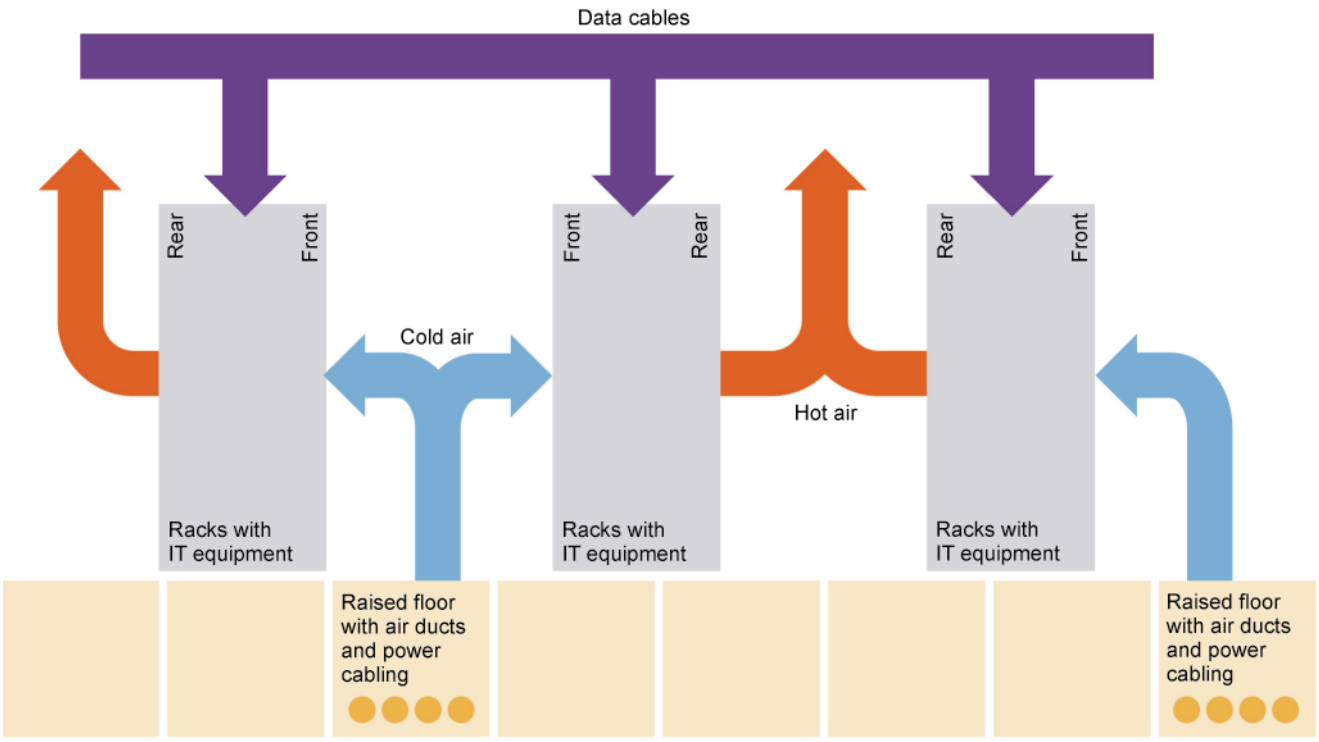
Green Sustainable Data Centres

Legal and Regulatory Framework



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Legal and Regulatory Framework

Chapter 7

Legal and Regulatory Famework

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INTRODUCTION

The aim of this chapter is to give students both a wide ranging awareness of legal and regulatory issues relevant to the green business agenda and the ability to critically reflect on the implications of these issues for the exercise of corporate stewardship. Emphasis will be placed upon helping students to develop their own professional ethics as environmentally responsible practitioners.
This course is built around the Code of Conduct on Data Centres. In this chapter the student learns about the position of this Code of Conduct in the landscape of initiatives, standards and laws.

LEARNING OBJECTIVES
After you have studied this chapter we expect that you are able to
- know international and national legislation relating to IT energy consumption
- apply industry codes of practice
- understand the recording and reporting of procedures necessary to comply with legal and regulatory requirements
- know and be aware of penalties for not following the rules.

Study hints
The purpose of this chapter is to provide an overview of a Green ICT legal and regulatory framework.
The workload is 10 hours.

CORE OF STUDY

1 Overview

ICT usage results in energy consumption, GHG emissions, waste generation and other environmental impacts (note: this has been discussed in Chapter 1). It is important to have a legal and regulatory framework for 'Greening of ICT' and 'Greening by ICT' (also discussed in the same chapter). This framework will provide a system of legislations, laws, standards, regulations and the means to enforce them with the ultimate goal of mitigating ICT impact on climate change.

In this section, we shall define several useful terms namely: initiatives, standards, legislations and regulations.

Initiative
Code of practice
Standard
Agreed way of doing something
Legislation
Law
Regulation

– *Initiative*: this is initiated by individuals, communities, industrial associations and governments who wish to establish a *code of practice* or a *de facto* standard that may become the basis for a standard or legislation[1].
– *Standard*: according to the British Standards Index group (BSI)[2], is an *agreed way of doing something* which may include the following: product manufacturing, process management, service or materials delivery. The main goal of a Green ICT standard is to provide a reliable basis for people to share the same expectations about an ICT product, service, or its usage. The European Code of Conduct on Data Centres is an example of a standard. Another word for standard is a covenant.
– *Legislation and regulation*: according to the US Environmental Agency (EPA)[3], *legislation* is synonymous with *law* or statute, and it is established by a governing authority but generally, enforced by the courts. The basis of legislation could be an initiative or a standard. A *regulation* is synonymous with a rule (or directive), and it is developed by a governing authority. It typically provides more specific and prescriptive information for how the broad legislative objectives will be met.

European Union

In the *European Union* legislation is as follows:

Regulation
Immediately enforceable

–A *regulation* is a legislative act of the European Union that becomes *immediately enforceable* as law in all member states simultaneously;

Directive

– A *directive* is a legislative act of the European Union, which requires member states to achieve a particular result without dictating the means of achieving that result. It can be distinguished from regulations which are self-executing and do not require any implementing measures. Directives normally leave member states with a certain amount of leeway as to the exact rules to be adopted

REFLECTION 1

a How should an organization react to legislation, code of conduct, regulation and directives?
b If you have identified that the reactions are different, why is this?

