and selection of computerized systems that manage the building's energy consumption, such as load-sharing software or software that manages the temperature, lowering the temperature when possible and raising it when necessary.

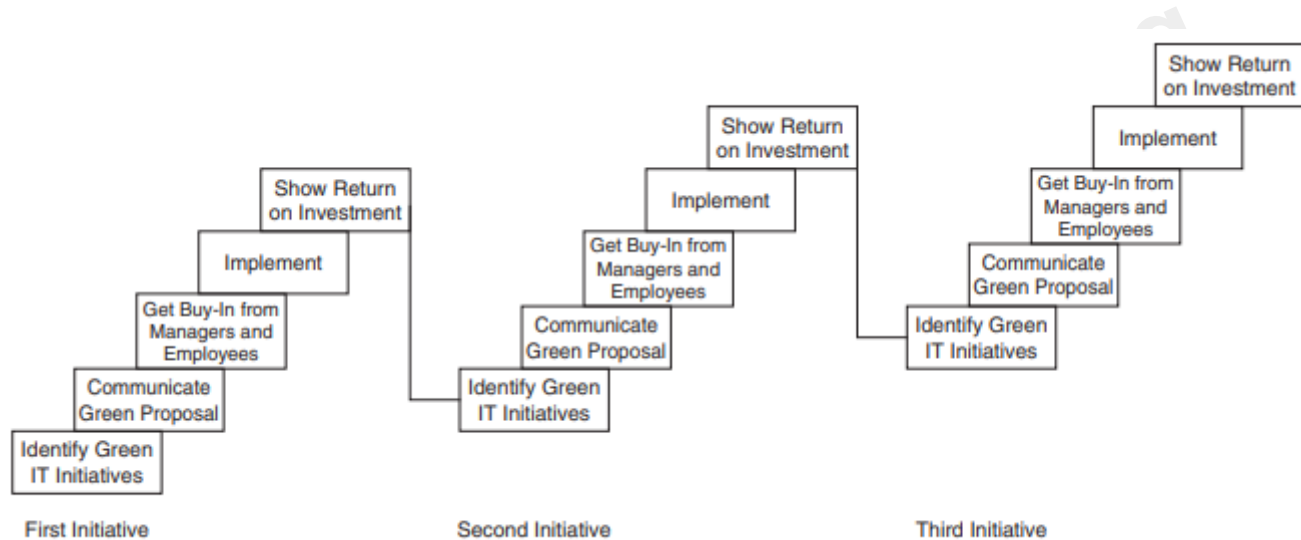
- By working together, the IT manager and the facilities manager can move the building towards green and reduce costs successfully.
- Green IT does not have to be an all-or-nothing movement; it can be incremental, as funding supports the changes.
- It is the job of the IT manager to manage continuous IT improvements: As these improvements are scheduled and planned, look for green solutions.
- Thorough understanding of the dynamics of continuous and discontinuous change helps the CIO accomplish the task of moving the company towards green.
- Clients usually have no insight into the factors that affect their IT costs, and no understanding of how to decrease their IT costs while supporting green IT.
- It is the IT manager's job to show value in terms they understand.
- Often this will require breaking down the factors.
- For example, in upgrading a data center to a green environment, an IT manager will need to break down the costs, such as cooling and energy consumption.
- An IT manager must make these factors known regarding how they fit into the objectives that he or she are trying to achieve, and why those objectives are important to the company.
- For example, assume that an IT manager is upgrading a data center, doing one server rack at a time.
- Although this may not be viewed as an incremental project, the manager still can show value at each stage in terms of green IT.
- As the equipment is purchased, place emphasis on the value added by the new equipment (e.g. it is made of X% recyclable material, as opposed to the Y% in the old boxes).

- This comparison is necessary to make sure that upper management understands the value of the change.
- Just telling them what percentage is recyclable does not mean anything to a non-IT manager, and sometimes not even to an IT manager.
- In order to impress them with the percentage change, and hence get credit for the first step towards green, both numbers are necessary.
- At the next step, the first installation, which is always the hardest and often where unexpected problems are found, should address problems as quickly as possible so as not to mar the success of the project.
- After the first installation, an IT manager should give the team credit for installing the equipment on time, and any downtime hopefully can be minimized.
- If the installation took longer than expected or had unanticipated problems, then the manager should acknowledge them also.
- After the first component is installed, announce it, making sure to discuss the decrease in the amount of energy used for the amount of cooling needed.
- At the end of the project, again announce how the new green IT equipment has made a difference to the environment and energy consumption.
- It often is helpful to publicize improvements and outcomes.
- For example, if you are replacing servers with more energy-efficient, less heat-producing servers, one way to visibly demonstrate value is to take the upper management or your boss on a brief tour of the facility prior to the replacement.



