Unit 52: Digital Sustainability

Unit code A/618/5694

Unit level 5

Credit value 15

Introduction

Living and working in the 21st century in the digital technologies sector presents a range of unforeseen sustainability challenges. These challenges are based on, among other potential issues, mineral resource, ethical working and employment practices, economic impact, supply chain and climate impact.

The Brundtland Commission of the United Nations in March 1987 defined sustainability as: ‘sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs’. Digital technologies is a sector in the frontline of the battle to overcome the challenges of creating a sustainable economy, but no single discipline has the capability to tackle the problems. Sustainability is a multidisciplinary challenge and technologists of the future will have to work collaboratively with a whole range of other stakeholders, such as engineers, scientists, governmental bodies and financiers, in order to find, within an urgent timescale, the practical and technological solutions needed.

On successful completion of this unit, students will have gained a wide range of knowledge and understanding of the issues and topics associated with sustainability and low impact digital technology solutions. They will have explored the interdisciplinary context of sustainability and how the development of a low carbon economy is essential in the digital technology sector. Students will have explored a current digital technology solution and evaluated its impact and potential sustainability, evaluating a range of solutions and data sources.

Learning Outcomes

By the end of this unit, students will be able to:

LO1 Determine the nature and scope of the technical challenges, ensuring sustainability, within the digital technologies sector.

LO2 Explore the importance of collaborating with other disciplines in developing digital technical solutions to sustainability problems.

LO3 Evaluate the use of sustainable techniques in relation to their contribution to a low carbon economy

LO4 Calculate the carbon footprint of a digital technologies' solution.

Essential Content

LO1 **Determine the nature and scope of the technical challenges, ensuring sustainability, in the digital technologies sector**

The scope and social context of sustainability:

Current sustainable development and digital technology challenges.

Moore's Law and the Brundtland definition of sustainability in a digital technologies context.

Impact of global demographics, trends and predictions, population growth and how this affects demand, economics, employment ethics and resource availability.

Environmental issues:

Climate change, planetary energy balance, carbon cycle science, carbon footprint of digital technologies, including: power consumption, mineral and material use, shipping, heat/energy output, packaging, recycling and safe disposal, potential pollution issues, contaminants in older equipment, low carbon power sources, corporate social responsibility and sustainable use of technologies – extending lifetime utilisation.

LO2 **Explore the importance of collaborating with other disciplines in developing digital technical solutions to sustainability problems**

Systems thinking and socio-technical systems:

The politics and economics of sustainability, following the principles of the Kyoto Protocol, UN Climate Change Conference (COP) and European Union Emissions Trading System (EU ETS).

Maintaining sustainable infrastructures:

Low carbon transport systems, engaging with sustainable cities and societies, using green building and built infrastructure principles, ensuring the use of low impact power generation, power storage and power distribution. Assuring low impact, sustainable logistics and maintaining a low-waste-based system.

Ethical standards:

Assuring 3rd party supplier, manufacturer and supply chain contractors all conform to current ethical sustainable and fair employment standards, along with associated legislation, e.g. ethical sourcing and disposal of end-of-life electrical equipment – Waste Electrical and Electronic Equipment (WEEE) Regulations (2013). Use of environmentally neutral, beneficial 3rd party cloud solutions, reviewing ecological credentials of cloud provisioning organisation.

LO3 **Evaluate the use of sustainable techniques in relation to their contribution to a low carbon economy**

Sustainable techniques:

Evaluating how digital technologies can be maintained via nuclear, solar, wind, tidal and wave, geothermal, biomass and bioenergy. Ensuring whole life cycle costing and using the precautionary principle.

Exploring the cost, power consumption and impact of digital technologies in a sustainability context, e.g. data centres, robotics in engineering, digital manufacturing, automated transport, telecommunications, health technologies, agri-tech.

Evaluate the KWH (kilowatt hour) power consumption of cloud solutions, data transmission and device use (routers, switches, servers, desktop systems, mobile computing, smart devices, wireless, wired etc.). Powering down devices when unused, reducing standby time, power consumption on 'spin up' to full utilisation.

LO4 **Calculate the carbon footprint of a digital technologies' solution**

Impact of digital technologies on climate:

Direct carbon emissions associated with digital technology manufacture, use and disposal. Case studies, e.g. Google Carbon Offset Data Centers, Microsoft and Ørsted offshore wind power, HP ink cartridge recycling program, NHS Electronic Prescription Service (EPS), Coca Cola manufacturing and warehouse automated robots.

Indirect positive emission effects from using digital technologies, e.g. travel substitution and transportation optimisation.

