D-GREEN HANDBOOK

Sustainable Business & Digital Transition Toolkit

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PART 1 – Foundations: Why + Shared Definitions

1. Introduction: Purpose and Scope

Small and medium-sized enterprises (SMEs) are at the heart of the European economy. They represent around 99% of European businesses and provide jobs for more than 85 million people in Europe (European Commission, n.d.). At the same time, SMEs increasingly depend on digital technologies for communication, operations, sales, customer service, data management, marketing, and innovation.

As digital technologies become essential to everyday business operations, digital sustainability is emerging as an important business capability. In this handbook, digital sustainability refers to the responsible and efficient use of digital technologies to create business value while minimising unnecessary resource consumption, environmental impacts, and digital waste. This concept is explored in greater detail in Chapter 4.

Digitalisation offers significant opportunities for growth, efficiency, productivity, and competitiveness. For many SMEs, digital tools make it possible to reach new customers, automate routine tasks, improve internal workflows, access new markets, and strengthen resilience. However, digitalisation also creates environmental and social impacts that are often invisible in everyday business practice.

When implemented strategically, digitalisation becomes a powerful driver of sustainable business growth, enabling SMEs to create value while improving operational efficiency and long-term competitiveness. For SMEs, sustainable digitalisation is not only an environmental responsibility but also a business opportunity. It also strengthens organisational resilience and prepares businesses for future sustainability and regulatory expectations. It can reduce operational costs, improve productivity, strengthen competitiveness, support innovation, and enhance customer trust.

However, digitalisation also creates environmental, economic, and organisational impacts that often remain invisible in everyday business practice.

Every email stored, file duplicated, cloud service used, software license maintained, artificial intelligence query processed, social media asset uploaded, and digital device purchased contributes to the overall footprint of digital technologies. These impacts include, e.g., energy consumption, use of raw materials, use of water, greenhouse gas emissions, electronic waste, data security risks, and growing dependence on digital infrastructure. Collectively, these activities also generate hidden operational costs that often remain unnoticed by organisations.

Many SMEs are aware of general sustainability challenges but have limited knowledge of how their digital activities affect energy use, resource consumption, electronic waste generation, and

operational efficiency. As a result, opportunities to reduce costs, improve sustainability performance, optimise digital processes, minimise digital waste, and strengthen competitiveness are often overlooked. By addressing these challenges, SMEs not only improve their own business performance but also contribute to the broader objectives of the European green transition, including more sustainable resource use, reduced environmental impacts, and responsible digital transformation.

The D-GREEN Handbook was developed to support SMEs throughout their green and digital transition by providing practical guidance, educational resources, and capacity-building tools. Rather than presenting digital sustainability as a compliance obligation, the handbook approaches it as a practical business optimisation strategy that helps organisations reduce costs, improve efficiency, strengthen competitiveness, and minimise digital waste. The concept of digital sustainability is explored in greater detail in Chapter 4, together with practical approaches for its implementation in SMEs. The handbook provides a practical roadmap to help SMEs integrate digital sustainability into everyday business operations and continuous improvement.

1.1 Purpose of the Handbook

Why this chapter matters

This chapter explains why digital sustainability matters for SMEs and introduces the purpose, scope, and objectives of the D-GREEN Handbook. It explains how responsible digital practices create business value by improving efficiency, competitiveness, organizational resilience, and environmental sustainability.

The transition towards a more sustainable and digital economy is one of the defining challenges and opportunities for European SMEs. Businesses are expected to adapt to rapidly evolving technologies, increasing stakeholder expectations, emerging sustainability requirements, and changing market conditions. At the same time, digital technologies have become essential for competitiveness, innovation, customer communication, and operational efficiency. For SMEs, this transition represents not only a sustainability challenge but also a business opportunity. Responsible digital practices can improve productivity, reduce operational costs, strengthen competitiveness, and support long-term resilience.

However, digitalization is not automatically sustainable. Digital tools can help organizations reduce environmental impacts, optimize resource use, and create new business opportunities. At the same time, they can also increase energy consumption, generate electronic waste, create unnecessary data storage, increase dependence on cloud infrastructure, and contribute to social and ethical challenges.

Digital sustainability therefore requires organizations to balance the benefits of digital technologies with their environmental, economic, and social impacts throughout their lifecycle.

The D-GREEN Handbook has been developed to support Vocational Education and Training (VET) professionals, consultants, business advisors, and other learning facilitators in designing and delivering training programmes that help SMEs understand and manage the intersection of digitalization and sustainability.

The Handbook provides a practical and scientifically grounded framework for understanding digital sustainability and translating it into actionable business practices. It combines sustainability principles, digital transformation concepts, practical tools, training methodologies, case examples, governance approaches, and implementation guidance that can be adapted to different SME sectors and organizational contexts. Rather than presenting sustainability as a compliance requirement, the Handbook promotes digital sustainability as a practical business optimisation approach that supports efficiency, innovation, and sustainable growth.

The Handbook adopts an integrated perspective by bringing sustainability and digitalisation together rather than treating them as separate topics. It recognizes that long-term business success increasingly depends on the ability to create value while using digital technologies responsibly and efficiently.

One of the central themes of the Handbook is improving digital sustainability by reducing digital waste and promoting the efficient use of digital resources, energy, software, and digital infrastructure. In the D-GREEN context, digital waste refers to digital resources, processes, data, content, devices, or software that consume energy, storage, computing capacity, materials, time, or money without creating meaningful value. Examples include duplicate files, outdated social media assets, unused software licenses, unnecessary cloud storage, inactive user accounts, poorly managed data, obsolete devices, and inefficient digital workflows. Digital waste is therefore presented as one important aspect of digital sustainability rather than its sole focus. The Handbook also promotes other digital efficiency practices, including energy-efficient use of digital devices and cloud services, effective data management, sustainable procurement of digital equipment, and optimised digital workflows that reduce unnecessary resource consumption.

The overall objective of the Handbook is to help trainers support SMEs in:

1. understanding the sustainability implications of digital technologies;
2. identifying opportunities for sustainable digital innovation;
3. reducing the environmental, social, and economic impacts of ICT;
4. recognizing and reducing digital waste;
5. improving the efficient use of energy, data, software, digital infrastructure, and devices;
6. strengthening organizational resilience and competitiveness;

7. building digital sustainability competencies across different organizational roles;
8. supporting behavioural and organisational change.

These objectives provide the foundation for the chapters that follow, guiding trainers and SMEs from understanding digital sustainability concepts to implementing practical improvements and evaluating their impact.

By strengthening the capabilities of trainers and SMEs alike, the D-GREEN project contributes to a more sustainable, resilient, resource-efficient, and competitive European economy while supporting the successful green and digital transition of businesses.

1.2 Target audience (VET trainers, SME managers, SME roles)

Why this chapter matters

This chapter explains who the D-GREEN Handbook is designed for and why digital sustainability requires collaboration across different organisational roles. It highlights the importance of engaging both trainers and SMEs in building practical competencies that support sustainable business development.

The primary target group of this Handbook is Vocational Education and Training (VET) professionals who support SMEs in developing the knowledge, skills, and competencies needed for the green and digital transition.

The primary target group of this Handbook consists of Vocational Education and Training (VET) professionals who support SMEs in developing digital and sustainability-related competencies.

The Handbook is specifically designed for:

1. VET trainers and educators;
2. SME consultants and advisors (including IT, digitalisation, sustainability, and business consultants);
3. SME support organisations;
4. innovation and entrepreneurship support providers;
5. digitalisation experts;
6. sustainability professionals working with SMEs;
7. trainers involved in lifelong learning and workforce development.

Although the Handbook is primarily intended for trainers, its practical structure also enables direct use by SMEs seeking to improve operational efficiency, reduce digital waste, strengthen competitiveness, and support sustainable business practices.

In addition, the Handbook can be used directly by SME managers, entrepreneurs, ICT professionals, procurement specialists, operations managers, human resource professionals, communication and marketing specialists, and sustainability coordinators seeking practical guidance on sustainable digitalisation. These different perspectives help organisations integrate digital sustainability into everyday decision-making rather than treating it solely as an ICT responsibility.

This broader audience is important because digital sustainability is not only an ICT issue. Successful implementation depends on leadership commitment, employee engagement, and collaboration across organisational functions. Decisions about devices, data, cloud services, artificial intelligence, cybersecurity, digital marketing, social media, procurement, and workflows are often made across different roles within an SME. For this reason, the Handbook encourages trainers to work with both decision-makers and employees who influence everyday digital practices.

Because SMEs vary significantly in size, sector, resources, and maturity levels, the Handbook promotes a flexible and modular approach. Trainers are encouraged to adapt content and learning activities according to organisational needs, sector-specific challenges, digital maturity, available resources, and learner profiles. This flexibility enables trainers to tailor learning pathways that reflect real business challenges, organisational priorities, and available resources.

In micro and small enterprises, one person may be responsible for several roles at once. In medium-sized enterprises, digital sustainability may involve cooperation between management, ICT, operations, procurement, marketing, HR, and sustainability-related functions. This collaborative approach helps organisations embed digital sustainability into everyday business processes and prepares the foundation for the practical methods and tools introduced in the following chapters.

1.3 Position within D-Green outputs (Handbook, MOOC, Assessment Tool)

Why this chapter matters

This chapter explains how the three main D-GREEN project outputs relate to each other. While each resource can be used independently, together they provide complementary support for building digital sustainability competencies, implementing practical improvements, and monitoring organisational progress.

The D-GREEN project has developed three complementary resources to support the green and digital transition of SMEs. Each resource serves a different purpose while remaining fully usable as a standalone output. Together, they provide organisations, trainers, and SME support professionals with complementary opportunities for learning, implementation, and continuous improvement.

D-GREEN Handbook

The Handbook provides the theoretical foundations, training methodologies, practical tools, examples, and implementation guidance required to design and deliver digital sustainability training programmes. It is primarily intended for trainers, consultants, and SME support professionals who need to translate complex sustainability and digitalisation topics into practical learning experiences. The Handbook can be used independently or together with other D-GREEN resources, depending on organisational needs.

D-GREEN MOOC

The Massive Open Online Course (MOOC) offers self-paced learning opportunities for SME managers, employees, and other stakeholders. It provides additional learning materials, practical examples, exercises, videos, and self-directed learning resources for those wishing to deepen their knowledge of digital sustainability.