- Have them feel the heat being emitted and see the push of cooling needed.
- After the changes, arrange another tour, again showing how little heat is emitted.
- Measure the temperature before and after the replacement, and record your improvements.
- In showing the value added of green IT, you need to find ways to describe value added, besides running IT at lower costs.
- Demonstrate how IT can not only assist in green movements, but also help the business become more successful.
- Transform that IT into more than a cost of doing business, more than just a commodity, such as electricity.
- Focus on contributions to business performance and outcomes, not just the performance of the machines.

Metrics



Progressive implementation of green initiatives.

- For the manager implementing a green IT programme, the challenge is to show that an improvement has been achieved and that moving to green has made a difference.
- Metric programmes are initiated to demonstrate the improvements or benefits.
- In order to demonstrate the difference, the first step in developing a metrics programme is to identify the program's goals or objectives.
- For example, a goal may be to reduce energy costs.
- Next define the attributes that are to be measured; an example of these may be heating or cooling costs, or energy consumed by desktop computers or servers.
- Continue forward by clarifying and quantifying the goals by specifying questions and identifying metrics and data that are needed.
- For example, how much energy is consumed by the current desktops, what is the energy usage of a green desktop, what is the current energy usage in the data center now and how does it change as new green servers are implemented? The final and very critical step is to close the loop – provide management with answers to their questions based on the metric analysis.
- The key to continued success of a metrics program is immediate, visible benefits.
- It must do the job it was designed to do and supply management with usable information to solve their current problem in a timely fashion.

- Metric programs are based on raw data and measurements collected from multiple sources.
- Successful metrics programs should initially focus on what data should be collected and the data collection format.
- There is an overwhelming amount of data available that can be very expensive to collect and may not provide any answers.
- Data collection can be expensive if not carefully monitored – the temptation is high to collect all possible data and then decide how to use it later.
- This type of process generally leads to failure because the quantity of data now overshadows its quality.
- Thus, extraneous data should be discarded.
- Data collection should be an intricate part of the work structure, automated whenever possible.
- Automation increases the accuracy and decreases interruptions.
- Automated input is also preferable; research indicates that electronic forms tend to be completed faster and more accurately than paper forms.
- Existing systems and data should be used whenever possible.
- Also, metric programs can successfully evaluate processes, but the temptation to use the resulting metrics to evaluate the people performing the processes must be resisted.



- It is difficult, if not impossible, to place a dollar amount on the benefits of a metrics program because, as in the case of risk management, you are trying to measure something that did not happen.
- The benefits derived are also applicable not only to the current project but also to future projects.
- The sooner benefits are seen by management and developers, the faster metrics programs progress.
- Metric programs should be designed to show visible benefits as soon as possible, as this is the key to continued support.

The Goal–Question–Metric (GQM) Paradigm

- Managers often have difficulty in determining where and how to start a metrics program.
- The goal–question–metric (GQM) paradigm is a simple mechanism that provides a framework for developing a metrics program by formalizing the characterization, planning, construction, analysis, learning and feedback tasks.
- The paradigm does not provide specific goals but rather a framework for stating goals and refining them into questions to provide a specification for the data needed to help answer goals; it provides a relatively simple technique to initiate a metrics program.

The GQM paradigm consists of three steps:

1. Generate a set of goals based upon the needs of the organization. Determine what it is you want to improve. This provides a framework for determining whether or not you have accomplished what you set out to do.
2. Derive a set of questions. The purpose of these questions is to quantify the goals as completely as possible. This requires the interpretation of fuzzy terms within the context of the development environment.



3. Develop a set of metrics which provide the information needed to answer the questions. In this step, the actual data needed to answer the questions are identified and associated with each of the questions. As data items are identified, it must be understood how valid the data item will be with respect to accuracy and how well it captures the specific question.