2 Initiatives

2.1 INDUSTRIAL INITIATIVES

Many pc manufacturers are getting greener with their green initiatives and we shall list some of them in an alphabetic order:

– Dell Green IT Initiative
Dell's green IT initiative is subsumed in its 2020 Legacy of Good Plan[4] with 21 strategic sustainability goals listed in the website[5].

[1]http://www.sustainability-perspectives.com/perspective/environmental-regulations#article-more
[2]http://www.bsigroup.com/en-GB/standards/Information-about-standards/what-is-a-standard/
[3]http://www.epa.gov/air/aqmportal/management/reg_imp.htm
[4]http://i.dell.com/sites/doccontent/corporate/corp-comm/en/Documents/2020-plan.pdf
[5]http://www.dell.com/learn/us/en/uscorp1/corp-comm/2020-goals-overview?c=us&l=en&s=corp&cs=uscorp1

Task 1
List the sustainability goals.

The environment is one of the foci of the plan, which addresses the following issues: reduction of the environmental impact of their operations; drive social and environmental responsibility in the industry and their supply chain; enable customers to reduce the environmental impact of their IT infrastructure; promote technology's role in addressing environmental challenges.

– Fujitsu Green IT Initiative
Fujitsu is focused on Green ICT throughout the entire product lifecycle and in 2009 Fujitsu achieved a global reduction of 2.37 million tons CO_2 emissions, exceeding the target of 2.13 million tons CO_2 emissions. In the same year, Fujitsu was awarded 'Super Green' status or three stars under a Garnter/WWF Green IT labelling scheme which is the highest achievement for environmental consciousness[6]. Fujitsu extended their global Green ICT Initiative to become the Green Policy Innovation which encompasses Green IT products and solutions.

Task 2
Watch this youtube video on Green Policy Innovation[7] and relevant activities are found here[8]

The Green Policy Innovation exploits Fujitsu's cutting edge green technology for the reduction of environmental impacts through 'Greening of ICT' and 'Greening by ICT' which is depicted in Figure 1.

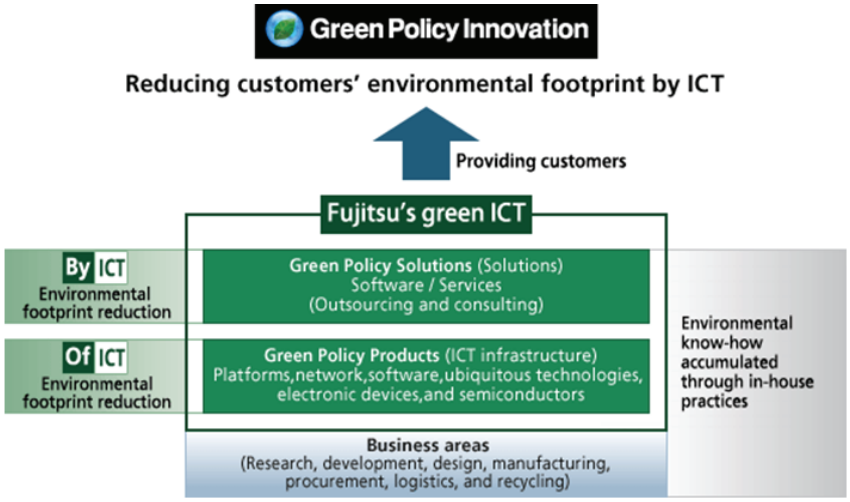

FIGURE 1 Green Policy Innovation (ibid)

– IBM Green IT Initiative
In 2007, IBM announced their Big Green Initiative known as the Project Big Green[9,10] which aimed at building and redesigning green data centers. The five components in the project are:

[6]http://www.fujitsu.com/uk/news/pr/fs_20101028.html
[7]http://www.youtube.com/watch?v=JuDDiyBNFmE
[8]http://www.fujitsu.com/global/about/environment/green-it/approach/

– DIAGNOSE: Evaluate existing facilities -- energy assessment, virtual 3-D power management and thermal analytics;
– BUILD: Plan, build or update to an energy efficient data center;
– VIRTUALIZE: Virtualize IT infrastructures and special purpose processors;
– MANAGE: Seize control with power management software;
– COOL: Exploit liquid cooling solutions -- inside and out of the data center;

Task 3
Watch these videos on the Project Big Green[11,12].

IBM's Energy Efficiency Initiative[13] is subsumed in Project Big Green and it focuses on energy efficiency in data centers. In the mid-2009s, IBM embarked on the Six Green IT Initiatives which addressed target, energy efficiency, and GHG reduction[14]. For this initiative, a Green Sigma coalition[15,16,17] (comprising IBM, and other industries) was formed. Green Sigma is used to develop a tailored carbon management solution and the phases involved can be found in this online document[18].

Task 4
Watch these videos on Green Sigma and Lean Six Sigma[19].

– Intel Green IT Initiative

Climate Savers Computing Initiative

In 2007, Intel and Google led the *Climate Savers Computing Initiative*[20,21]which aimed to develop energy-efficient computers (with power management tools) and components. An overview of Intel's emissions reduction and energy efficiency initiatives can be found in this website[22].

[9]http://www.pcworld.com/article/131777/article.html
[10]http://www-03.ibm.com/press/us/en/pressrelease/21524.wss
[11]http://www.youtube.com/watch?v=jvqOCRzkMhI
[12]http://www.youtube.com/watch?v=9PSAqQA6HDI
[13]http://www-07.ibm.com/in/gts/datacentre/pdf/IBM_GTS_Bringing_energy_efficiency_to_your_data_centers_1.pdf
[14]http://www.techweekeurope.co.uk/news/news-it-infrastructure/ibm-announces-new-green-it-plans-1209
[15]http://www.reliableplant.com/Read/18415/ibm-forms-green-sigma-coalition-to-target-ecobusiness-gains
[16]http://www-935.ibm.com/services/us/gbs/bus/pdf/amr_research_0908asus-a-stokes1_tcm7-46629_ibms_green_sigma_coalition_the_f.pdf
[17]http://www.youtube.com/watch?v=jUeIIvLMMwY
[18]http://www-935.ibm.com/services/uk/bcs/pdf/ibm2216_02_green_sigma_final.pdf
[19]http://www.internetevolution.com/tutorial_greensigma.asp
[20]http://apps1.eere.energy.gov/news/news_detail.cfm/news_id=11049
[21]http://www.youtube.com/watch?v=pJD2Fko3TeU&list=PL0A30234EEDD68809&index=1
[22]http://www.intel.co.jp/content/www/jp/ja/corporate-responsibility/eco-responsible-operations.html

– Microsoft Green IT Initiative

Microsoft's top ten sustainability initiatives[23] relate to: carbon footprint reduction; data center improvements to save energy; Sustainability Partner of the Year Award; environmental benefits of cloud computing; energy smart buildings; managing energy consumption; reducing traveling with microsoft unified communications; policy on restricted substances; environmental sustainable packaging; saving energy through built-in power management features.