D-GREEN Assessment Tool

The assessment tool enables SMEs to evaluate their current digital sustainability maturity, identify strengths and weaknesses, prioritise actions, and monitor progress over time. The assessment tool may be used before, during, or after training activities to support continuous improvement. Although each resource can be used independently, together they provide a comprehensive framework for building awareness, developing competencies, implementing improvements, and monitoring progress

towards digital sustainability. Organisations may choose to use one or all of these resources according to their objectives and level of digital maturity.

Together, these complementary resources support organisations throughout their digital sustainability journey—from understanding key concepts to implementing practical improvements and evaluating long-term progress.

The complete D-GREEN Digital Sustainability Maturity Self-Assessment Questionnaire is provided in Annex B.5. Trainers are encouraged to use the questionnaire before the training to establish a baseline, repeat it after the training to evaluate learning outcomes, and use the results to support action planning and KPI development.

1.4 How to Use This Handbook

Why this chapter matters

This chapter explains how trainers and SME support professionals can use the D-GREEN Handbook in a flexible and practical way. It provides a recommended learning pathway while encouraging adaptation to different organisational contexts, learner needs, and levels of digital maturity.

The D-GREEN Handbook is designed as a flexible training resource rather than a fixed curriculum. Trainers are encouraged to assess the needs of participating SMEs, select the most relevant chapters, adapt examples to the organisational context, and combine handbook content with practical tools, exercises, templates, and resources provided throughout the Handbook and its annexes.

The D-GREEN Handbook is designed as a flexible training resource rather than a fixed curriculum. Trainers are encouraged to assess the needs of participating SMEs, select the most relevant modules, adapt examples to the organisational context, and combine handbook chapters with practical tools provided in the annexes.

Recommended Learning Pathway

The recommended learning pathway consists of seven steps:

1. Assess the needs and digital sustainability maturity of participating SMEs using the D-GREEN Digital Sustainability Maturity Self-Assessment Questionnaire (Annex B.5).
2. Select relevant handbook modules and trainer resources.
3. Adapt content to the sector, company size, and learner roles.
4. Deliver training activities using participatory methods.
5. Facilitate reflection and discussion.
6. Support participants in developing action plans.
7. Monitor implementation and continuous improvement.

The self-assessment questionnaire provides a practical starting point for identifying organisational strengths, priority improvement areas and training needs. Trainers may also repeat the questionnaire after implementation to measure progress and support continuous improvement.

Not every chapter or exercise needs to be used in every training programme. Trainers should tailor learning activities according to available time, participant needs, and organisational priorities and the digital maturity of participating SMEs.



Figure 1.1. Trainer Workflow: How to Use This Handbook

Handbook Structure

Part 1 – Foundations: Why + Shared Definitions

Part 1 provides the sustainability context, introduces key concepts, explains the role of digitalisation in sustainability, and establishes a shared vocabulary. It helps trainers and learners understand why digital sustainability matters for SMEs and how digital waste connects to business efficiency, environmental impact, and long-term resilience.

Part 2 – Trainer Toolkit

Part 2 supports trainers in designing, adapting, and delivering effective digital sustainability training programmes for SMEs. It includes training design principles, workflow guidance, personas, SME segmentation, facilitation methods, engagement strategies, and change management approaches.

Part 3 – Core Digital Sustainability Modules

Part 3 presents the main thematic learning modules. These include Green IT and energy efficiency, digital tools for sustainability, artificial intelligence, cybersecurity and data ethics, circular economy and lifecycle thinking, and sustainable business models. These modules help trainers address the most relevant digital sustainability topics in practical SME contexts.

Part 4 – Measurement and Governance

Part 4 provides guidance on KPI development, governance structures, monitoring routines, role definitions, and implementation planning. It helps SMEs move from individual actions to more systematic and measurable digital sustainability practices.

Part 5 – Case Library and Trainer Materials

Part 5 offers practical examples, trainer resources, exercises, and ready-to-use learning materials. These resources help trainers translate concepts into workshops, discussions, group exercises, assessments, and action plans.

Throughout the Handbook, trainers are encouraged to connect digital sustainability concepts with real business challenges, organisational priorities, and practical opportunities for improving operational efficiency, reducing digital waste, and supporting organisational change.

The Handbook should therefore be viewed not only as a source of information, but also as a practical facilitation, implementation, and continuous improvement tool.

The Handbook can be used in different ways:

- as a complete training programme;
- as a modular resource for workshops and short training sessions;
- as a reference guide for coaching and consulting;
- as a basis for SME self-assessment and action planning;
- as a practical guide for improving digital sustainability in everyday business operations.

2. Digital Sustainability for SMEs

Why this chapter matters

This chapter introduces the concept of digital sustainability and explains why it is becoming a strategic business priority for SMEs. It explores how global sustainability challenges, digital technologies, and responsible business practices are interconnected, providing the foundation for the practical guidance presented throughout the Handbook.

This chapter introduces the concept of digital sustainability and explains why it has become increasingly important for Small and Medium-sized Enterprises (SMEs). It explores the relationship between sustainability and digitalisation, highlights the environmental and social impacts of Information and Communication Technologies (ICT), and introduces practical opportunities for SMEs to create value while reducing their digital footprint. The chapter also explains the important roles of SMEs and Vocational Education and Training (VET) professionals in supporting the transition towards a more sustainable and resilient digital economy.

2.1 The Global Sustainability Challenge

Businesses today operate in an increasingly complex and rapidly changing environment. Climate change, biodiversity loss, resource scarcity, geopolitical instability, technological disruption, and changing customer expectations are reshaping markets across Europe and globally. These challenges are interconnected and influence how organisations produce, consume, innovate, and create value.

Scientific evidence shows that human activities are placing growing pressure on the Earth's natural systems. The Planetary Boundaries framework highlights the environmental limits within which societies and economies can operate safely. Exceeding these boundaries increases risks related to climate instability, ecosystem degradation, freshwater scarcity, pollution, and resource shortages. These risks increasingly affect business operations, supply chains, investment decisions, and long-term economic resilience (Rockström et al., 2009; Richardson et al., 2023; Kitzmann et al., 2025).

At the same time, sustainability challenges are not limited to environmental issues. Social inequalities, changing labour markets, skills shortages, digital exclusion, and declining trust in institutions also influence business performance and societal wellbeing. These environmental, social, and economic challenges are closely connected and require integrated solutions.

For SMEs, sustainability is no longer only a corporate responsibility topic. It has become a strategic business issue that affects competitiveness, operational costs, customer relationships, access to finance, regulatory compliance, and risk management (Willard, 2012; Pereira, 2025). Rising energy prices, increasing customer expectations, supply chain requirements, and new reporting obligations are encouraging organisations to rethink how they operate and create value.

Digital technologies play an important role in this transition. They can help organisations improve efficiency, optimise resource use, reduce waste, strengthen decision-making, and develop innovative products and services. However, digitalisation also creates environmental and social impacts that need to be managed responsibly.

Understanding the broader sustainability context is therefore an important first step towards digital sustainability. It helps SMEs recognise why sustainability matters, how global challenges influence local business decisions, and why responsible digitalisation is becoming increasingly important for long-term resilience and competitiveness.

Key Takeaways

- Global sustainability challenges increasingly influence business performance, competitiveness, and organisational resilience.
- Environmental, social, and economic challenges are interconnected and require integrated solutions.
- SMEs are increasingly expected to respond to changing customer expectations, regulatory developments, and resource constraints.
- Digital technologies can support sustainability but must be implemented and managed responsibly.
- Understanding the global sustainability context provides the foundation for digital sustainability and long-term business resilience.

Trainer Reflection

How could climate change, resource scarcity, changing customer expectations, or technological disruption affect SMEs in your sector over the next five to ten years?

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2.2 Sustainability Impacts of ICT

Digital technologies have become an essential part of modern business. SMEs use email, cloud services, websites, e-commerce platforms, social media, digital marketing tools, enterprise software, artificial intelligence, and connected devices to support everyday operations.

These technologies create significant opportunities for efficiency, innovation, communication, and growth. However, they also have environmental, social, and economic impacts that are often invisible to users.

Understanding these impacts is an important step towards digital sustainability.

Environmental Impacts

Digital technologies require energy, materials, infrastructure, and natural resources throughout their lifecycle.

The production of computers, smartphones, servers, and other digital devices depends on critical raw materials such as lithium, cobalt, copper, and rare earth elements. Manufacturing processes consume energy and water, while global supply chains create additional environmental impacts through transportation and logistics (European Commission, 2023).

During use, digital technologies continue to consume resources. Data centres, cloud services, artificial intelligence applications, video streaming, online platforms, and connected devices all require electricity and digital infrastructure to operate. As digitalisation expands, demand for data processing and storage continues to grow. The International Energy Agency (IEA) highlights that data centres, AI applications, and digital infrastructure are becoming increasingly important contributors to global electricity demand (IEA, 2024).

At the end of their lifecycle, digital devices become electronic waste (e-waste). E-waste is one of the fastest-growing waste streams globally and contains both valuable materials and potentially hazardous substances. Extending device lifetimes, supporting repair, reuse, refurbishment, and responsible recycling are therefore important elements of digital sustainability (UNITAR & ITU, 2024).

Digital Waste: The Hidden Impact

One of the most overlooked impacts of digitalisation is digital waste.

Digital waste refers to digital resources that consume storage capacity, energy, computing power, materials, time, or money without creating meaningful value. Recent research and digital sustainability initiatives increasingly identify digital waste as an emerging challenge for organisations seeking to improve both sustainability and operational efficiency.

Common examples within SMEs include:

- duplicate files and documents;
- outdated marketing materials;
- unused software licences;
- inactive user accounts;
- unnecessary cloud storage;
- obsolete digital content;
- redundant backups;
- inefficient data management;
- unnecessary AI-generated content.

Although digital waste is often invisible, it contributes to higher operational costs, larger environmental footprints, and reduced organisational efficiency.

For many SMEs, reducing digital waste represents one of the simplest and most cost-effective opportunities to improve sustainability performance.

Social and Ethical Impacts

Digital technologies also influence people, organisations, and societies.

Access to digital technologies and digital skills can create new opportunities for education, employment, entrepreneurship, and innovation. At the same time, unequal access to technology, connectivity, and digital competencies can reinforce existing inequalities (OECD, 2023). Moreover, modern ICT devices, such as computers and mobile phones, rely on various minerals—including tin, tantalum, tungsten, and gold—that are often sourced from conflict-affected regions and are therefore referred to as “conflict minerals.” In addition, the production of digital devices raises important human rights and ethical considerations. Many ICT products rely on minerals such as tin, tantalum, tungsten, gold, cobalt, and lithium, which are often extracted under environmentally and socially challenging conditions. Responsible sourcing, transparent supply chains, and longer product lifecycles are therefore important elements of digital sustainability.