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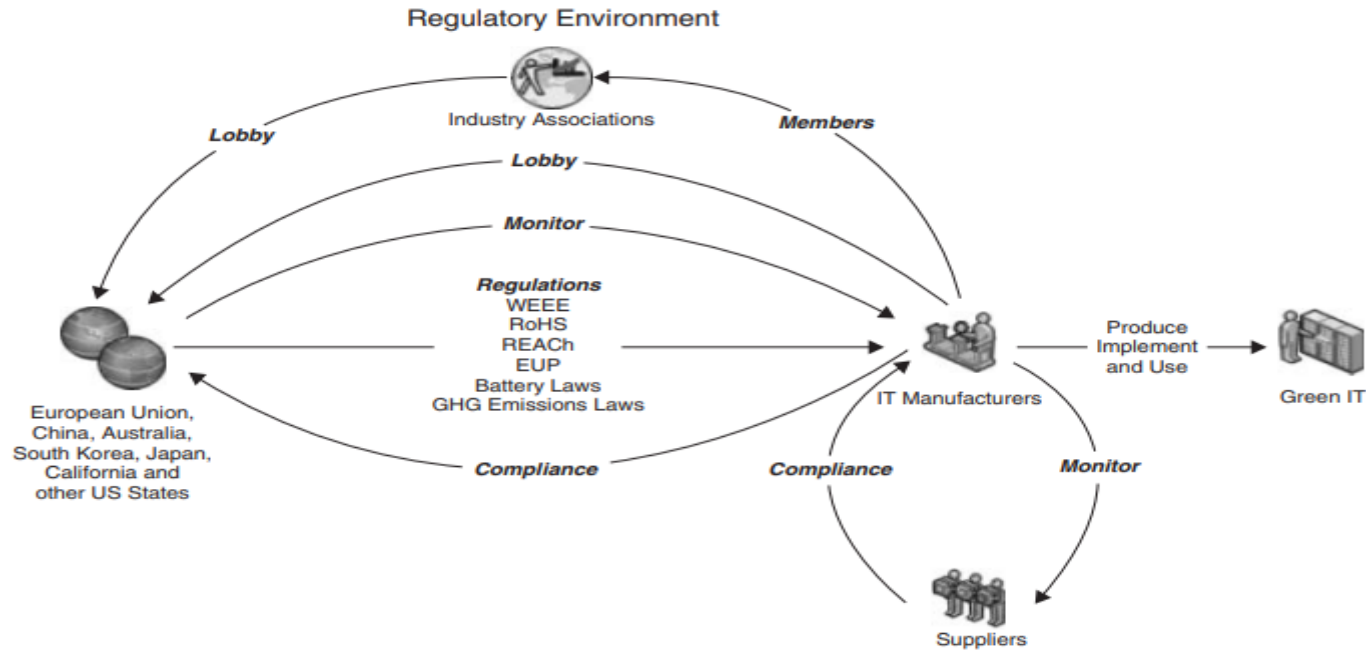
Communication and Social Media

- Communication to stakeholders and stakeholder participation are keys to the success of green initiatives.
- Among other channels, social media can be used for communicating among stakeholders green initiatives, their progress and their benefits as well as to get their feedback and to engage and involve them.
- Judiciously using these technologies allows you to present your authoritative stance on the advantages of implementing green IT initiatives.
- Start by establishing the IT department as the social authority expert in the field of green IT and that the benefits that can be derived with minimal disruption to the workforce.
- By becoming the social authority, you become the influencer and have the opportunity to pull other employees outside the IT department into the push towards green IT.
- One of the foundational concepts of social media, however, is that you cannot completely control your message through social media but you begin to participate in the conversation with the objective of becoming a relevant influence in it.
- Be careful in your conversations, as the participation must be cleverly executed; people are resistant to direct or overt 'marketing'.
- Credibility is important: Always back up your statements with clear facts, but do not overwhelm conversation participants.



- Build trust slowly but continually.
- The most effective marketing approaches revolve around honestly convincing people of genuine intention, knowledge and expertise in green IT through providing valuable and accurate information on an on-going basis with a marketing angle overtly associated.
- If this approach is successfully executed, the message itself will begin to develop naturally, the IT organization will be viewed as the authority and users will naturally begin to gravitate to them for additional information.
- No project can be successful without comprehensive communication to all levels within the company.
- Everyone must support the move to green IT, but in order to support it, they must know about it and understand the value.

The Regulatory Environment and IT Manufacturers



The global regulatory environment for the electrical, electronic and IT sectors.

- However, manufacturers are not passive consumers of environmental legislation; they actively lobby regulators, both individually and collectively, to shape current and future environmental laws that govern their processes and products.
- In a global context, the European Union (EU) has arguably led the way in regulating these and other industry sectors with onerous environmental laws based on the Restriction of Hazardous Substances (RoHS) Directive, the Waste Electrical and Electronic Equipment (WEEE) Directive, the Registration, Evaluation and Authorisation of Chemicals (REACH) Regulation, the Eco-Design for Energy Using Products (EuP) Directive and its amended Battery Directive (2006/66/EC), which regulates the manufacture and disposal of batteries in the European Union.
- These laws have enormous implications for all electrical, electronics and IT manufacturers (Butler, 2010; Butler and McGovern, 2009).
- For instance, RoHS, REACH and the Battery Directive impact the design and manufacture of IT, whilst EuP focusses on the power consumed during use; WEEE addresses the take-back, recycling and disposal of each artefact.
- These laws have been emulated from China to California, and from Canada to Australia. It must be noted that industry associations (Institute of Electrical and Electronics Engineers (IEEE), etc.) and dominant corporations (e.g. Dell, IBM, HP and Siemens) were typically consulted when such laws were being drafted; alternatively, individual corporations and their trade associations lobbied to have the draft laws on RoHS, WEEE, REACH and EuP changed and various exemptions obtained.