2.2 INDUSTRIAL ASSOCIATION INITIATIVES

– The Green Grid

The Green Grid (TGG)

The Green Grid (TGG) is a non-profit, open industry consortium of end users, policy makers, technology providers, facility architects, and utility companies that works to improve the resource efficiency of information technology and data centers throughout the *world*[24]. TGG and the Climate Savers Computing Initiative will pull together their aligned resources to accelerate the implementation of energy efficiency and sustainability within the IT and communications industries[25,26]. The TGG Sustainable Computing Initiative (SCI) program was established in 2012 and it enabled organizations to opt into a commitment to procure green ICT equipment and to use power management features[27].

World

– Global e-Sustainability Initiative (GeSI)[28]

GeSI has partnered with the United Nations Climate Change (UNCC) Secretariat on their Momentum for Change program which seeks to showcase ICT-driven changes that contribute towards a low-carbon economy for climate change mitigation and to build resilience[29,30].

GeSI promotes sustainable development in the ICT sector

GeSI promotes sustainable development in the ICT sector (Smart2020 and Smarter2020)[31,32].

[23]https://econewsnetwork.org/2012/03/top-ten-sustainability-initiatives-of-microsoft/
[24]http://www.thegreengrid.org/
[25]http://www.thegreengrid.org/about-the-green-grid/~/media/CSCI%20Documents/TGG%20FAQ%202012-07-19.pdf
[26]http://www.datacenterknowledge.com/archives/2012/07/20/the-green-grid-climate-savers-computing-initiative-merge/
[27]https://www.thegreengrid.org/en/SCI-Agreement-retired.aspx
[28]http://gesi.org/
[29]http://unfccc.int/files/press/press_releases_advisories/application/pdf/20132111_mfc_ict.pdf
[30]http://unfccc.int/secretariat/momentum_for_change/items/7861.php
[31]http://www.smart2020.org/_assets/files/02_Smart2020Report.pdf
[32]http://gesi.org/assets/js/lib/tinymce/jscripts/tiny_mce/plugins/ajaxfilemanager/uploaded/SMARTer%202020%20-%20The%20Role%20of%20ICT%20in%20Driving%20a%20Sustainable%20Future%20-%20December%202012.pdf

2.3 GOVERNMENT INITIATIVES

– Japan's Green IT Initiative

Green IT Society

Japan's Green IT Initiative is developed to provide a balance between environmental sustainability and economic growth[33] and it has two strands: 'Saving energy of IT' (through 'Green IT Project') and 'Energy-efficient society by IT' ('*Green IT Society*)[34]. These two strands are aligned to the 'Greening of IT' and 'Greening by ICT' which we have discussed in Chapter 1. The Japanese 'Green IT Project' aims to develop innovative technologies to achieve a great reduction of energy consumption for entire network systems including data centers, in addition to saving energy for IT devices.

The Green IT Promotion Council[35] is an industry-government-university partnership for promoting concrete action under the Green IT Initiative.

– South Korean Smart Grid Initiative

The South Korean Smart Grid Initiative[36] addresses five sectors: smart power grid; smart consumer; smart transportation; smart renewable energy; smart electricity service (note: some of these areas overlap with those identified in Smarter2020[37]).

– Denmark's Green IT Action Plan[38]

In 2008, Denmark drew an action plan for Green IT. The action plan includes eight initiatives that focus on greener IT solutions and also contribute to strengthening the development and use of innovative IT solutions for reducing energy consumption.

– Australian Sustainability ICT Plan (2010-2015)[39,40]

This five year plan will assist Financial Management and Accountability Act 1997 (FMA Act) agencies[41] (note: that are financially part of the Commonwealth as a single legal entity) to better align their use of ICT with the Government's overall sustainability agenda. Fifteen ICT sustainability initiatives[42] addressed in this plan have been grouped into the following categories: sustainable ICT procurement; energy and carbon management; effective use of ICT; environmental management systems; and reporting.

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[33] http://home.jeita.or.jp/greenit-pc/e/about/

[34] http://www.meti.go.jp/english/policy/GreenITInitiativeInJapan.pdf

[35] http://home.jeita.or.jp/greenit-pc/e/

[36] http://www.smartgrid.or.kr/10eng4-1.php

[37] http://gesi.org/assets/js/lib/tinymce/jscripts/tiny_mce/plugins/ajaxfilemanager/uploaded/SMARTer%202020%20-%20Executive%20Summary%20-December%202012.pdf

[38] http://gesi.org/assets/js/lib/tinymce/jscripts/tiny_mce/plugins/ajaxfilemanager/uploaded/SMARTer%202020%20-%20Executive%20Summary%20-December%202012.pdf

[39] http://www.environment.gov.au/resource/australian-government-ict-sustainability-plan-contents

[40] http://www.environment.gov.au/topics/sustainable-communities/government-sustainability/ict-sustainability-plan

[41] http://www.finance.gov.au/financial-framework/fma-legislation/fma-agencies.html

[42] http://www.environment.gov.au/resource/australian-government-ict-sustainability-plan-2010-2015-1

– UK Greening Government ICT Strategy[43]
In 2011, the UK Government launched the Greening Government Commitments[44] so as to ensure substantial reductions in waste generation, water consumption and greenhouse gas emissions. The Greening Government ICT Strategy sets out ways by which ICT can be exploited to help the UK Government achieve their Green ICT Commitments.

Task 5
Read the UK Greening Government ICT Strategy[45]

2.4 GLOBAL INITIATIVES

– UN Framework Convention on Climate Change (UNFCCC)
The UNFCCC is a member of the Coalition on ICT and Climate Change[46,47], which aims to fulfill the following objectives: (i) raise the awareness of ICT's role in climate change; (ii) share best practices relating to ICT and the environmental sustainability; (iii) understand the relationships among ICT, climate change and sustainable development; (iv) embed ICT as a key element in each country's national climate change policies.