Growing reliance on digital systems also raises important questions related to privacy, cybersecurity, data protection, transparency, and responsible use of artificial intelligence. Organisations increasingly need to ensure that digital technologies are used ethically, securely, and responsibly.

For SMEs, this means balancing innovation with responsible governance and maintaining trust among employees, customers, and business partners.

Economic Impacts

Digital technologies are powerful drivers of productivity, innovation, and competitiveness. They help organisations automate processes, optimise resources, improve communication, and access new markets. At the same time, dependence on digital infrastructure, software providers, cloud services, and external platforms introduces new operational and cybersecurity risks. Successful digital sustainability therefore requires organisations to balance these opportunities and risks throughout the technology lifecycle.

Practical Example

A medium-sized SME decides to conduct a digital sustainability audit after recognising that its digital systems have grown organically over several years without a clear management strategy. The audit examines cloud storage, duplicate and outdated files, inactive user accounts, software licences, AI applications, digital workflows, and the organisation's hardware inventory. It also reviews the energy

efficiency, repairability, and expected lifecycle of computers and other digital devices, as well as opportunities to replace unnecessary equipment with more sustainable alternatives.

The audit reveals several improvement opportunities. Employees are using multiple cloud storage platforms, many software licences are no longer required, outdated marketing materials and duplicate files occupy unnecessary storage space, and some AI tools are being used for routine tasks that add little business value while increasing computing demand. The company also identifies older devices with high energy consumption that could be replaced with more energy-efficient models as part of its normal procurement cycle.

Based on the audit findings, the organisation consolidates its cloud storage, removes obsolete files and inactive accounts, optimises software licences, introduces guidelines for the responsible use of AI, improves data management practices, and establishes procurement criteria that consider energy efficiency, repairability, and expected device lifetime. Employees receive training on good digital practices and are encouraged to regularly review digital content, applications, and storage.

Within several months, the company reduces cloud storage costs, lowers unnecessary digital resource consumption, improves information management, strengthens cybersecurity by removing unused accounts, extends the useful life of digital equipment, and creates a more structured approach to managing digital technologies. The audit demonstrates that improving digital sustainability can generate environmental, operational, and economic benefits simultaneously while strengthening the organisation's long-term resilience.

Key Takeaways

- ICT creates significant opportunities for productivity, innovation, competitiveness, and sustainable business development.
- Digital technologies consume energy, materials, water, and other resources throughout their lifecycle and should therefore be managed responsibly.
- Electronic waste and digital waste are growing sustainability challenges that also create unnecessary operational costs.
- Environmental, social, ethical, and economic impacts should all be considered when implementing digital technologies.
- Digital sustainability audits help organisations identify opportunities to improve resource efficiency, strengthen cybersecurity, optimise AI and software use, extend device lifecycles, and reduce digital waste.
- SMEs can improve both sustainability performance and business resilience by managing digital resources more efficiently throughout the technology lifecycle.

Trainer Reflection

Consider an SME that you know or work with.

- Which forms of digital waste or inefficient digital practices are most commonly observed?
- Which digital systems, cloud services, software, AI applications, or devices could be reviewed to improve efficiency and reduce unnecessary resource consumption?
- How could a digital sustainability audit help identify opportunities to reduce costs, improve cybersecurity, extend device lifecycles, and strengthen overall business performance?
- What practical actions could be implemented within the next six months to improve the organisation's digital sustainability?

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2.3 Digital sustainability

Digital sustainability is one of the core concepts of the D-GREEN project. It refers to the responsible, efficient, and value-driven use of digital technologies throughout their lifecycle. Rather than focusing on technology itself, digital sustainability encourages organisations to create business value while reducing unnecessary resource consumption, digital waste, and environmental impacts.

As discussed in the previous sections, digital technologies offer significant opportunities for SMEs to improve operational efficiency, optimise resource use, strengthen decision-making, support innovation, and enhance competitiveness. However, these benefits are accompanied by environmental, social, and economic impacts. Digital infrastructures consume energy and water, require critical raw materials, generate electronic waste, and raise important ethical considerations related to data, privacy, artificial intelligence, and digital inclusion (Freitag et al., 2021; Lange et al., 2022; UNESCO, 2021).

Digital sustainability therefore extends beyond adopting digital technologies. It focuses on ensuring that digitalisation creates business value while minimising unnecessary resource consumption, digital waste, and negative environmental and social impacts throughout the technology lifecycle. For SMEs, digital sustainability should be understood not only as a sustainability objective but also as a business optimisation strategy that supports efficiency, resilience, innovation, and long-term competitiveness.

For this reason, digital sustainability can be understood through two complementary perspectives:

- **Digitalisation for Sustainability**
- **Sustainable Digitalisation**

Together, these perspectives help organisations create business value while improving resource efficiency, reducing digital waste, strengthening responsible governance, and minimising the environmental and social impacts of digital technologies (OECD, 2021; UNEP, 2022).



Figure 2.2 Digital Sustainability vs Sustainable Digitalisation

Digitalisation for Sustainability

Focus Question: What can digital technologies do for sustainability?

Digitalisation for sustainability refers to the use of digital technologies to support sustainability goals. In this perspective, sustainability is the primary objective, while digital technologies are tools that help organisations achieve it.

Examples include:

- smart energy monitoring systems;
- digital tools for measuring environmental performance;
- route optimisation in logistics;
- predictive maintenance in manufacturing;
- resource-efficiency monitoring;
- digital platforms that support circular economy practices;
- AI-supported decision-making for sustainability challenges.

For SMEs, digitalisation can help improve efficiency, reduce costs, minimise waste, and identify new business opportunities. Digital tools can also provide better visibility into resource consumption,

supply chains, and environmental impacts. Digital technologies can support sustainability when they are intentionally aligned with environmental and social goals (UNEP, 2022; OECD, 2021).

However, technology alone does not guarantee positive outcomes. The sustainability benefits of digitalisation depend on how technologies are selected, implemented, managed, and used.

For SMEs, successful digitalisation for sustainability also depends on organisational commitment, employee engagement, and the ability to integrate digital solutions into everyday business processes. When aligned with business objectives, digital technologies can strengthen ESG performance, improve customer trust, support innovation, and create long-term competitive advantage.

Sustainable Digitalisation

Focus Question: What should sustainability require of digitalisation?

While digitalisation for sustainability focuses on the benefits that technology can create, sustainable digitalisation focuses on the impacts created by technology itself.

Digital technologies are not environmentally neutral. Devices require raw materials, cloud services consume energy, data centres require electricity and water, and digital infrastructures generate growing volumes of electronic waste. In addition, digital systems create important social and ethical considerations related to privacy, cybersecurity, artificial intelligence, accessibility, and fairness (Freitag et al., 2021; UNESCO, 2021).

Sustainable digitalisation therefore aims to minimise negative environmental and social impacts throughout the lifecycle of digital technologies.

For SMEs, this may include:

- extending the lifespan of devices;
- purchasing repairable or refurbished equipment;
- reducing unnecessary cloud storage;
- managing data responsibly;
- improving cybersecurity practices;
- reducing digital waste;
- using artificial intelligence responsibly;
- considering environmental impacts when selecting digital solutions.

This perspective encourages organisations to think not only about what technology can do, but also about how technology should be selected, managed, maintained, and continuously improved throughout its lifecycle. Achieving sustainable digitalisation also requires leadership commitment,

behavioural change, cross-functional collaboration, and internal change champions who can promote responsible digital practices across the organisation.

Practical Example

An SME introduces a digital energy monitoring system to reduce electricity consumption in its production facility while simultaneously reviewing its own digital infrastructure. The company removes obsolete files, optimises cloud storage, replaces ageing computers with more energy-efficient and repairable devices, introduces responsible AI usage guidelines, and trains employees on sustainable digital practices. By combining digitalisation for sustainability with sustainable digitalisation, the organisation reduces operational costs, improves resource efficiency, strengthens ESG performance, and lowers the environmental impact of its digital operations.

Trainer Reflection

- Can you identify examples of both digitalisation for sustainability and sustainable digitalisation within your organisation or sector?
- Which of these two perspectives is currently stronger in your organisation, and what actions could help achieve a better balance between them?

Key Takeaways

- Digital sustainability combines responsible technology use with business value creation.
- Digitalisation for sustainability uses digital technologies to achieve sustainability goals.
- Sustainable digitalisation focuses on reducing the environmental, social, and economic impacts of digital technologies.
- Both perspectives are complementary and should be integrated into organisational decision-making.
- Digital sustainability supports operational efficiency, innovation, ESG performance, competitiveness, and long-term organisational resilience.
- Successful implementation depends on responsible governance, employee engagement, and continuous improvement.

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2.4 Business Case for Digital Sustainability in SMEs

Why this section matters

This section explains why digital sustainability is not only an environmental responsibility but also a practical business opportunity for SMEs. It highlights how responsible digital practices can improve operational efficiency, reduce costs, strengthen competitiveness, and support long-term organisational resilience.

Digital sustainability is becoming an increasingly important business capability for SMEs. Rather than being viewed solely as an environmental or regulatory obligation, it should be understood as a practical business optimisation strategy that helps organisations improve efficiency while reducing unnecessary resource consumption and digital waste.

For SMEs, responsible digital practices can create measurable business value. Improving data management, optimising cloud services, reducing unnecessary software licences, extending device lifecycles, strengthening cybersecurity, and using artificial intelligence responsibly can reduce operational costs, improve productivity, minimise risks, and support innovation. At the same time, these practices contribute to environmental sustainability through more efficient use of energy, materials, and digital infrastructure (OECD, 2021; UNEP, 2022).

Digital sustainability also strengthens organisational resilience. SMEs that actively manage their digital resources are often better prepared to respond to changing customer expectations, new regulatory requirements, technological developments, and emerging business risks. Responsible digital practices can strengthen customer trust, support ESG objectives, improve organisational reputation, and create competitive advantages in increasingly sustainability-oriented markets.

Although SMEs often operate with limited financial resources, smaller teams, and restricted access to specialised expertise, they also possess important strengths. Their organisational flexibility, shorter

decision-making processes, and close relationships with employees and customers enable them to implement changes more rapidly than many larger organisations. These characteristics make SMEs well positioned to adopt practical digital sustainability improvements that deliver both short-term operational benefits and long-term strategic value (OECD, 2023).

Successfully implementing digital sustainability requires more than technology alone. Organisations also need appropriate knowledge, digital skills, leadership commitment, and employee engagement. Behavioural change, continuous learning, and collaboration across different organisational roles are essential for embedding responsible digital practices into everyday business operations.