Impact that digital technologies have on behaviours and references, e.g. reshaping how we lead our lives.

Carbon footprint:

Evaluating the digital technology carbon footprint perspective, including organisational, value and supply chain, product-based challenges, current carbon footprint science, calculation of footprint based on system boundaries (limits of sphere of influence and control), geographical location, e.g. Global Carbon Project (GCP) map.

Calculation of carbon footprint, e.g. ISO 14067:2018 – Greenhouse gases – Carbon footprint of products – Requirements and guidelines for quantification.

Decarbonisation of digital technologies:

Significance of digital technology electricity consumption. Use of renewable energy, e.g. solar and wind power, to lower carbon emissions.

Impact of new and evolving digital technologies, e.g. artificial intelligence (AI).

Digital technologies as a driver of greater sustainability.

Approaches to reducing digital technologies carbon footprint, e.g. maintaining digital devices to prolong life, use digital devices for longer before upgrading, recycle/reuse equipment, consume digital services on smaller devices, charge batteries with electricity from renewable sources, purchase digital devices and services from companies that have science-based targets (SBTs), use digital technology to help to reduce carbon emissions.

Data sources:

Evaluating power consumption, manufacturers' ecological/green rating of device(s), data sheets, regional waste-management metrics, energy efficiency ratings.

Long-term sustainability:

Projecting long-term sustainability of selected digital technologies to include sustainability plan and practices, e.g. zero-carbon, carbon neutral, net-positive approach, green IT; voluntary sustainability report, stakeholder engagement.

Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
LO1 Determine the nature and scope of the technical challenges, ensuring sustainability, in the digital technologies sector		
P1 Investigate the nature and scope of the technical challenges of ensuring sustainability for the digital technologies sector.	**M1** Analyse the impact of sustainability on the deployment of digital technologies.	**D1** Critically analyse the interrelationship between sustainability, digital technology demand and resource availability.
LO2 Explore the importance of collaborating with other disciplines in developing digital technical solutions to sustainability problems		
P2 Explain the interdisciplinary issues associated with the construction of sustainable infrastructures, with attention to the competing pressures within these infrastructures.	**M2** Analyse how political, economic and ethical standards can impact digital technical solutions.	**D2** Critically analyse how a systemic approach can be used to support interdisciplinary collaboration in developing sustainable digital technologies.
LO3 Evaluate the use of sustainable techniques in relation to their contribution to a low carbon economy		
P3 Discuss the sustainable techniques that need to be considered when selecting alternative low carbon energy sources.	**M3** Analyse the challenges present, when selecting low carbon sustainable techniques for a digital technology solution.	**D3** Critically analyse how current digital technology solutions could be improved via the application of low carbon sustainable techniques.
LO4 Calculate the carbon footprint of a digital technologies' solution		
P4 Calculate the carbon footprint of a digital technology solution.	**M4** Analyse the use of renewable energy to lower carbon emissions to support a digital technology solution.	**D4** Critically review the overall carbon footprint impact and long-term sustainability of an existing digital technologies solution.

Recommended resources

Textbooks

BERNERS-LEE, M. (2019) *There Is No Planet B: A Handbook for the Make or Break Years* Cambridge University Press

BERNERS-LEE, M. (2010) *How Bad Are Bananas?* Profile Books.

BOYLE, G. (2012) *Energy Systems and Sustainability: Power for a Sustainable Future.* Oxford University Press.

FENNER, A. and AINGER, C. (2013) *Sustainable Infrastructures: Principles into Practice.* ICE Publishing.

HAZAS, M. & NATHAN, L (2017) *Digital Technology and Sustainability: Engaging the Paradox,* Routledge

HELM, D. (2015) The Carbon Crunch: *Why we are Getting Climate Change Wrong and How to Fix It.* Yale University Press.

HONE, D. (2014) *Putting The Genie Back: 2°c Will Be Harder Than We Think.* Whitefox Publishing.

Websites

bsigroup.com	Product Carbon Footprinting for Beginners – guidance for smaller businesses on tackling the carbon foot printing challenge
carbontrust.com	Carbon Trust Carbon foot printing (General reference)
fern.org	FERN Trading Carbon How it Works and Why it is Controversial (E-book)
gov.uk/guidance/regulations-waste-electrical-and-electronic-equipment	UK Government Technology Waste Disposal
populationinstitute.org	Population Institute Demographic Vulnerability report (Report)

Links

This unit links to the following related units:

Unit 12: Management in the Digital Economy

Unit 53: Digital Technologies as a Catalyst for Change