– Global Action Plan – Green ICT
The Green ICT Handbook[48] forms the basis of Global Action Plan's Green IT programmes for businesses. The Green ICT website[49] is a joint initiative of Global Action Plan[50,51] and Environmental IT Leadership Team (EILT), which aims to reduce ICT's carbon footprint.

– World Wildlife Fund (WWF)
The WWF and Ericsson co-authored the 5-Step Plan for Development[52] as follows (pages 10-11):
– Make ICT a central part of national and city strategies and targets for reducing CO_2 emissions;
– A shift to 21st century low carbon information infrastructure which will require a fast broadband network to foster the following services: telework, virtual meetings, smart buildings, intelligent transport and dematerialisation of products;

[43]https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/155098/greening-government-ict-strategy.pdf
44https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/61172/Greening_20Government_20Commitments_20-_20guidance_20on_20measurement_20and_20reporting.pdf
[45]https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/155098/greening-government-ict-strategy.pdf
[46] http://www.itu.int/themes/climate/events/cop17/coalitionflyer.pdf
[47] http://gesi.org/portfolio/project/8
[48]http://greenict.org.uk/handbook
[49]http://www.greenict.org.uk/
[50]http://www.globalactionplan.com/
[51]http://globalactionplan.org.uk/node/281
[52]http://wwf.panda.org/about_our_earth/all_publications/ict/

– Encourage cross-sectoral partnerships with a focus on developing new and innovative services to promote green digital agenda;
– Policy makers should provide positive examples of low carbon ICT use and to ensure there is minimal carbon emission trade-offs;
– Promote the development of low carbon solutions through innovative research and development activities.

– Europe 2020
Europe 2020 is the European Union's ten-year growth strategy[53],[54]. Climate change and energy sustainability is one of the five targets to be achieved by the end of the decade and the following is a list of set targets[55]:
– greenhouse gas emissions 20% (or even 30%, if the conditions are right) lower than 1990 ;
– 20% of energy from renewables ;
– 20% increase in energy efficiency.

Europe 2020 promotes the following: development of green technologies; roll out the use of ICTs for smart grids, logistics, energy infrastructures; to bring about energy efficiency in energy-intensive sectors.

– Europe Roadmap 2050
The Roadmap 2050[56] project is an initiative of the European Climate Foundation (ECF)[57] which provides a practical guide to a prosperous low-carbon Europe[58] in order to achieve at least 80% reduction in greenhouse gas emissions below 1990 levels by 2050.

REFLECTION 2
Is it helpful to have so many different plans and initiatives?

3 Standards and Labels

Metrics

Lifecycle of standards-based regulations

According to Fujitsu[59], measureable and acceptable *metrics* as well as processes are necessary to effectively support technical legislations and regulations. The *lifecycle of standards-based regulations* includes:
i a de facto standard which uses a convention or practice used by a user community but could eventually be globally accepted;
ii the de jure form which is obligatory, endorsed by a formal standards organization and aims to meet users' needs;
iii creation of a regulation based on the standard.

We have coded green ICT standards into the following categories:

Green ICT Standards and Labels for Product, discussed in section 3.1
Green ICT Standards for ICT equipment, discussed in section 3.2
Green ICT Standards for e-Waste Disposal, discussed in section 3.3
ICT and Environment, discussed in section 3.4

[53]http://ec.europa.eu/europe2020/europe-2020-in-a-nutshell/index_en.htm
[54]http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:2020:FIN:EN:PDF
[55]http://ec.europa.eu/europe2020/europe-2020-in-a-nutshell/targets/index_en.htm
[56]http://www.roadmap2050.eu/
[57]http://europeanclimate.org/
[58]http://www.roadmap2050.eu/project/roadmap-2050
[59]http://www.sustainability-perspectives.com/perspective/environmental-regulations#article-more

3.1 GREEN ICT STANDARDS AND LABELS FOR PRODUCT

Energy star
This has been discussed in Chapter 1. However, the energy star standards for electronics and office equipment (note: this includes ICT equipment) can be found in this website[60].

EPEAT (Discussed in Chapter 1)
To reiterate, EPEAT registers products that meet the IEEE 1680 family of Environmental Assessment Standards[61]:
– IEEE 1680 'umbrella standard' describes how products are registered and how product declarations are verified;
– IEEE 1680.1 product standard contains the specific environmental performance criteria for computer desktops, laptop and monitors;
– IEEE P1680.2 product standard contains the specific environmental performance criteria for imaging equipment;
– IEEE P1680.3 product standard contains the specific environmental performance criteria for televisions.

80Plus Certification (Discussed in Chapter 1)
Please revisit Chapter 1 if you need a recap on this. A list of 80Plus Certified power supplies and manufacturers can be found in this website[62]

ECMA International Standards
– *ECMA-328*[63]: this standard specifies methods to determine chemical emission rates from ICT and Consumer Electronics (CE) products;
– *ECMA-341*[64,65]: this standard specifies requirements and recommendations for the design of environmentally sustainable ICT and CE products. Thus, it only covers criteria which are directly linked to the environmental performance of the product;
– *ECMA-370*[66]: this standard specifies environmental attributes and measurement methods for ICT and CE products according to known regulations, standards, guidelines and currently accepted practices.

European Union Eco-label
The European eco-labelled products and services[67] include electronic equipment (i.e. computers and television).The eco-label *aims to promote more environmental friendly products.*

Aims to promote more environmental friendly products

– *2005/341/EC*[68] and *2005/343/EC*[69] establishes ecological criteria and the related assessment and verification requirements for the award of eco-labels to personal and portable computers respectively.

[60]http://www.energystar.gov/products/specs/
[61]http://www.epa.gov/epeat/
[62]http://www.plugloadsolutions.com/80PlusPowerSuppliesDetail.aspx?id=0&type=2
[63]http://www.ecma-international.org/publications/standards/Ecma-328.htm
[64]http://www.ecma-international.org/publications/standards/Ecma-341.htm
[65]http://www.ecma-international.org/publications/files/ECMA-ST-ARCH/Ecma-341%203rd%20edition%20June%202008.pdf
[66]http://www.ecma-international.org/publications/files/ECMA-ST/ECMA-370.pdf
[67]http://ec.europa.eu/environment/ecolabel/eu-ecolabelled-products-and-services.html
[68]http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2005:115:0001:0008:EN:PDF
[69]http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2005:115:0035:0041:EN:PDF

TCO Certified Eco-label

Task 6
Watch this video entitled 'TCO makes recognizing green ICT products easy'[70].