Vocational Education and Training (VET) providers, business advisors, consultants, and SME support organisations play an important role in this process. By translating complex sustainability and digitalisation concepts into practical tools, training programmes, and action plans, they help SMEs build the competencies needed to improve digital sustainability in a structured and measurable way (CEDEFOP, 2024).

Ultimately, digital sustainability enables SMEs to create business value while contributing to broader sustainability goals. Organisations that improve their digital practices can reduce costs, strengthen resilience, improve employee capabilities, enhance customer trust, and build more competitive and future-ready businesses.

Practical Example

A small manufacturing company reviews its digital operations as part of a digital sustainability initiative. It removes unused software licences, consolidates cloud storage, replaces ageing computers with energy-efficient and repairable devices during its normal procurement cycle, and introduces internal guidelines for responsible AI use. Employees receive training on digital file management and cybersecurity. Within one year, the company reduces software and cloud costs, improves operational efficiency, strengthens data security, extends the lifespan of its devices, and supports its ESG reporting with measurable improvements in digital resource management.

Trainer Reflection

- Which business benefits would most strongly motivate SMEs in your sector to invest in digital sustainability?
- What are the main barriers preventing SMEs from adopting responsible digital practices?
- How could training, mentoring, or external support help SMEs overcome these barriers?
- Which quick-win actions could SMEs implement within the next six months to improve both business performance and digital sustainability?

Recommended Tool:

Annex B.1 – D-GREEN Digital Sustainability Maturity Self-Assessment Questionnaire

Key Takeaways

- Digital sustainability is a practical business optimisation strategy rather than only an environmental responsibility.
- Responsible digital practices improve operational efficiency, reduce unnecessary costs, and strengthen organisational resilience.
- SMEs can create business value by improving the management of data, software, cloud services, AI, and digital devices.
- The flexibility and agility of SMEs enable them to implement digital sustainability improvements relatively quickly.
- Successful implementation requires leadership commitment, employee engagement, behavioural change, and continuous learning.
- VET providers and SME support organisations play a key role in helping businesses build digital sustainability capabilities.
- Digital sustainability contributes simultaneously to business competitiveness, ESG performance, and broader sustainability objectives.

Related Annexes

- **Annex A.1** Understanding Sustainability and Digitalisation Worksheet
- **Annex A.2** Future Vision Exercise

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3. Business Case and Urgency

Why this chapter matters

This chapter explains why digital sustainability has become an urgent business priority for SMEs. It explores how economic, environmental, social, technological, and regulatory developments are reshaping the business environment and why responsible digital practices are essential for maintaining competitiveness, resilience, and long-term business success.

Sustainability is increasingly recognised as a strategic business issue rather than solely an environmental or social concern. Rising energy prices, resource constraints, changing customer expectations, supply chain pressures, cybersecurity risks, rapid technological development, and emerging regulations are transforming the operating environment for organisations of all sizes.

For SMEs, these developments create both challenges and opportunities. Organisations that improve resource efficiency, reduce waste, strengthen resilience, and adopt responsible digital practices are often better positioned to remain competitive in rapidly changing markets.

At the same time, digital technologies have become essential for almost every aspect of business operations. Cloud services, artificial intelligence, digital platforms, e-commerce, collaboration tools, automation, and data-driven decision-making create significant opportunities for innovation, productivity, and business growth. However, they also generate environmental and social impacts, operational risks, hidden costs, increasing energy demand, and growing dependence on digital infrastructure that organisations need to understand and manage responsibly.

This chapter explores why digital sustainability creates business value while supporting broader sustainability goals. It examines the relationship between competitiveness, cost optimisation, innovation, risk management, organisational resilience, and responsible digital transformation. Rather than focusing solely on digital waste, the chapter also addresses energy and resource efficiency, responsible AI, cybersecurity, cloud services, digital infrastructure, and the importance of leadership and behavioural change in supporting successful implementation.

3.1 Cost, Risk and Competitiveness

For many SMEs, sustainability is often associated with environmental responsibility, regulations, or additional costs. However, sustainability is increasingly recognised as a strategic factor influencing profitability, competitiveness, risk management, and long-term resilience.

Global risk assessments consistently identify environmental challenges among the most significant threats facing economies and organisations (World Economic Forum, 2025). Climate change, resource scarcity, biodiversity loss, supply chain disruptions, and increasing energy costs are affecting business operations across sectors. These challenges influence production costs, access to resources, customer expectations, insurance costs, and market stability.

For SMEs, sustainability is becoming increasingly relevant for several practical reasons. These business drivers are closely interconnected. Improvements in one area often create positive impacts in others, making digital sustainability a strategic investment rather than a standalone environmental initiative.

Cost Efficiency

Improving resource efficiency often leads directly to cost savings. Reducing energy consumption, extending the lifespan of equipment, minimising waste, optimising cloud services, managing software licences more effectively, reducing digital waste, and improving data management can lower operational expenses while increasing productivity.

Competitiveness

Customers, business partners, investors, and public sector organisations increasingly expect businesses to demonstrate responsible practices. Sustainability can strengthen reputation, support customer trust, and create access to new market opportunities. Responsible digital practices can also support ESG objectives, strengthen supplier relationships, improve access to public procurement opportunities, and enhance customer confidence.

Risk Management

Environmental, social, and technological risks can disrupt operations and increase uncertainty. Organisations that actively manage sustainability-related risks are generally better prepared to respond to supply chain disruptions, market changes, and evolving regulations. Digital risks—including cybersecurity threats, poor data management, increasing dependence on cloud services, and the responsible use of artificial intelligence—should also be considered as part of effective business risk management.

Innovation and Growth

Sustainability can stimulate innovation by encouraging organisations to rethink products, services, processes, and business models. Digital technologies often play an important role in enabling these innovations. Digital sustainability encourages organisations to use digital technologies more

strategically to develop sustainable products, services, and business models that create long-term value.

Resilience

Businesses that use resources efficiently, manage risks proactively, and invest in employee capabilities are generally better positioned to adapt to future challenges and opportunities.

Business sustainability expert Bob Willard highlights that one of the greatest benefits of sustainability is often risk avoidance (Willard, 2012). While savings from reduced energy use or improved efficiency may be visible, the value of avoiding disruptions, compliance failures, reputational damage, or supply chain interruptions is often much larger but less immediately apparent.

Willard's Sustainability Maturity Model illustrates how organisations typically progress over time (Willard, 2012). Many SMEs begin by responding to compliance requirements or customer requests. As their understanding develops, sustainability increasingly becomes integrated into business strategy, decision-making, innovation, and value creation. Continuous learning, employee engagement, and digital competencies further strengthen organisational resilience by improving the ability to adapt to changing technologies and market conditions.

Practical Example

A growing SME initially focuses on reducing electricity costs by replacing outdated equipment. During the process, it also reviews cloud storage, removes unused software licences, improves data management, and introduces basic AI usage guidelines. These actions reduce operating costs, strengthen cybersecurity, improve employee productivity, and increase customer confidence. Over time, digital sustainability becomes part of the organisation's wider business strategy rather than a series of isolated initiatives.

Key Takeaways

- Digital sustainability creates business value through cost optimisation, competitiveness, innovation, and resilience.
- Business benefits often reinforce one another and develop progressively over time.
- Managing digital resources responsibly reduces operational costs while strengthening organisational performance.
- Digital risks should be managed alongside environmental, social, and economic risks.
- Long-term success depends on integrating digital sustainability into everyday business decision-making.

Trainer Reflection

Which sustainability drivers are currently most relevant for the SMEs you work with: cost savings, customer expectations, competitiveness, innovation opportunities, compliance requirements, or risk management?

3.2 The Cost of Digital Waste

Why this section matters

Digital waste is often invisible, yet it creates measurable business costs. This section helps trainers and SMEs recognise how inefficient digital practices affect operational efficiency, financial performance, cybersecurity, and environmental sustainability, while identifying practical opportunities for improvement.

Digital waste is not only an environmental issue but also a business performance issue. Every unnecessary file, inactive user account, unused software licence, duplicated dataset, obsolete digital asset, or inefficient digital process consumes organisational resources without creating corresponding value. Over time, these hidden inefficiencies increase operational costs, reduce productivity, complicate information management, and contribute to the environmental footprint of digital technologies.

Within the D-GREEN project, digital waste refers to digital resources, processes, and activities that consume storage capacity, computing power, energy, materials, employee time, or financial resources without generating meaningful business value (Digital Cleanup Foundation, 2024). Reducing digital waste is therefore presented as one practical way of improving digital sustainability while simultaneously strengthening organisational efficiency and competitiveness.

Financial and Operational Costs

Many forms of digital waste create direct financial costs that remain largely unnoticed because they accumulate gradually over time. These include unnecessary cloud storage, duplicated software subscriptions, unused licences, excessive data retention, redundant backups, and outdated digital assets that continue to consume storage and maintenance resources.

Digital waste also creates operational inefficiencies. Employees often spend valuable time searching for information, working with multiple versions of the same document, managing outdated files, or maintaining systems that no longer create value. Poor information governance slows decision-making, increases administrative workload, and reduces overall organisational productivity.

For SMEs with limited financial and human resources, these inefficiencies can have a disproportionate impact on business performance.

Risk and Governance Impacts

Poor digital housekeeping also increases organisational risks. Inactive user accounts, outdated software, unmanaged cloud services, poorly classified information, and unnecessary data retention expand the potential attack surface for cybersecurity incidents and increase compliance challenges related to data protection and information governance.

The growing adoption of artificial intelligence introduces additional considerations. While AI offers significant opportunities for productivity and innovation, unnecessary AI-generated content, repeated AI queries, poorly managed datasets, and excessive experimentation without business value may increase computational demand, energy consumption, operational costs, and information overload (IEA, 2024). Responsible AI use therefore requires organisations to focus not only on technological capability but also on purposeful, value-driven application.

Environmental Impacts

Although digital activities may appear invisible, they rely on physical infrastructure that consumes electricity, water, computing capacity, and raw materials throughout its lifecycle. Every unnecessary file stored in the cloud, duplicated dataset, inactive service, or obsolete device contributes—directly or indirectly—to growing demand for data centres, digital infrastructure, and electronic equipment.

Reducing digital waste therefore supports both business optimisation and environmental sustainability. It lowers unnecessary resource consumption, improves energy efficiency, reduces demand for storage and computing capacity, extends device lifecycles, and contributes to more responsible use of digital technologies (Freitag et al., 2021; UNITAR & ITU, 2024).