RoHS

- The RoHS Directive was instituted by the European Union in February 2003 and came into force on 1 July 2006.
- Subsequently, each EU member state transposed the directive into, what were often idiosyncratic, national laws.
- The RoHS Directive restricts the use of hazardous materials in products that cause environmental pollution during the disposal and recycling of electrical, electronic and IT equipment.
- The substances currently targeted by RoHS are mercury, lead, cadmium, hexavalent chromium, polybrominated biphenyls (PBBs) and named polybrominated diphenyl ethers (PBDEs).
- PBBs and PBDEs are types of brominated flame retardants (BFRs) used in plastics found in IT equipment and cables.
- The list of hazardous substances is to be increased in the near future: These include nickel plating, polyvinyl chloride (PVC), gallium arsenide, antimony trioxide, liquid crystals, cobalt and 42 BFRs.
- Eliminating these substances will pose a significant challenge for manufacturers.
- Several general exemptions were made in the original RoHS Directive to cover medical devices and monitoring and control instruments; EU member states publish a list of specific exemptions currently in force.

- Indeed, such were the focus and consequences of restrictions on the use of lead in solder (the glue that holds all electronic circuits together) that it was colloquially known as the lead directive.
- The fun for manufacturers began, however, with initial interpretations of the directive and its institution into laws in member states.
- The following excerpt from the directive provides a useful point of departure for this discussion: 'A maximum concentration value of 0.1% by weight in homogeneous materials for lead, mercury, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE) and of 0.01% weight in homogeneous materials for cadmium shall be tolerated.
- Homogeneous material means a unit that cannot be mechanically disjointed in single materials'.
- A practical example will illustrate the challenge facing IT manufacturers.
- A typical laptop has over 200 discrete parts sourced, ultimately, from hundreds of suppliers in a global supply chain.
- When it is disposed of and/or recycled, the different parts or subcomponents may be mechanically separated out.
- Hence, EU RoHS stipulates that none of the individual parts may exceed the limits set for restricted substances. Cadmium is used as a stabilizer or colouring agent in plastics; however, exposure to the chemical can harm human kidney function.

- Companies could be forgiven for thinking that if cadmium levels in a laptop were lower than the 0.01% threshold, then the device is compliant.
- However, if the cadmium levels in any of the individual cables or in individual elements of the plastic case was 0.02%, for example, then the entire device would be noncompliant and would need to be withdrawn from the market.
- An example of the consequences comes from Sony's experience with its PlayStation. Although unrelated to the RoHS legislation, approximately 1.3 million PlayStation 1 game consoles were impounded in the Netherlands in the run-up to Christmas 2001 because they contained noncompliant levels of cadmium in the cable sheathing.
- The withdrawal of the games console cost Sony in terms of both reputation and loss of revenue.
- The real problem for IT manufacturers is that they are so heavily dependent on upstream suppliers (Tier 1 to n).
- This makes it extremely difficult for an individual IT manufacturer to properly assess whether particular components sourced from upstream suppliers are compliant with regulations or corporate standards and codes of conduct.
- Indeed, the vice president of one division of a leading Fortune 100 ICT company admitted to the author that of the 5000 suppliers feeding into his division, he trusted only one in terms of being RoHS compliant.



Equipment categories

Mainframes

Minicomputers

Servers (exempt from lead-free solder until 1 January 2010)

Routers, switches, and so on

Printers

Personal computers (including the CPU and all peripheral devices)

Laptop computers

Notebook computers

Notepad computers

Copying equipment

Electrical and electronic typewriters

Pocket and desk calculators

User terminals and systems

Facsimile machines

Telex

Telephones – all types

Video conferencing and so on

All other products and equipment for the collection, storage, processing, presentation or communication of information by electronic means

IT equipment covered under RoHS


REACH

- The introduction of the REACH Regulation in June 2007 complicated matters significantly for IT manufacturers, as it requires organizations to declare the possible dangers associated with chemical combinations in their products both in use and on disposal.
- REACH also places disclosure requirements to the extent that customers and organizations like Greenpeace have access to information on regulated substances in use.
- Failure by EU-based IT manufacturers, or importers or EU-based agents of non-EU suppliers, to register with the European Chemicals Agency (ECHA) substances of very high concern (SVHC) contained in IT equipment in volumes of over 1 tonne per annum or in concentrations above 0.1%, will result in exclusion of the equipment from the European Union.
- SVHCs are carcinogenic, mutagenic, toxic for reproduction or persistent bio accumulates.
- In 2008, REACH listed 15 SVHCs.
- In January 2010, the list grew to 29, and in 2012 it is likely to reach 135 (something which will particularly impact IT manufacturers).
- IT equipment is considered as a finished product under REACH: As such, the reporting obligation relates to SVHCs that may be emitted during normal use.
- Nonetheless, as many components are imported in significant volumes into the European Union, the implications of REACH are significant and extend beyond this regulatory domain, as downstream manufacturers and business customers and consumers are demanding proof of compliance.