Currently, there is a total of 74 eco-labels for electronic products and details of these labels can be found in this website[71].

3.2 GREEN ICT STANDARDS FOR ICT EQUIPMENT

ISO

ISO is International Standardization Organization[72] develops specifications for products, services, and practice and since 1947, it has published more than 19 500 *International Standards* relating to technology and business. The key principles in the development of standards are discussed here[73].

International Standards

– *ISO/IEC JTC 1/SC 39*[74]: Sustainability for and by Information Technology and the two working groups are:

ISO/IEC JTC 1/SC 39/WG 1 – Resource Efficient Data Centers

INCITS/ITS39[75] (International Committee for Information Technology Standards) is the Technical Committee for IT Sustainability which addresses standardization in the areas assigned to JTC 1/SC 39 and it will entail the following:

Taxonomy and vocabulary

i Development of a data center energy efficiency *taxonomy and vocabulary*;

Key Performance Indicators (KPIs

ii Development of a holistic suite of metrics supporting universally accepted standardized *Key Performance Indicators (KPIs*);

Best practices

iii Development of a *best practices* for energy efficiency of data centers;

Energy manage ment system

iv Development of an *energy management system* standard specifically tailored for data centers.

However, it is suggested that SC39 collaborate with ITU to revise its ITU-T L1300 standard (Best Practices for Green Data Centers)[76,77].

ISO/IEC JTC 1/SC 39/WG 2 – Green ICT

This working group is responsible for the development of ISO/IEC 30132[78], Information technology – IT Sustainability – Guidance for the Development of Energy Efficient ICT Products. Details of the standard are found here[79].

[70] http://www.dailymotion.com/video/xcso0v_tco-makes-recognizing-green-ict-pro_tech
[71] http://www.ecolabelindex.com/ecolabels/?st=category,electronics
[72] http://www.iso.org/iso/home/about.htm
[73] http://www.iso.org/iso/home/standards_development.htm
[74] http://www.iso.org/iso/home/standards_development/list_of_iso_technical_committees/iso_technical_committee.htm?commid=654019
[75] http://standards.incits.org/a/public/group/its39
[76] http://www.itu.int/rec/T-REC-L.1300-201111-I/en
[77] http://www.itu.int/ITU-T/recommendations/rec.aspx?rec=11429
[78] http://jtc1info.org/wp-content/uploads/2013/03/SC-39-Business-Plan-2012.pdf
[79] http://standardsdevelopment.bsigroup.com/Home/Project/201301709

EN

European Standard (EN)

A European Standard (EN)[80] is a standard that has been adopted by one of the three recognized European Standardisation Organisations (ESOs): European Committee for Standardization (CEN)[81], European Committee for Electrotechnical Standardization (CENELEC)[82] or European Telecommunications Standard Institute (ETSI) (discussed in the next sub-section).

ETSI

ETS[83] stands for European Telecommunications Standards Institute which produces globally applicable standards for ICTs. However, according to ETS, standards comprise a collection of specification, standards, reports and guides and details of this could be found here[84]. Published standards are in this website[85].

ETS's Technical Committee on Access Terminals Transmission & Multiplexing (TC ATTM) has developed a list of approved standards[86]:
TS 105 174-1: Energy Efficiency and Broadband Deployment: Overview, common and Generic Aspects
TR 105174-2-1: Energy Efficiency and Broadband Deployment: Operator sites.
TS 105174-2-2: Energy Efficiency and Broadband Deployment: Data centres.
TR 105174-4: Energy Efficiency and Broadband Deployment: Access networks
TR 105174-5-1: Energy Efficiency and Broadband Deployment: Customer network infrastructures: Homes (Single-tenant)
TR 105174-5-2: Energy Efficiency and Broadband Deployment: Customer network infrastructures: Office premises (Single-tenant)
TS 105174-5-4: Energy Efficiency and Broadband Deployment: Customer network infrastructures: Customer data centres (Single-tenant).

ITU-T

ITU is the leading publisher of telecommunication technology, regulatory, and standard information and ITU-T[87] are standards it has produced for the telecommunications sector. Currently, ITU-T contains more than 3,000 standards that are in force and these standards define how telecommunication networks operate and interwork. Details of these standards can be found ink this website (ibid).

[80] http://www.cen.eu/cen/products/en/pages/default.aspx
[81] http://www.cen.eu/cen/products/en/pages/default.aspx
[82] http://www.cenelec.eu/
[83] http://www.etsi.org/
[84] http://www.etsi.org/standards/different-types-of-etsi-standards
[85] http://www.etsi.org/deliver/
[86] http://hes-standards.org/doc/SC25_WG1_N1379.pdf
[87] http://www.itu.int/en/publications/ITU-T/Pages/default.aspx

SPEC
The Standard Performance Evaluation Corporation (SPEC)[88] is a non-profit corporation formed to establish, maintain and endorse a standardized set of relevant benchmarks that can be applied to high-performance computers. These include: CPU; servers; power; virtualization; network file system, etc…

ATIS NIPP Energy Efficiency
The ATIS Network Interface, Power and Protection (NIPP) Committee developed standards for determining telecommunications energy efficiency[89]. They are as follows:
ATIS-0600015.2009: Energy Efficiency for Telecommunications Equipment: Methodology for Measuring and Reporting General Requirements
ATIS-0600015.01.2009: Energy Efficiency for Telecommunications Equipment: Methodology for Measuring and Reporting – Server Requirements
ATIS-0600015.02.2009: Energy Efficiency for Telecommunications Equipment: Methodology for Measuring and Reporting – Transport Requirements

3.3 GREEN ICT STANDARDS FOR E-WASTE DISPOSAL

EPA encourages electronics recyclerS to meet specific standards to safely recycle and manage electronics. Currently, there are two accredited certification standards[90]:

e-Stewards ® Standard
The e-Stewards Standard is for responsible recycling and reuse of electronic equipment. It is owned by Basel Action Network (BAN)[91], which aims to prevent global illegal and unjust trafficking of hazardous waste, based on the United Nations' Basel Convention[92] on the Control of Trans Boundary Movements of Hazardous Wastes and their Disposal. Some of the key requirements of the standard are in this website[93] while details of the standard are found here[94].