Practical Example

A small manufacturing company conducts its first digital sustainability review. The assessment reveals multiple cloud storage accounts containing duplicate files, inactive user accounts belonging to former employees, several unused software licences that continue to renew automatically, and thousands of outdated marketing assets stored across different platforms. The review also identifies extensive use of generative AI for producing draft content that is rarely used or reviewed.

Following the assessment, the company introduces clear file management guidelines, removes obsolete digital content, consolidates cloud storage, cancels unnecessary software subscriptions, reviews AI usage practices, and establishes quarterly digital clean-up routines.

Within six months, the company reduces recurring software and storage costs, improves information accessibility, strengthens cybersecurity by removing unnecessary accounts, decreases employee time spent searching for documents, and lowers unnecessary digital resource consumption. The initiative also raises employee awareness of responsible digital practices and demonstrates that digital sustainability can deliver measurable business value without major financial investment.

Trainer Reflection

Which forms of digital waste create the greatest hidden costs for SMEs in your sector? Consider financial costs, employee time, cybersecurity risks, cloud usage, software licences, AI usage, and environmental impacts.

Key Takeaways

- Digital waste creates hidden financial, operational, environmental, and organisational costs.
- Many digital waste reduction measures require behavioural and organisational change rather than major technology investments.
- Efficient management of data, software, cloud services, AI, and digital assets improves productivity while reducing unnecessary resource consumption.
- Regular digital audits help organisations identify opportunities for cost savings, risk reduction, and operational improvement.
- Reducing digital waste strengthens both business performance and digital sustainability.

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3.3 Understanding Cloud and AI Cost–Sustainability Trade-Offs

Business Opportunities

Digital technologies such as cloud computing and artificial intelligence have become key enablers of digital transformation for SMEs. They offer significant opportunities to improve productivity, innovation, collaboration, and operational efficiency while supporting more data-driven decision-making.

Cloud services and artificial intelligence can automate routine tasks, optimise resource use, improve customer service, support decision-making, and enable new business models. For many SMEs, these technologies provide access to capabilities that would otherwise require significant investment in infrastructure or specialised expertise.

Understanding the Trade-Offs

However, these benefits are accompanied by increasing demands for energy, computing power, data storage, and digital infrastructure. Large-scale cloud services and AI systems rely on data centres, cooling systems, networking equipment, and specialised processors that require significant amounts of electricity and natural resources (International Energy Agency, 2024). Although the activities of individual SMEs may appear relatively small, their cumulative demand contributes to increasing pressure on digital infrastructure and global electricity consumption.

The challenge is therefore not whether organisations should adopt cloud services or artificial intelligence, but how these technologies can be used responsibly and efficiently.

Responsible digital sustainability is not about avoiding cloud services or AI. Instead, it involves making informed decisions that maximise business value while minimising unnecessary resource consumption, operational costs, and environmental impacts.

Managing cloud and AI trade-offs requires organisations to balance:

- performance and sustainability;
- innovation and resource efficiency;
- scalability and environmental impact;
- business value and long-term resilience.

Hidden Digital Costs

Hidden digital costs should also be considered when evaluating cloud services and AI solutions. Unnecessary cloud storage, duplicate files, inactive user accounts, duplicated SaaS subscriptions, obsolete website content, outdated marketing assets, outdated datasets retained without a clear business purpose, unnecessary AI-generated content, and energy-inefficient or obsolete digital devices all consume organisational resources without creating meaningful value.

Over time, these hidden costs increase storage requirements, software expenditure, energy consumption, IT management effort, and the environmental footprint of digital technologies. Regular digital audits can help SMEs identify these inefficiencies and prioritise improvements that generate both business and sustainability benefits.

For SMEs, understanding these trade-offs is becoming increasingly important as digitalisation accelerates and sustainability expectations continue to grow. Making informed technology decisions enables organisations to improve operational efficiency, strengthen digital governance, reduce unnecessary costs, and ensure that digital technologies contribute to long-term business resilience.

Practical Example

An SME migrates its business systems to cloud-based services and introduces generative AI tools to support marketing and customer communication. After several months, an internal review reveals overlapping cloud subscriptions, duplicate digital assets, unnecessary AI-generated content, and growing storage requirements.

The organisation conducts a digital sustainability review, consolidates cloud services, removes obsolete content, optimises software subscriptions, introduces responsible AI usage guidelines, and establishes data retention policies. As a result, the company reduces recurring operational costs, improves information management, strengthens cybersecurity, and ensures that cloud and AI technologies create measurable business value while reducing unnecessary resource consumption.

Trainer Reflection

When introducing cloud services or AI solutions, how can organisations evaluate both the business benefits and the sustainability implications of their choices? Which criteria should be included in a digital sustainability assessment before adopting new digital technologies?

Key Takeaways

- Cloud services and artificial intelligence create significant opportunities for innovation, productivity, and business growth.

- Responsible technology adoption requires balancing business value, operational efficiency, sustainability, and long-term resilience.
- Hidden digital costs often result from poor governance rather than from technology itself.
- Digital audits help organisations optimise cloud services, AI usage, software subscriptions, and digital assets.
- Responsible digital practices maximise business value while minimising unnecessary resource consumption and environmental impacts.

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3.4 Motivating Change: The Role of Trainers

For VET trainers working with SMEs, sustainability learning should not only provide information but also support lasting behaviour change.

Research shows that people are more likely to adopt new behaviours when learning is relevant, practical, achievable, and connected to their own goals (Ryan & Deci, 2020). Sustainability training should therefore move beyond information transfer and focus on enabling action.

Trainers can support this process by:

- allowing participants to select sustainability goals relevant to their own business context;
- breaking complex challenges into manageable actions;
- encouraging experimentation through pilot projects;

- providing regular feedback and opportunities for reflection;
- facilitating peer learning and exchange of experiences.

Practical action-oriented tasks make it easier for participants to translate knowledge into everyday business practices. Small successes help build confidence, reinforce motivation, and increase engagement.

For trainers, the implication is clear: sustainability learning should be designed as a process that is practical, meaningful, and action-oriented. The goal is not simply to increase awareness but to support lasting organisational change. Behavioural change rarely occurs after a single training session. Sustainable improvement requires reinforcement, leadership support, opportunities to practise new behaviours, and regular follow-up. Trainers should therefore view every workshop as the beginning of a continuous learning process rather than a one-time event. Supporting SMEs through incremental improvements helps build confidence, strengthens motivation, and increases the likelihood that new digital sustainability practices become embedded in everyday business operations.

Practical Example

Following a digital sustainability workshop, an SME agrees to introduce one new digital sustainability practice every month. The first month focuses on reviewing cloud storage, the second on improving file management, and the third on switching off unused devices after working hours. Progress is reviewed during monthly team meetings, helping new behaviours become part of everyday organisational routines.

Key Takeaways

- Behaviour change requires more than awareness.
- Small, achievable actions increase motivation and implementation.
- Practical application reinforces learning.
- Leadership and peer support strengthen organisational change.
- Continuous follow-up helps embed sustainable digital practices.

Trainer Reflection

How can you make sustainability learning more relevant, practical, and motivating for the SMEs you support?

Role-Based Value Examples

SME Role	Sustainability Value
Business Leaders	Risk management, competitiveness, compliance readiness, long-term resilience
Product Developers	Eco-design, lifecycle assessment, resource-efficient innovation, longer product lifecycles
Procurement Professionals	Supply-chain transparency, supplier evaluation, responsible sourcing
Supply Chain Managers	Resource efficiency, waste reduction, resilience to disruptions
Marketing and Communication Specialists	Content efficiency, reduced digital waste, sustainable communication practices
ICT and Digital Teams	Energy efficiency, cybersecurity, responsible technology management
HR Professionals	Skills development, employee engagement, organisational culture
Operations Managers	Resource efficiency, process optimisation, performance improvement
Executive Leadership	Strategic direction, governance, business resilience and investment decisions

Sustainable digitalisation creates value not only through greater operational efficiency but also by strengthening organisational resilience, supporting innovation, improving decision-making, reducing unnecessary resource consumption, and helping SMEs remain competitive in a rapidly changing business environment. These benefits extend across environmental, social, and economic dimensions of sustainability.

Key Takeaways

- Sustainability is increasingly a business issue that includes environmental, social, and economic dimensions.
- Responsible digital practices can reduce costs, improve resilience, strengthen competitiveness, and support long-term business value.
- Environmental, social, technological, and resource-related challenges create direct business risks.
- Digital waste creates hidden financial, operational, and environmental costs.
- Cloud services and AI create significant opportunities but also require responsible governance and resource-efficient use.
- Effective sustainability training should focus on behaviour change and practical implementation rather than awareness alone.
- Different organisational roles contribute to digital sustainability in different ways.
- SMEs create long-term value by combining digital innovation with responsible management of digital resources.

Chapter 3 Business Case and Urgency

Related Annexes:

- Annex C.1 Sustainability Business Case Canvas
- Annex B.2 Opportunity Assessment
- Annex B.3 Risk Assessment

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4. Definitions and Terminology Alignment

Why This Chapter Matters

A shared understanding of terminology is essential for effective communication, training, and collaboration. This chapter establishes the common definitions used throughout the D-GREEN Handbook, helping trainers, SMEs, and other stakeholders interpret key concepts consistently and apply them in practice.

To ensure consistent communication throughout the D-GREEN Handbook, this chapter provides a shared vocabulary for the key concepts used across all training modules. While many of these terms have broader academic or policy definitions, the explanations presented here reflect the context and objectives of the D-GREEN project and support a common understanding among trainers, SMEs, and other stakeholders.

4.1 ICT, IT and Computing

In European policy and statistical frameworks, **Information and Communication Technology (ICT)** is the broadest term and refers to all technologies used for information processing and electronic communication. ICT includes hardware, software, networks, telecommunications infrastructure, data services, and digital platforms (OECD, 2021).

Information Technology (IT) is generally understood as a subset of ICT, focusing primarily on the storage, processing, management, and use of digital information through computer systems and software applications.

Computing refers to the scientific and technical discipline underlying both ICT and IT. It includes areas such as computer science, software engineering, algorithms, programming, artificial intelligence, and data processing.

In this handbook, the term **ICT** is used as the primary concept because it reflects the terminology most commonly used within European Union policies and programmes.

4.2 Core Sustainability Concepts

Sustainability

In the D-GREEN project, sustainability is understood through the Framework for Strategic Sustainable Development (FSSD). A sustainable society is one in which nature is not subject to

systematically increasing concentrations of substances extracted from the Earth's crust, concentrations of substances produced by society, or degradation by physical means. At the same time, people are not subject to structural obstacles to health, influence, competence, impartiality, or meaning-making (Broman & Robèrt, 2025).