WEEE

- The WEEE Directive, which was instituted in February 2003, establishes collection, take-back and recycling targets and related obligations for IT equipment and broader categories of electrical and electronic devices.
- The responsibility for the take-back, disposal, recycling and reuse of WEEE is placed on manufacturers.
- This seemingly innocuous piece of legislation has caused headaches for IT manufacturers, not only in taking responsibility for their products' end of life, but also in gathering accurate information for reporting purposes.
- With EU WEEE, the producer is responsible – physically and financially – for their products, whether the end users are individual consumers or corporate clients.
- Take, for example the transposition into law of WEEE in Sweden.
- In order to bring order to what could have been a chaotic process, the Swedish government created a compliance and take-back system for IT products.
- Swedish local governments were made responsible for collecting WEEE and transporting it to a collection centre.
- However, equipment producers provide the collection centres for take-back.
- Producers trading into Sweden must finance the take-back of all products placed on the market after August 2005 and for historical products if a replacement is bought.
- In addition, the cost of equipment take-back is allocated according to the current market share of equipment producers.
- The problem for global IT manufacturers is that each member state implements different types of WEEE systems.
- Thus, IT manufacturers placing products in all of the European Union's 27 member states need to comply with WEEE on a state-by-state basis and participate in what are heterogeneous WEEE-based systems.
- This poses a high level of complexity for manufacturers.

- In sum, the implementation of WEEE and RoHS Directives resulted in sophisticated, highly differentiated, legal instruments in EU member states.
- The REACH regulation adds to this regulatory complexity, despite the fact that it is uniform in its application in EU member states.
- To further complicate matters, this body of legislation is not easy to comprehend and then apply to a firm's R&D, operations, products and logistics processes.
- It is clear that the task of maintaining compliance with, for example, RoHS will become even more burdensome as the European Union moves to include new substances on top of the original six covered under EU RoHS.
- Environmental laws in other jurisdictions are no less stringent.
- The US Environmental Protection Agency (EPA) has a significant body of legislation covering hazardous substances across the whole range of manufacturing sectors.
- Significantly, individual US states such as California and New Jersey are following the European Union's lead in introducing exacting WEEE- and RoHS-like laws.
- Korea, Australia and Canada, have introduced legislation similar to the RoHS and WEEE directives, whilst in China, a directive known as the China RoHS, or the Methods for the Control of Pollution by Electronic Information Products Directive, came into force in March 2007.
- Japan has the most stringent and comprehensive set of environmental laws outside of the European Union.

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- It is clear that the need to address compliance legislation in different geographical locations adds complexity for global IT manufacturing organizations; however, determining the applicable regulation for a given geographical area can be complicated by the problem of understanding which products are covered, or are exempt, by sets of seemingly conflicting regulations.
 - Understanding which products are covered by or exempt from sets of complex and apparently conflicting regulations is clearly an intimidating, information intensive task.
 - One way or another, the issues created by EU legislation for manufacturing firms are significant in that the requirements in each section of the various transposed laws in 27 member states will have to be enumerated, and understood, if they are to be properly addressed.
 - This, however, only scratches the surface of the regulatory mountain facing IT manufacturers and business organizations using IT.

Legislating for GHG Emissions and Energy Use of IT Equipment

- The EC EuP Directive 2005 32/EC focuses on energy efficiency in electrical, electronic and IT products.
- This law sets challenging targets for energy savings of up to 9% in the majority of electrical, electronic and IT products from 2008 to 2016.
- When this directive was transposed into law in EU member states, it required IT manufacturers (among others) to make voluntary compliance declarations on the energy used in the design, packaging, delivery and recycling of products across supply chains, in addition to the energy consumed during use.
- The directive extends voluntary Energy Star-like standards in EU member states such as Blue Angel in Germany and Nordic Swan in Scandinavia.
- Another example of EuP-like legislation comes from Canada, whose Action on Standby Power Development is a standard covering standby limits for consumer electronics products.
- This regulation aims to reduce the power consumption of electronic devices including IT, by setting minimum performance standards for new products, and making existing standards even more stringent.
- Essentially, it implements the 1-W Initiative, which aims to bring standby power to 1 W per device.
- The new standby power limits are equivalent to those in the State of California's energy legislation.