Responsible Recycling Practices (R2)[95]
R2 focuses on responsible electronics recycling and it sets forth requirements relating to environmental, health, safety, and security aspects of electronics recycling[96]:

[88] http://www.spec.org/
[89] http://www.itu.int/md/dologin_md.asp?lang=en&id=T09-FG.ICT-IL-0003!!MSW-E
[90] http://www.epa.gov/osw/conserve/materials/ecycling/certification.htm
[91] http://www.ban.org/
[92] http://www.basel.int/Portals/4/Basel%20Convention/docs/text/BaselConvention Text-e.pdf
[93] http://www.e-stewards.org/certification-overview/e-stewards-standard/what-is-the-e-stewards-standard/
[94] http://www.e-stewards.org/certification-overview/e-stewards-standard/access/
[95] http://www.epa.gov/osw/conserve/materials/ecycling/certification.htm
[96]http://www.r2solutions.org/index.php?submenu=Standard&src=gendocs&ref=R2Standard&category=R2Practices

– reducing environmental and human health impacts from improper recycling;
– increasing access to quality reusable and refurbished equipment to those who need them; and
– reducing energy use and other environmental impacts associated with mining and processing of virgin materials – conserving our limited natural resources.
Further details of R2 standards can be found here[97].

Recycling Industry Operating Standards® (RIOS)[98]
RIOS is the recycling industry's standard of quality environmental, and health and safety and it provides a framework for e-scrap recyclers. A Certified Electronics Recycler must implement and be certified to two standards: R2 and RIOS where R2/RIOS[99] aims to help companies recycle electronics in an environmentally friendly manner.

OECD C(2004)100 Standard on Environmentally Sound Management (ESM) of Waste
Environmentally Sound Management (ESM) is defined[100] as a 'Scheme for ensuring that wastes and used and scrap materials are managed in a manner that will: save natural resources; and protect human health and the environment against adverse effects that may result from such waste and materials'. OECD's C(2004)100 standard focuses on the Environmentally Sound Management (ESM) of waste and it recommends that both recovery and disposal operations as well as both hazardous and non-hazardous wastes should be Environmentally Soundly Managed (ibid). The guidance for the implementation of the standard is found here[101] and technical guidance for the environmentally sound management of specific waste streams: used and scrap personal computers can be accessed here[102].

3.4 ICT AND ENVIRONMENT

Standards for ICT and environment are divided into:
– Environmental Management
– Methodologies for product lifecycle accounting and reporting
– EU ICT Codes of Conduct

[97] http://asoft10298.accrisoft.com/r2solutions/clientuploads/The%20R2%20Electronics%20Recycling%20Practices%20%2010-30-08%20R2S.pdf
[98] http://www.isri.org/imis15_prod/ISRI/_Program_and_Services/Recycling_Industry_Operating_Standards__RIOS_/ISRI/_Program_and_Services/Recycling_Industry_Operating_Standards__RIOS_.aspx
[99] http://www.ecolabelindex.com/ecolabel/r2-rios
[100] http://www.epa.gov/waste/conserve/materials/ecycling/conference/resource/guide-esm.pdf
[101] http://www.oecd.org/env/waste/39559085.pdf
[102] http://search.oecd.org/officialdocuments/displaydocumentpdf/?doclanguage=en&cote=ENV/EPOC/WGWPR(2001)3/FINAL

3.4.1 *Environmental Management*

ISO
ISO stands for International Standard Organizations which has a membership of 160 national standards institutes[103].
– *ISO 14000*[104,105,106]: family of environmental management standards to help public and private organizations take a proactive approach to manage environmental issues.
ISO Guide 64:2008: guide for addressing environmental issues in product standards.
ISO 14001:2004: environmental management systems and requirements with guidance for use.
ISO 14004:2004: environmental management systems and general guidelines on principles, systems and support techniques.
ISO 14006:2011: environmental management systems and guidelines for incorporating ecodesign.
ISO 14020:2000: Environmental labels and declarations.
ISO 14063:2006: Environmental communication.
ISO 14064:2006[107]: GHG emissions inventories and verification. The relationships between ISO 14064 and ISO 14065 are found in Figure 2.
ISO/TS 14067:2013[108]: specifies principles, requirements and guidelines for the quantification and communication of the carbon footprint of a product (CFP).

The components of ISO 14064 and ISO 14065, and their relationships and dependencies are shown in Figure 2, while Figure 3 shows the relationship between ISO 14040 and other (non-ISO) standards.

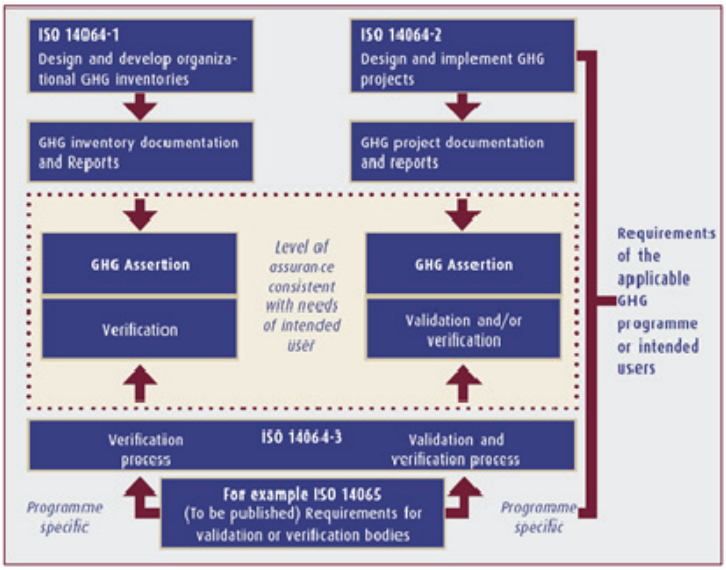
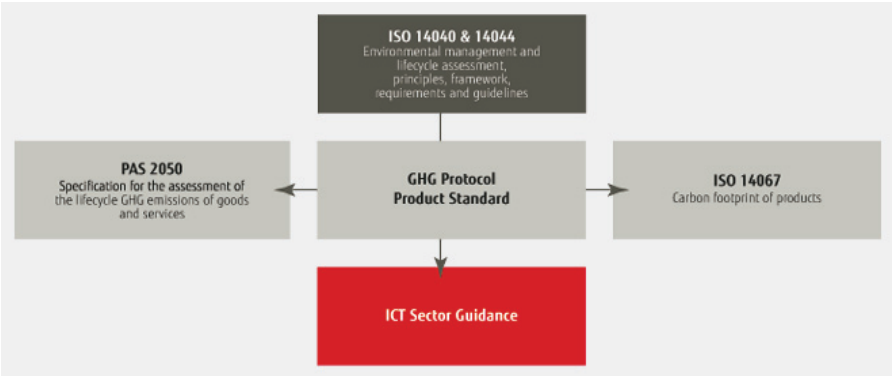