Sustainable Development

Sustainable development refers to the transition from today's unsustainable society towards a sustainable society, followed by continued development within sustainability constraints (Broman & Robèrt, 2025).

Planetary Boundaries

Planetary boundaries are scientifically defined limits within which humanity can safely operate without destabilising Earth's life-support systems. The framework identifies nine critical Earth-system processes. Current assessments indicate that seven of these boundaries have already been exceeded, increasing the risk of abrupt and potentially irreversible environmental change (Stockholm Resilience Centre, 2026).

Resilience

Resilience is the ability of a system to cope with change, absorb shocks, adapt to disturbances, and continue developing. Resilient systems are capable of learning, renewing themselves, and maintaining essential functions under changing conditions (Stockholm Resilience Centre, 2015).

Systems Thinking

Systems thinking is the study of systems, their interconnections, feedback loops, and overall behaviour. It helps identify how actions in one part of a system may influence outcomes elsewhere and supports more holistic decision-making (Meadows, 2008).

Complex System

A complex system consists of multiple interconnected parts whose interactions produce behaviours that may be difficult to predict. Environmental, economic, social, and digital systems are all examples of complex systems (Meadows, 2008)

ABCD Process

The ABCD Process is a four-step planning methodology used within the Framework for Strategic Sustainable Development (FSSD). It supports organisations in moving strategically from their current situation towards a desired sustainable future state (Broman & Robèrt (2025).

Digital Sustainability

Digital sustainability is introduced as a core concept in Chapter 2. In this chapter, the term is included to establish a shared vocabulary for trainers and SMEs.
Digital sustainability refers to the responsible design, use, management, and governance of digital technologies in ways that create business value while supporting environmental, social, and economic sustainability and minimising negative impacts throughout the lifecycle of digital systems (Lange et al., 2022).

Digitalisation for Sustainability

The use of digital technologies to achieve sustainability objectives, such as improving resource efficiency, reducing waste, supporting circular economy initiatives, and enabling better decision-making (Lange et al., 2022).

Sustainable Digitalisation

The design, deployment, use, and governance of digital technologies in ways that minimise environmental and social impacts throughout their lifecycle (Lange et al., 2022).

Digital Waste

Digital waste refers to digital information, files, emails, applications, databases, software assets, and digital resources that consume storage, energy, processing capacity, or organisational resources without creating meaningful value (Let ‘s Do It World, 2024).

Digital Footprint

The total environmental impact associated with the creation, storage, transmission, processing, and use of digital technologies, services, and data (Freitag et al., 2021).

Data Lifecycle

The stages through which data passes during its existence, including creation, storage, use, sharing, archiving, and deletion (International Organization for Standardization, 2016-ISO 15489-1, 2016).

Green ICT

The environmentally responsible design, procurement, use, management, and disposal of information and communication technologies (Freitag et al., 2021).

Digital Waste Management

The systematic identification, reduction, governance, and removal of unnecessary digital assets and information in order to improve efficiency and reduce environmental impacts (Let ‘s Do It World, 2024).

Digital Maturity

The degree to which an organisation effectively uses digital technologies, processes, skills, and governance structures to achieve strategic objectives (OECD, 2021).

Digital Sustainability Maturity

The degree to which an organisation integrates sustainability considerations into its digital technologies, digital processes, governance structures, and decision-making (Lange et al., 2022).

Digital Governance

The structures, policies, responsibilities, and processes used to manage digital technologies, information assets, and digital transformation activities (OECD, 2021).

ICT Governance

A subset of digital governance focusing specifically on the management, control, security, performance, and strategic alignment of ICT resources (ISO/IEC 38500, 2015).

Cloud Computing

The delivery of computing services, including servers, storage, databases, networking, software, and analytics, over the internet (NIST, 2011).

Artificial Intelligence (AI)

Computer systems capable of performing tasks that normally require human intelligence, such as learning, reasoning, prediction, decision support, and content generation (OECD, 2024).

Internet of Things (IoT)

A network of connected physical devices capable of collecting, transmitting, and exchanging data through digital networks (OECD, 2021).

4.3 SME and Training-Related Terms

The following terms describe the organisations, roles, and learning concepts that are used throughout the D-GREEN training approach.

SME (Small and Medium-Sized Enterprise)

According to the European Commission, an SME is an enterprise with fewer than 250 employees and either an annual turnover not exceeding €50 million or an annual balance sheet total not exceeding €43 million (European Commission, 2024).

VET (Vocational Education and Training)

Education and training programmes that provide learners with practical skills, knowledge, and competencies required for specific occupations, industries, or professional roles (CEDEFOP, 2023).

Lifelong Learning

The continuous development of knowledge, skills, and competencies throughout an individual's life (UNESCO, 2023).

Capacity Building

Activities that strengthen the knowledge, competencies, skills, processes, and resources required by individuals and organisations to achieve desired outcomes (UNDP, 2022).

Change Management

The structured approach used to support individuals, teams, and organisations in transitioning from a current state to a desired future state (Kotter, 2012).

Organisational Resilience

The ability of an organisation to anticipate, prepare for, respond to, and adapt to disruptions while maintaining essential functions (ISO 22316, 2017).

4.4 Circular Economy and Resource Management Terms

These concepts explain how resources, products, and materials can be managed more sustainably throughout their lifecycle.

Circular Economy

An economic system aimed at eliminating waste and keeping products, materials, and resources in use for as long as possible through reuse, repair, refurbishment, remanufacturing, and recycling (Ellen MacArthur Foundation, 2019).

Lifecycle Thinking

An approach that considers environmental, social, and economic impacts across the entire lifecycle of a product, service, or system (European Commission, 2021).

E-Waste (Electronic Waste)

Discarded electrical and electronic equipment and associated components (Baldé et al., 2024, Global E-Waste Monitor, 2024).

Extended Producer Responsibility (EPR)

A policy approach in which producers are given responsibility for the environmental impacts of products throughout their lifecycle, including end-of-life management (OECD, 2016).

Sustainable Procurement

Procurement practices that consider environmental, social, and economic impacts alongside traditional purchasing criteria such as cost and quality (ISO 20400, 2017).

Refurbishment

The process of restoring used products or equipment to good working condition in order to extend their useful life (European Environment Agency, 2020).

4.5 Cybersecurity and Data Ethics Terms

These terms describe key governance, security, and ethical considerations associated with digital technologies.

Cybersecurity

The protection of digital systems, networks, devices, and information from unauthorised access, disruption, misuse, or attack (ENISA, 2024).

Data Ethics

The responsible collection, management, use, and sharing of data in ways that respect privacy, fairness, transparency, and accountability (OECD, 2024).

Privacy

The right of individuals to control how personal information is collected, used, stored, and shared (GDPR, Regulation (EU) 2016/679).

Algorithmic Bias

Systematic and unfair outcomes produced by algorithms due to biased data, design choices, or implementation practices (UNESCO, 2021).

Responsible AI

The development and use of artificial intelligence systems that are transparent, fair, accountable, secure, and aligned with ethical principles (OECD, 2024; European Commission, 2024). Together, these definitions provide the conceptual foundation for the remainder of the handbook. Trainers are encouraged to use this shared terminology consistently during workshops and discussions to support a common understanding among participants.

Key Takeaways

- ICT is the primary terminology used throughout this handbook.
- Sustainability is understood through the Framework for Strategic Sustainable Development (FSSD).
- Planetary boundaries define the environmental limits within which society can safely operate.
- Resilience and systems thinking support better understanding of sustainability challenges.
- A shared vocabulary enables consistent communication between trainers, SMEs, and other stakeholders.

Chapter 4 Definitions and Terminology

Related Annexes:

- Annex A.3 Role-Based Discussion Cards

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Commentato [1]: This list needs a refurbishing to be in line with how we reference above

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PART 2 - TRAINER TOOLKIT: HOW TO DESIGN AND DELIVER

5. Training Design Principles for SMEs

Chapter Overview

This part provides practical guidance for trainers, consultants, and VET professionals who support SMEs in adopting digital sustainability practices. It explains how SMEs learn, how to design effective training programmes, how to adapt learning to different SME roles and maturity levels, and how to facilitate behavioural and organisational change.

By the end of this section, trainers will be able to:

1. understand SME learning characteristics;
2. design digital sustainability training programmes;
3. assess SME digital sustainability maturity;
4. adapt training to different SME personas;
5. facilitate behavioural and organisational change;
6. support implementation beyond the training session.



Figure 5.1. SME Digital Sustainability Training Journey

Why This Chapter Matters

Training is one of the most effective ways to help SMEs translate digital sustainability into everyday business practice. However, SMEs learn differently from large organisations. Trainers therefore need practical methods that are relevant, flexible, and closely connected to real business challenges. This chapter provides guidance on designing training programmes that lead not only to increased knowledge but also to lasting behavioural and organisational change.

5.1 Understanding SME Learning Characteristics

Small and Medium-sized Enterprises (SMEs) represent the backbone of the European economy, accounting for over 99% of all businesses and playing a crucial role in employment and innovation (European Commission, 2023). Within the context of the twin transition—digital and green—SMEs are increasingly expected to adopt digital sustainability practices, while addressing both digitalisation challenges and environmental pressures (European Commission, 2022; OECD, 2021).

However, SMEs exhibit specific structural and cultural characteristics that significantly influence how they engage with learning and training. One of the most critical aspects is the limitation of resources. SMEs typically operate with constrained financial capacity, limited human resources, and high operational pressure. As a result, training is often perceived as a secondary priority compared to core business activities (OECD, 2021; Kitching & Blackburn, 2002). This constraint is particularly relevant in the domain of digital sustainability, which requires continuous upskilling and cross-functional competencies.

Another defining characteristic is the informal organizational structure of SMEs. Decision-making processes are often centralized around the owner-manager, and formal human resource development systems are rarely in place. This leads to a reactive rather than strategic approach to training, where learning activities are initiated only when immediate needs arise (CEDEFOP, 2022; Storey, 2004).

Learning in SMEs is predominantly experiential and embedded in daily work practices. Employees tend to acquire knowledge through problem-solving, peer interaction, and direct application rather than through formal training programs. This “learning-by-doing” approach aligns well with digital sustainability topics, which require practical experimentation with tools, processes, and behaviours (Kolb, 1984; Eraut, 2004).

SMEs also tend to adopt a short-term orientation. Immediate operational needs often take precedence over long-term investments in skills and innovation. This creates a barrier to engaging in complex topics such as sustainability, which require a strategic and forward-looking perspective (OECD, 2021).