Nonregulatory Government Initiatives

- Governments across the world have reshaped the IT manufacturing industry through environmental laws.
- The United States, the European Union (particularly Germany) and Japan have also initiated and supported several industry standards (discussed in this chapter) and adopted wider non regulatory initiatives.
- Take, for example, research by the OECD (2009a) that reports on 50 government programmes and 42 industry initiatives aimed at achieving energy savings and GHG emissions reductions through the direct and enabling effects of green IT.
- Whilst one thinks of government in terms of regulation, it must also be remembered that they institute nonregulatory initiatives;
- Likewise, it must be remembered that governments are also large users of IT products and services.
- In the United Kingdom, for example, government accounts for approximately 35% of the IT market, with expenditures of up to £17 billion annually.
- The same can be said of other leading OECD countries where e-government is now the norm, rather than the exception. Thus, government organizations are heavy users of IT: Accordingly, they are conscious of the fact that they could contribute to IT-related environmental problems, if they did not take action on the use of toxic chemicals, hazardous substances, e-waste and IT-related GHG emissions.

- Hence many adopt rigorous environment-focussed procurement policies and other measures. Governments also recognize that IT-based applications are key enablers of GHG reductions and offsets (OECD, 2009a, 2009b).
- As government departments and organizations are not exempt from mandatory reporting of GHG emissions in countries such as the United Kingdom, public policy of a nonregulatory nature will increasingly impact IT manufacturers and service providers alike.
- Take, for example, that the UK public sector is governed by the Carbon Reduction Commitment (CRC) Energy Efficiency law from 2010.
- In line with this new law, and in keeping with other environmental obligations described here, the UK public sector has also adopted stringent policies on green IT procurement and outsourcing – thereby placing pressures on suppliers not covered by the CRC law.
- The US public sector is also preparing itself for mandatory GHG emissions reporting in the near future.
- It is also significant that whilst the US government did not regulate on the EPEAT standard, in 2007 it passed an executive order to all US federal bodies to purchase only EPEAT-certified IT (Ryan, 2008).

Regulation or policy-making body	Law, regulation or policy standard
European Union	The Eco-Label (Flower Label) standard mandates that an environmental impact analysis be conducted on products or services throughout their life cycle. The analysis should include life cycle stages such as the extraction of raw materials, production, distribution and disposal or recycling.
Germany	German Sustainability in the Information and Communication Technologies initiative. The Blaue Engel (Blue Angel) eco-label covers more than 3600 products, including papers, oil burners, wall paints and IT equipment.
United Kingdom	Greening of Government ICT Strategy: The British government developed a Green ICT Scorecard with evaluated constituent departments, agencies and so on, using 32 key indicators, including 18 ICT-related metrics. Areas covered include green policy, governance of policies, energy efficiency, waste management, supplier management, procurement, buildings and energy management and behaviours.
Denmark	Action Plan for Green IT. This has two major strands the first of which aims to (i) foster reductions in the environmental impact of IT use in private sector organizations by promoting green IT to businesses, (ii) adopt the same approach to promote energy-efficient IT to children and teenagers, (iii) provide green IT guidelines for the public sector and (4) create a knowledge base for energy consumption and GHG emissions calculations. The focus of the second strand is to (i) foster R&D on green IT, pervasive computing and e-government; (ii) the transfer of green IT knowledge and technologies and (iii) green IT knowledge sharing using international conferences on green IT hosted in Denmark.
Finland	The government's central procurement is invested in a limited company called Hansel Ltd. This organization works with the Finnish Environment Institute to develop and apply rigorous environmental criteria for public-tendering procedures including IT.
Japan	Green IT Promotion Council: The council consists of members from academia, industry (nationally and internationally) and government or the public sector. The green IT initiative aims to (i) generate R&D on energy-efficient IT, (ii) promote awareness of the environmental impacts of IT and (iii) institute education initiatives aimed at management of the environment and green IT.