FIGURE 2 The relationships between ISO 14064 and ISO 14065

[103]http://www.iso.org/iso/theiso14000family_2009.pdf
[104]http://www.iso.org/iso/ghg_climate-change.pdf
[105]http://www.iso.org/iso/home/standards/management-standards/iso14000.htm
[106]http://www.iso14000-iso14001-environmental-management.com/
[107]http://www.epa.gov/ttnchie1/conference/ei16/session13/wintergreen.pdf
[108]https://www.iso.org/obp/ui/#iso:std:iso:ts:14067:ed-1:v1:en



Note: PAS 2050[109] is the specification for the assessment of the life cycle greenhouse gas emissions of goods and services

FIGURE 3 Relationship of ISO 14040 with other standards

– *ISO 50001:2011*[110,111]: this standard relates to energy management system and it outlines energy management practices that are considered to be the best, globally. It provides a requirements framework with guidance for use.

3.4.2 *Methodologies for Product Lifecycle Accounting and Reporting*

GHG Product Lifecycle Accounting and Reporting Standards[112] *(or referred to as Product Standard)*
This standard is developed by GHG Protocol[113], World Resources Institute (WRI)[114], the World Business Council for Sustainable Development (WBCSD)[115], the Carbon Trust[116] and the Global e-Sustainability Initiative (GeSI)[117]. This standard provides requirements, guidance and consistent approach (i.e. methodologies) for assessing and publicly report on the *life cycle GHG impacts of ICT products*[118],[119].

Life cycle GHG impacts of ICT products

PAS 2050[120]: is a specification developed by the British Standards Institution that provides a method for assessing the lifecycle GHG emissions of goods and services.

[109] http://shop.bsigroup.com/en/forms/PASs/PAS-2050/
[110]http://www.bsigroup.com/en-GB/iso-50001-energy-management/
[111]http://www.iso.org/iso/home/standards/management-standards/iso50001.htm
[112] http://www.ghgprotocol.org/feature/ghg-protocol-product-life-cycle-accounting-and-reporting-standard-ict-sector-guidance
[113]http://www.ghgprotocol.org/
[114] http://www.wri.org/
[115] http://www.wbcsd.org/home.aspx
[116] http://www.carbontrust.com/
[117] http://gesi.org/
[118] http://www.ghgprotocol.org/files/ghgp/public/Product-Life-Cycle-Accounting-Reporting-Standard_041613.pdf
[119] http://www.ghgprotocol.org/feature/ghg-protocol-product-life-cycle-accounting-and-reporting-standard-ict-sector-guidance
[120] http://shop.bsigroup.com/en/forms/PASs/PAS-2050/

ISO 14040:2006: environmental management and life cycle assessment including principles and framework
for life cycle analysis. Its relationship with other relevant ISOs is shown in Figure 3.

ISO 14044:2006[121,122]: specifies requirements and provides guidelines for life cycle assessment (LCA).

ITU
ITU-T L.1400[123]: Overview and general principles of methodologies for assessing the environmental impact
of information and communication.
Technologies:
ITU-T L.1410[124]: Methodology for environmental impacts assessment of ICT goods, networks and services.
ITU-T L.1420[125]: Methodology for environmental impacts assessment of ICT in organisations.

ETSI
TS 103 199[126]: Life Cycle Assessment (LCA) of ICT equipment, networks and services: General methodology and common requirements.
DTS/EE-00014: General definition and common requirements (ibid).
DTR/EE-00008[127]: Environmental Impact Assessment of ICT including the Positive Impact by using ICT Services.

IEC (International Electrotechnical Commission)
IEC TC 111 - IEC/TR 62725[128]: Quantification methodology of greenhouse gas emissions (CO_2e) for electrical and electronic products and systems.

IEC TC 111/335/DTR - IEC TR 62726[129]: Guidance on quantifying greenhouse gas emission reductions from

IEEE (Institute of Electrical and Electronics Engineers)
IEEE Standard 1888™[130]: this is a standard for Ubiquitous Green Community Control Network Protocol, promoting green ict, and gives a standardized generalization of equipment, data communication interface, and interactive message in this digital community network.

[121]http://www.iso.org/iso/catalogue_detail?csnumber=38498
[122]https://law.resource.org/pub/in/bis/S02/is.iso.14044.2006.pdf
[123] http://www.itu.int/rec/T-REC-L.1400-201102-I
[124] http://www.itu.int/rec/T-REC-L.1410-201203-I/en
[125] http://www.itu.int/rec/T-REC-L.1420-201202-I/en
[126]http://www.etsi.org/deliver/etsi_ts/103100_103199/103199/01.01.01_60/ts_103199v010101p.pdf
[127] http://www.etsi.org/images/files/ETSITechnologyLeaflets/EnergyEfficiency.pdf
[128] http://webstore.iec.ch/webstore/webstore.nsf/artnum/047668!opendocument
[129] http://www.iec.ch/dyn/www/f?p=103:23:0::::FSP_ORG_ID:1314
[130] http://standards.ieee.org/findstds/standard/1888-2011.html

3.4.3 *EU ICT Codes of Conduct*[131,132]

Codes of Conduct (CoC) published by Joint Research Centre (JRC):
– *Code of Conduct on energy consumption of broadband equipment*[133]: sets out the basic principles for energy efficiency of broadband communication equipment;
– *Code of Conduct on energy efficiency of external power supplies*[134,135]: only covers single voltage external ac-dc and ac-ac power supplies for electronic and electrical appliances, including among others AC adapters, battery chargers for mobile phones, domestic appliances, power tools and IT equipment, in the output power range 0.3W to 250W;
– *Code of Conduct on data centre energy efficiency*[136]: aims to increase energy consumption in data centres and reduce the related environmental, economic and energy supply security impacts through improved understanding of energy demand within the data centre, awareness promotion, and recommendation of energy efficient best practice and targets;
– *Code of Conduct on energy efficiency and quality of AC uninterruptible power systems*[137]: aims to minimise energy consumption by maximising energy efficiency of UPS (according to EN 62040-3 Ed. 1.0 b: 1999[138]) which deliver 1-phase and 3-phase uninterruptible power above 0.3kVA at 230/400 V;

REFLECTION 3
What will happen if different standards make different requirements?