A further characteristic is the presence of a combined skills gap. SMEs often lack both digital competences and sustainability-related knowledge, as well as the ability to integrate these domains strategically. This gap highlights the need for training approaches that are interdisciplinary, practical, and closely aligned with business outcomes (European Commission, 2022; CEDEFOP, 2022).

Table 5.1. SME Characteristics and Training Implications

SME Characteristic	Training Implication
Limited time	Deliver short, modular learning sessions
Limited financial resources	Focus on practical, low-cost improvements
Small teams	Encourage cross-functional learning and collaboration
Owner-led decision-making	Involve managers and decision-makers early
Learning by doing	Use practical exercises and real business examples
Different digital maturity levels	Adapt training depth and pace to learner needs

Key Takeaways

- SMEs learn best through practical experience and real business examples.
- Training should focus on operational relevance and quick wins.
- Digital sustainability should be integrated into existing business processes.
- Trainers should adapt content to SME size, resources and maturity level.

Trainer Reflection Questions

1. How do SMEs in your target group currently learn and develop new skills?
2. What barriers might prevent participation in digital sustainability training?

3. How can you connect sustainability topics to everyday business challenges?
4. What practical examples would be most relevant for your learners?

5.2 Integrating ICT Sustainability into Curricula for SMEs

Integrating digital sustainability into ICT training for SMEs requires moving beyond the transmission of isolated knowledge toward the design of applied learning processes that reduce the environmental impact of digital technologies themselves. Trainers working with SMEs are therefore not only supporting digital adoption, but also guiding companies in optimizing how digital systems are used, managed, and scaled, in order to minimize their ecological footprint (GeSI, 2019; IEA, 2023).

As mentioned above, SMEs engage more effectively in training when learning is directly linked to operational practices and produces visible short-term benefits (OECD, 2021; CEDEFOP, 2022). This is particularly relevant for digital sustainability, where inefficiencies in digital use often translate into unnecessary energy consumption, redundant data storage, or suboptimal use of devices (IEA, 2023).

In order to effectively integrate ICT Sustainability learning paths into training curricula for SMEs we suggest to adopt the following principles that you can adapt to your context and goals

Principle	Main Objective
Start from Digital Practices	Make training relevant
Identify Impact Hotspots	Focus efforts
Embed Sustainability in ICT Topics	Integrate, don't isolate
Use Micro-Applications Translate into Business Value	Promote action Increase motivation
Adapt to Digital Maturity	Ensure relevance
Ensure Continuity	Create long-term change

1. Start from Digital Practices, Not from Generic Sustainability Concepts

Rather than starting from broad sustainability principles, training should begin with an analysis of how digital technologies are currently used within the SME.

In practical terms, the trainer should guide learners through a focused reflection on their digital ecosystem. This includes identifying questions such as: Are devices left running unnecessarily? Is

data stored without clear purpose? Are cloud services used efficiently? Are digital processes duplicated or poorly optimized?

Many SMEs already rely on digital tools, but rarely assess their environmental impact. For instance, excessive data storage, inefficient software use, or outdated hardware can significantly increase energy consumption without adding value (IEA, 2023; Malmodin & Lundén, 2018).

By starting from these concrete practices, digital sustainability is framed as improving the efficiency and responsibility of existing digital use, rather than introducing entirely new systems.

2. Identify Digital Impact Hotspots

Once current practices are mapped, the next step is to identify where the environmental impact of digital technologies is most significant.

Trainers should help participants recognize typical "digital impact hotspots", such as:

- high energy consumption from always-on devices or inefficient hardware
- excessive or unmanaged cloud storage
- redundant data processing or duplication
- inefficient digital workflows requiring multiple systems or repeated actions

For example, an SME may store large volumes of unused data on cloud platforms, generating unnecessary energy consumption in data centres. Another company might rely on outdated devices that consume more energy than necessary (IEA, 2023).

The objective of this approach is to help SMEs identify a limited number of priority areas where optimizing digital practices can lead to measurable environmental benefits, such as reduced energy use or lower digital resource consumption.

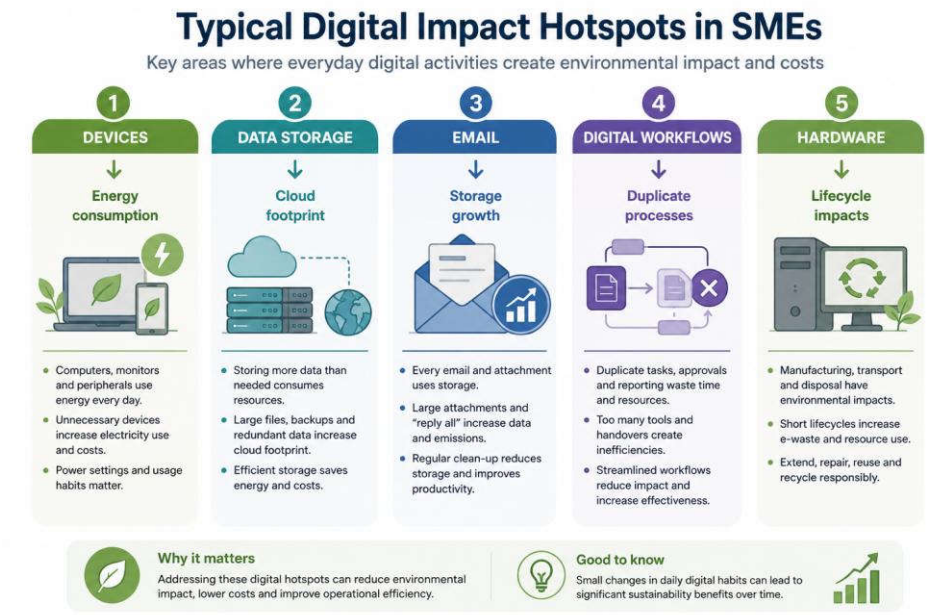

Figure 5.2. Typical Digital Impact Hotspots in SMEs

3. Embed Digital Sustainability into ICT Topics

Digital sustainability should be embedded within all ICT-related training activities.

This means that every digital competence introduced during training should be accompanied by a reflection on its environmental implications.

For example, when addressing data management, the trainer should include aspects such as:

- reducing unnecessary data storage
- defining data retention policies
- optimizing file formats and sizes

Similarly, when discussing cloud services, participants should explore:

- selecting energy-efficient providers
- avoiding redundant storage
- optimizing usage patterns

This integrated approach reflects research on sustainable ICT practices, which highlights that efficiency gains often derive from **optimisation of existing systems rather than technological substitution** (GeSI, 2019; Belkhir & Elmeligi, 2018).

4. Design Micro-Applications Focused on Digital Efficiency

To ensure applicability, each training unit should include a micro-application task focused on reducing the environmental impact of digital use.
Rather than generic exercises, these tasks should involve concrete actions within the company's digital environment.

Examples include:

- auditing stored files to identify and remove unnecessary data
- measuring the number of devices left active outside working hours
- optimizing shared folders to reduce duplication
- reviewing email practices to reduce storage and server load

These activities may appear simple, but they can have a significant cumulative impact on energy consumption and digital resource use (IEA, 2023).
Importantly, the goal is not technological sophistication, but behavioural and operational change in how digital tools are used, consistent with research on workplace learning and SME behaviour (Eraut, 2004; CEDEFOP, 2022).

Example Micro-Applications

Topic	Practical Activity
Data Storage	Remove obsolete files
Devices	Measure devices left on overnight
Email	Clean mailbox archives
Shared Drives	Remove duplicates
Cloud Services	Review storage usage

5. Translate Digital Sustainability into Business Value

For SMEs, digital sustainability must be clearly connected to tangible benefits. Trainers should therefore highlight how reducing the environmental impact of digital technologies can also improve business performance.

For example:

- reducing data storage can lower cloud service costs
- optimizing device use can reduce energy bills
- extending hardware lifecycle reduces replacement costs

In addition, more efficient digital practices can improve system performance, reduce downtime, and simplify workflows.

By explicitly linking digital sustainability to cost savings and operational efficiency, trainers can increase engagement and support long-term adoption. Evidence shows that SMEs are more likely to implement changes when they perceive direct economic value (European Commission, 2023; OECD, 2021).

Sustainability–Business Value Matrix

Sustainability Action	Business Benefit
Reduce cloud storage	Lower costs
Extend hardware lifetime	Lower investment costs
Optimise workflows	Higher productivity
Reduce duplicate data	Better performance
Improve digital governance	Lower risk

6. Adapt to Digital Maturity and Usage Patterns

SMEs differ significantly in how they use digital technologies, and training must reflect this diversity.

In companies with low digital maturity, the focus may be on basic practices such as:

- switching off devices
- organizing files efficiently
- avoiding unnecessary duplication

In more advanced SMEs, training can address:

- optimization of cloud infrastructures
- data lifecycle management
- monitoring digital energy consumption

The key is to ensure that recommendations are realistic and proportionate to the company's capabilities, avoiding overly complex solutions that are unlikely to be implemented (OECD, 2021).

SME Type	Training Focus
Beginner	Basic digital habits
Intermediate	Efficiency improvements
Advanced	Monitoring and optimisation

7. Ensure Continuity and Behavioural Change

Reducing the environmental impact of digital technologies requires sustained changes in behaviour and routines.

Training should therefore include elements that encourage continuity, such as:

- defining simple digital sustainability practices
- assigning responsibilities within the team
- introducing basic monitoring indicators

Trainers can also encourage SMEs to experiment with small changes and progressively scale them.
The objective is to move from isolated actions to systematic, everyday practices that reduce the ecological footprint of digital technologies over time. Behavioural research confirms that sustained change depends on repetition, reinforcement, and integration into routines (OECD, 2021; European Commission, 2023).
Together, these seven principles provide trainers with a practical framework for designing digital sustainability training that is relevant, action-oriented, and closely aligned with SME business realities. Rather than treating sustainability as a separate topic, they encourage organisations to integrate sustainable digital practices into everyday operations and continuous improvement.