Government-sponsored green IT initiatives



Industry Associations and Standards Bodies

- There are numerous industry associations associated with the IT and related industry sectors.
- These include umbrella groups such as the sector-specific Electronic Industries Alliance (EIA), the Consumer Electronics Association (CEA), the Storage Networking Industry Association (SNIA), the Green IT Promotion Council (Japan) and the Information Technology Industry Council (ITI).
- These organizations promote green IT among industry members, whilst also lobbying to limit the scope and impact of regulations.
- In addition, such associations are typically represented on, or influence the deliberations of, standards bodies.
- Some of these bodies are also associated with sector-based environmental movements such as the Climate Savers Computing Initiative and the Global e-Sustainability Initiative (GeSI).
- The GeSI is encouraging sustainable development in the IT and telecommunications sectors.
- Its SMART 2020 Report (GeSI, 2008) is, perhaps, one of the most influential documents on green IT.
- GeSI advocates programmes to reuse and recycle IT equipment, in addition to the promotion of green IT applications that enable smart buildings and smart transportation systems.
- The Climate Savers Computing Initiative promotes the use of green IT and its direct effects in lowering GHG emissions.

- Climate Savers Computing members commit to deploying energy-efficient personal computers and servers (i.e. Energy Star/EPEAT compliant) and to apply available power management features to reduce emissions.
- Significantly, the WWF plays a key role in both of these industry movements.
- One function of industry standards is to disseminate best practices across organizations in a particular sector. Others such as ISO 14000 series span several sectors.
- The International Standards Organization (ISO) and IEEE, and non government organisations (NGOs) like the Green Electronics Council, are among the most influential of such bodies.
- The ISO 14000 standards series addresses several aspects of environmental management: Specifically, ISO 14001 and ISO 14004 provide for the requirements and guidelines for environmental management systems (EMSs).
- The ISO 14060 series covers both process- and product-related GHG emissions.
- However, the most widespread industry standard comes from the EPA Energy Star initiative, which concentrates on the energy consumption of products in use.
- Almost all major manufacturers now produce Energy Star-compliant products.
- However, in 2006, the Green Electronics Council, which includes the EPA, the US Department of Energy and other industry standards bodies, went beyond this standard by introducing EPEAT.
- This extensive standard has pushed the envelope on green IT standards

Green Building Standards

- As identified by the GeSI's Smart 2020 report, the enabling effects of green IT could make a significant contribution in environment-oriented, green IT-enabled building design and management.
- There are two rival standards in use globally: the US Leadership in Energy and Environmental Design (LEED) Standard, which is a green building rating system developed by the US Green Building Council; and the United Kingdom's BREEAM (BRE Environmental Assessment Method), which is argued to be the leading and most widely used standard globally, due to the existence of UK and international versions.
- Both LEED and BREEAM standards implement best practice in sustainable design.
- Major US corporations are implementing LEED in the construction of offices and manufacturing facilities and new data centres.
- Indeed, the Lawrence Berkeley National Labs (LBNL) drew on LEED to arrive at its 'Environmental Performance Criteria (EPC) Guide for Data Centers'.
- The BREEAM standard was extended to cover data centres in collaboration with the largest data centre provider globally, Digital Realty Trust.

Social Movements and Greenpeace

- Environmental concerns voiced by citizens and consumers gave rise to various social movements, the most visible of which is, perhaps, the NGO Greenpeace.
- NGOs have been driving organizations towards environmental sustainability.
- Social movements such as Friends of Earth, Greenpeace and the WWF regularly target companies that are not environmentally responsible.
- Social movements such as the WWF and Greenpeace also have direct and indirect effects on individual organizations.
- The WWF is, as indicated, participating in the Global e-Sustainability Initiative and the Climate Savers Computing Initiative.
- In contrast to other NGOs, Greenpeace directly monitors the processes and products of leading IT corporations.
- It also acts in more overt ways by lobbying to change government laws and policies; hence, its activities deserve special mention as it has in many ways a greater influence over major players in the IT industry than government regulators.
- In the November 2011 Guide to Greener Electronics, Greenpeace provides a comparative analysis of 15 (down from 18 in previous years) of the IT industry's leading corporations including, for example, Apple, Hewlett Packard, Dell, Acer, Lenovo, Sony Ericsson, Motorola and Nokia.
- Greenpeace focusses on these ICT providers simply because their product ranges include consumer-based goods, from mobile phones to laptops.

- Three categories of ranking criteria are employed by Greenpeace to evaluate IT and consumer electronics manufacturers: toxic chemicals, e-waste and energy.
- An elaborate scorecard was developed from this to score each organization's performance on a scale of 0–10.
- In its November 2011 report, no organization achieves the holy grail of being the first to 'go green'.
- Indeed only HP is in the 'green zone' of the dashboard, although Sony Ericsson and Nokia were previously in this zone – most of the organizations score below 5/10.
- The first category in the scorecard covers toxic chemicals and seeks to 'stimulate substitution of hazardous chemicals in electronic products and their production processes'.
- The five criteria in this category are
 - (i) the application of the precautionary principle;
 - (ii) chemicals management;
 - (iii) establishing a timeline for the elimination of PVCs and BFR;
 - (iv) establishing a timeline for the phaseout of substances including all phthalates, beryllium (including alloys and compounds) and antimony and related compounds and
 - (v) evaluating PVC-free and BFR-free models presently on the market.