4 **Legislation and Regulations**

4.1 EU DIRECTIVES AND REGULATIONS ON PRODUCT

– *Directive 2009/125/EC on ecodesign*[139,140]: aims to reduce the environmental impact of energy related products, including the energy consumption throughout their entire life cycle by providing consistent rules for improving their energy performances. It established a framework for the ecodesign requirements for energy-related products[141].

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131 http://ec.europa.eu/enterprise/sectors/ict/files/mandate_462_en.pdf
132 http://re.jrc.ec.europa.eu/energyefficiency/html/standby_initiative.htm
133http://iet.jrc.ec.europa.eu/energyefficiency/sites/energyefficiency/files/code_of_conduct_broadband_equipment_v4_1_final.pdf
134http://iet.jrc.ec.europa.eu/energyefficiency/sites/energyefficiency/files/code_of_conduct_for_ps_version_5_-_draft_120919.pdf
135http://iet.jrc.ec.europa.eu/energyefficiency/sites/energyefficiency/files/files/documents/ICT_CoC/code_of_conduct_for_eps_version_5_-_final.pdf
136http://ec.europa.eu/information_society/activities/sustainable_growth/docs/datacenter_code-conduct.pdf
137http://re.jrc.ec.europa.eu/energyefficiency/Code%20of%20conduct/UPS/Code_of_conduct_UPS_16032011.pdf
138 http://www.en-standard.eu/csn-en-62040-3-ed-2-uninterruptible-power-systems-ups-part-3-method-of-specifying-the-performance-and-test-requirements/?gclid=CO_DwoC9nrwCFesJwwodgAEAlw
139 http://ec.europa.eu/energy/efficiency/ecodesign/eco_design_en.htm
140 http://ec.europa.eu/enterprise/policies/sustainable-business/ecodesign/index_en.htm
141 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:285:0010:0035:EN:PDF

Ecodesign Directive

Some of the regulations implementing the Ecodesign Directive include
– *Commission regulation (eu) no 617/2013*[142]: supports the implementation of the Directive 2009/125/EC with regard to ecodesign requirements for computers and computer servers. An example of an Ecodesign Regulation is the Ecodesign Regulation on standby[143] it requires that personal computers do not consume more than 0.5W in off mode as of 2013. Details of other regulations are found in Annex II of Regulation n°617/2013;
– *Commission Regulation (EC) No 1275/2008*[144] on ecodesign requirements for standby and off-mode power consumption of electronic office equipment. As an example, to incorporate a power management function in an energy using product;

4.2 DIRECTIVES AND REGULATIONSON E-WASTE

– *EPA's Universal Waste Regulations*[145]: govern the collection and management of generated wastes (e.g. batteries, mercury containing equipment), thus facilitating environmentally sound collection and proper recycling or treatment. Details of e-waste management of batteries can be found here[146].
– *Directive on waste electrical and electronic equipment (WEEE)*[147]: aim to minimise the generation of e-waste, to promote reuse, recycling or recovery. Design and production of electrical and electronic equipment ought to consider dismantling and recovery, reuse and recycling. Producers are required to employ the best available treatment (compliant to Annexes II and III of the Directive), recovery, and recycling techniques. A review on the implementation of the WEEE Directive in EU Member States can be found in this technical report[148] commissioned by EC Environmental Directorate-General.
– *Directive 2011/65/EU on Restriction of Hazardous Substances (ROHS2) in electrical and electronic equipment*[149]: aims to ensure that common restrictions be applied on the levels of six hazardous substances (i.e. lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB), and polybrominated diphenyl ethers (PBDE)) that may be present in a wide range of electrical and electronic equipment, as well as minimising the end of life environmental impact of that equipment.

[142] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:175:0013:0033:EN:PDF
[143] http://ec.europa.eu/enterprise/policies/sustainable-business/ecodesign/files/brochure_ecodesign_en.pdf
[144] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:339:0045:0052:en:PDF
[145] http://www.epa.gov/osw/hazard/wastetypes/universal/
[146] http://www.epa.gov/osw/hazard/wastetypes/universal/batteries.htm
[147] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:197:FULL:EN:PDF
[148] http://ftp.jrc.es/EURdoc/eur22231en.pdf
[149] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:174:0088:0110:EN:PDF

SUMMARY

There are a number of different ways in which practice can be promoted: ranging from standards which have some form of legal or regulatory support to advisory 'best practice'. The benefits and drawbacks of each have been identified, and there are opposing views of the most appropriate. Some will claim that the required behaviour will only be implemented with the backing of legally enforceable fines; others feel that a shared community approach, where those who are expected to carry out the requirements are closely involved in the development, are the most productive. There are examples to support both views.

MODEL ANSWERS

Answers to Reflection Questions

1 a All these forms of framework are important, and must be considered carefully.

b Being able to show conformance to all forms is beneficial for company image
Legislation and regulation are more powerful, because they are usually supported (enforced) by some kinds of penalty (usually a fine).

Codes of conduct and directives are often made part of the terms for being allowed to contract for Government business. Therefore adopting the appropriate ones will be necessary to access this business area.

It is often the case that legislation will be developed which requires the adoption of existing code of conduct.

2 There are different views on the issue "*Is it helpful to have so many different plans and initiatives?"*: one is that it is helpful to have a bigger number of activities, so that coverage is wider and nothing is missed out. The alternative is that the conflicting information which is likely to appear can be confusing, and can give those who do not want to adopt these approaches an excuse to do nothing ("let us wait to see what happens").

Andrew Tanebaum, the author of a number of books on Computer Systems and Networks has a saying "the great thing about standards is that you can always find one to suit your needs".

3 The optimistic view is that the community of users will adopt the strongest ("best") of the alternatives – a bit like evolution and the survival of the fittest.
The alternative view is that users will be confused and will be tempted by the "wait and see" approach.