- In applying the second category, 'Greenpeace expects companies to take financial responsibility for dealing with the e-waste generated by their products when discarded by consumers, to take back discarded products in all countries with sales of their products and to reuse or recycle them responsibility'.
- The five criteria in this category cover
 - (i) individual producer responsibility,
 - (ii) voluntary take-back,
 - (iii) provision of take-back or recycling information to individual customers,
 - (iv) disclosures on amounts recycled and
 - (v) use of recycled plastic content in products and packaging.
- Greenpeace employs four criteria to evaluate electronics manufacturers in relation to GHG emissions and a fifth in relation to adopting and adhering to energy efficiency standards.
- These cover
 - (i) global GHG emissions reduction support,
 - (ii) carbon footprint disclosure,
 - (iii) own GHG emissions reduction commitment,
 - (iv) amounts of renewable energy used and
 - (v) energy efficiency of new models (companies score double on this criterion).

- As with the other two categories, four of the criteria covering GHG emissions involve disclosure – whether of support for institutional policies or emissions using the GHG Protocol Corporate Standard:
- The first criterion examines the political commitment of the organization, that is, ‘clear support for global mandatory cuts of at least 50% by 2050 (from 1990 levels) and cuts from industrialized countries of at least 30% as a group by 2020’.
- The second criterion examines the level of disclosure of GHG emissions. It seeks to have companies calculate and report (i) emissions from their Scope 1 (direct) and Scope 2 (indirect) operations and (ii) two stages of their supply chain (Scope 3). In relation to this, companies should have their disclosed calculations certified according to ISO 14064, which is an emerging standard on GHG accounting and verification.
- The third criterion is targeted at reducing GHG emissions from their own operations, and corporate disclosure forms the benchmark for this. The recommended benchmark baseline can be emissions in 2006, 2007 or 2008. Full points are awarded if companies fulfil these obligations and commit to absolute GHG reductions of 20% by 2012.
- The fourth criterion evaluates the use of renewable energy in comparison to the total electrical energy consumed by the company. The final energy criterion evaluates the adoption of energy efficiency standards in current and future products. Greenpeace issues quarterly updates on all 18 organizations in its Greener Electronics reports.

GHG Protocol

GHG Protocol classifies carbon emissions into three categories: Scope 1, Scope 2 and Scope 3.

- **Scope 1:** GHG emissions are generated by all sources of combustion, processing as well as the unintended leakage of gases from equipment and plant, all of which operate under the direct control of organizations.
- **Scope 2:** GHG emissions relate to electricity consumption and the energy content of steam, heating plant and cooling water.
- **Scope 3:** GHG emissions are embodied in the life cycle of products and corporate supply chains.

- Criterion 3 on GHG emissions should concern all organizations, not just large IT manufacturers, as it is not unreasonable to expect tougher regulation in this area when emissions reduction targets are not being met and the effects of climate change become more evident.
- Indeed, many organizations are now publishing detailed reports on GHG emissions in their corporate social and environmental reports.
- The problem for regulators and other societal stakeholders is accounting and verification.
- Apple Inc.⁶ for example, discloses that 'Greenhouse gas emissions are calculated in accordance with guidelines and requirements as specified by ISO 14040 and ISO 14044'.
- The latter standards perform a life cycle analysis of GHG emissions, including Scope 3 emissions. In a comparison between a life cycle assessment (LCA; ISO 14040) versus GHG Protocol (ISO 14064) standards, Arthur Braunschweig indicates that LCA provides for more comprehensive reports, hence Apple appears to be one of the few IT manufacturers accounting for Scope 3 emissions.
- Disclosure of GHG emissions is optional for many organizations.
- And whilst the United Kingdom is leading the way with its CRC law, over 2500 companies report their emissions to the Carbon Disclosure Project (CDP), which represents over 300 institutional investors that are concerned about climate change and the need to reduce corporate GHG emissions.



- Another non-sector-specific global initiative of growing significance that IT professionals need to be aware of is the Greenhouse Gas Protocol Initiative, which is a collaboration between the World Resources Institute and the World Business Council for Sustainable Development.
- This NGO provides the foundation or reference point for GHG standards and programmes globally – from the ISO to The Climate Registry – in addition to structuring the GHG inventory and reporting activities of individual organizations through the GHG Protocol Corporate Standard.
- The latter is in widespread use in sustainability reports as is the protocol's approach to GHG accounting.
- Significantly, the GHG Protocol Initiative provides sector-specific toolsets for the IT industry among others.