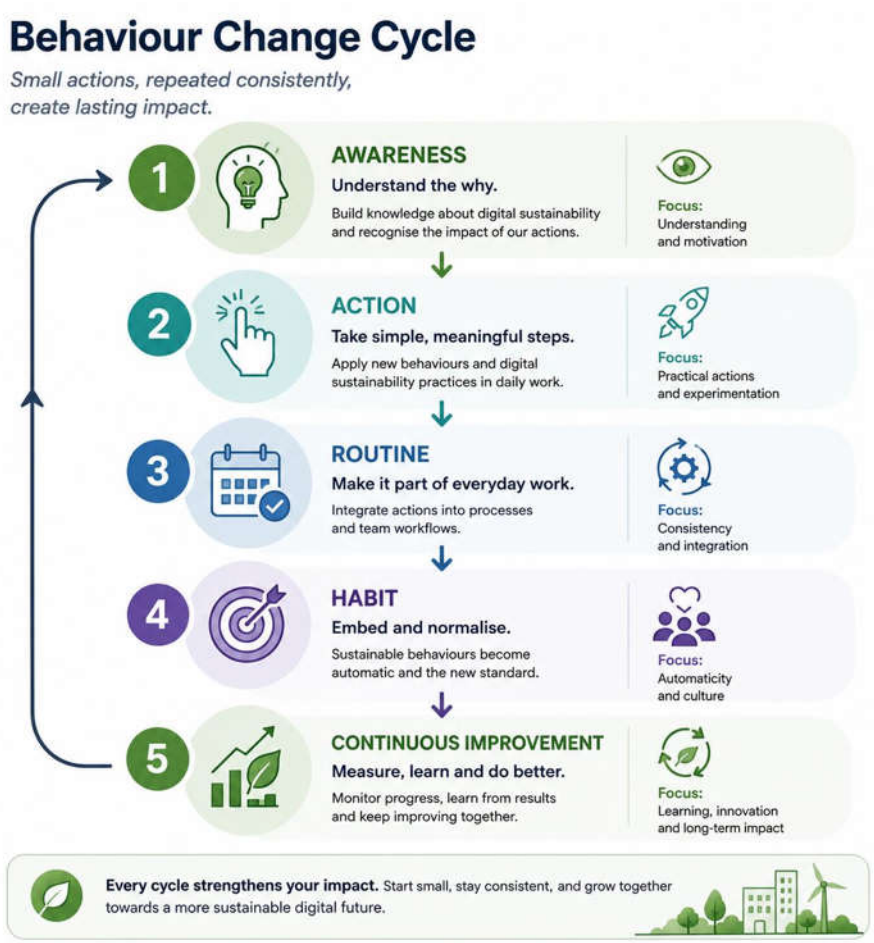

Figure 5.3. Behaviour Change Cycle

Key Takeaways

- Digital sustainability training should start from existing digital practices rather than abstract sustainability concepts.
- SMEs benefit from identifying concrete digital impact hotspots within their own operations.
- Sustainability considerations should be integrated into all ICT-related learning activities.
- Practical micro-applications help translate knowledge into action.
- Linking sustainability improvements to business value increases SME engagement.

- Training should be adapted to different levels of digital maturity.
- Long-term impact depends on behavioural change and continuous improvement.

Trainer Reflection Questions

1. How can you connect digital sustainability topics to the everyday digital practices of SMEs?
2. Which digital impact hotspots are most relevant for your target group?
3. How can you demonstrate both environmental and business benefits during training?
4. How will you support behavioural change after the training has ended?
5. Which of the seven principles would be most challenging to implement in your training context?

Trainer Tip

Focus on one practical improvement at a time. SMEs are more likely to implement small, visible changes than large transformation programmes. Early successes build confidence and create momentum for continuous improvement.

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5.3 Interactive Training Methods for SMEs

Interactive learning methods are particularly effective in SME contexts because they align with the informal, experiential, and problem-driven learning culture typical of small firms. This is especially relevant when addressing digital sustainability, where the objective is not only to understand concepts, but to **change everyday digital practices in ways that reduce environmental impact**.

As mentioned, SMEs benefit most from **practice-based, contextualised, and participatory learning approaches**, particularly when these are directly linked to operational challenges (OECD, 2013; CEDEFOP, 2022; Eraut, 2004). In the context of digital sustainability, this means focusing on how digital technologies are used, managed, and optimized in daily business activities, rather than on abstract sustainability principles.

Method	Best Used For	Time Required	SME Maturity Level
Learning by Doing	Identifying inefficiencies in daily digital practices	30–90 min	L0–L3
Case-Based Learning	Understanding sustainability impacts and solutions	30–60 min	L1–L3
Problem-Based Learning	Solving real organisational challenges	60–120 min	L1–L3
Peer Learning	Sharing experiences and benchmarking	30–60 min	L0–L3
Simulations	Exploring future scenarios and decisions	45–90 min	L2–L3
Facilitated Workshops	Developing action plans and organisational change	Half day – full day	L0–L3

Table 5.3. Selecting Interactive Methods for SME Digital Sustainability Training

Learning by Doing (Optimising Real Digital Practices)

Experiential learning is particularly effective when SMEs are asked to work directly on their own digital usage patterns.

For example, participants can:

- review how data is stored and identify unnecessary duplication
- analyse device usage (e.g., computers left running outside working hours)
- assess the efficiency of current digital workflows

This approach allows SMEs to immediately identify inefficiencies that contribute to unnecessary energy consumption or resource use. As highlighted by Kolb (1984), experiential learning is based on the transformation of experience into knowledge, while OECD (2013) emphasizes that learning embedded in real work contexts significantly improves adoption and behavioural change, which is essential for digital sustainability.

Case-Based Learning (Digital Impact Scenarios in SMEs)

Case-based learning supports understanding by presenting **realistic and context-specific examples** of digital practices and their environmental implications. In SME contexts, cases should avoid large-scale corporate examples and instead reflect **small-scale, resource-constrained environments.**

Effective cases may include:

- an SME managing excessive cloud storage without data retention policies
- a company using outdated hardware with high energy consumption
- inefficient digital workflows generating redundant processing

Participants analyse the case, identify the sources of digital inefficiency, and propose improvements. The key is that cases remain close to SME reality, reflecting constraints such as limited resources and technical capacity.
Research confirms that contextualised case-based learning enhances **knowledge transfer and practical application**, particularly in business and vocational training environments (Herreid, 2011).

Problem-Based Learning (Solving Digital Efficiency Challenges)

Problem-based learning is particularly suited to digital sustainability because it focuses on concrete inefficiencies in digital systems rather than theoretical knowledge.

In this approach, participants work on real challenges such as:

- excessive data storage and lack of data lifecycle management

- inefficient use of cloud services
- unmanaged device energy consumption

The trainer facilitates the process by guiding participants in diagnosing the problem, exploring possible solutions, and selecting feasible actions. This iterative approach reflects how SMEs typically learn—through experimentation, feedback, and adaptation.
Studies on SME learning and innovation highlight the importance of **adaptive, problem-oriented approaches** for developing practical competences and supporting organisational change (OECD, 2021). Problem-based learning also enhances critical thinking and decision-making skills, which are essential for managing digital sustainability challenges.

Peer Learning and Exchange of Digital Practices

Peer learning is particularly valuable in digital sustainability, where SMEs often lack formal expertise but can learn significantly from the experiences of similar companies.

Through structured exchanges, participants can share:

- strategies for managing digital resources more efficiently
- practical solutions for reducing data storage or optimizing devices
- lessons learned from implementing digital changes

This creates opportunities for **benchmarking and mutual learning**, helping SMEs understand what is realistic and achievable within their constraints. Wenger (1998) highlights that learning in communities of practice is a key mechanism for knowledge sharing, while CEDEFOP (2022) confirms that **informal networks and peer exchange are critical drivers of learning and innovation in SMEs**.

Simulations and Scenario-Based Learning (Digital Usage Decisions)

Simulations allow SMEs to explore the impact of different digital usage scenarios in a **low-risk environment**, supporting experimentation without operational consequences.

In the context of digital sustainability, participants can explore:

- centralized vs. decentralized data storage

- continuous vs. optimized device usage
- different data management strategies

These exercises help participants understand how small changes in digital practices can lead to **significant differences in energy consumption and resource use** (IEA, 2023). Active learning methods such as simulations have been shown to improve engagement, understanding, and retention in adult and vocational learning contexts (Salas et al., 2009).

Facilitated Workshops (Co-Creating Digital Sustainability Practices)

Workshops are particularly effective for integrating digital sustainability into SME training because they allow participants to **co-create solutions based on their own digital environment**.

The trainer acts as a facilitator, guiding participants through:

- reflection on current digital practices
- identification of inefficiencies
- definition of improvement actions

Rather than providing predefined solutions, the trainer supports SMEs in developing **context-specific and actionable strategies**. This approach increases ownership and the likelihood of implementation. Evidence from SME training research highlights the importance of **interactive, collaborative, and co-creative learning environments** in supporting behavioural change and sustained adoption (CEDEFOP, 2023).

Key Implication for Trainers

Across all methods, a consistent pattern emerges: SMEs learn most effectively when training is:

- embedded in real work practices
- interactive and participatory
- focused on solving concrete problems
- supported by peer exchange and reflection

Traditional lecture-based approaches are insufficient in this context. Instead, trainers must design learning experiences that directly influence how digital technologies are used, enabling SMEs to **reduce inefficiencies and improve the environmental performance of their digital systems**.

Practical Example

During a digital sustainability workshop, participants work in small groups to analyse their own digital practices. One group identifies duplicate cloud storage and unused software licences, while another maps devices left running outside working hours. By sharing findings and discussing practical improvements, participants develop realistic action plans that can be implemented immediately after the training.

Trainer Reflection

Which interactive training methods would be most effective for helping SMEs in your sector improve their digital sustainability practices, and how could you combine different methods to maximise engagement and implementation?

Key Takeaways

- SMEs learn most effectively through practical, experience-based learning.
- Interactive methods improve engagement and knowledge retention.
- Real business challenges provide stronger learning outcomes than abstract examples.
- Peer learning encourages collaboration and exchange of practical solutions.
- Trainers should facilitate action and reflection rather than simply transfer knowledge.

5.4 Behaviour Change in SME Training

Digital sustainability training should not only increase awareness but also support behavioural change within SMEs. Research shows that information alone rarely leads to action. Sustainable practices are more likely to be adopted when employees and managers understand the practical benefits, receive clear guidance, and can immediately apply new behaviours in their daily work.

For VET trainers, this means moving beyond knowledge transfer and creating learning experiences that encourage reflection, experimentation, and action.

Key Principles for Behaviour Change

Make benefits visible

Learners should clearly understand how sustainable ICT practices reduce costs, save time, improve efficiency, or strengthen competitiveness.

Focus on small achievable actions

SMEs often have limited resources. Trainers should encourage incremental improvements rather than large-scale transformations.

Use real-life examples

Practical examples help learners relate sustainability concepts to their own business context.

Encourage peer learning

Sharing experiences and solutions among participants increases motivation and trust.

Support action planning

Every training activity should lead towards concrete next steps that can be implemented in the workplace.

Key Takeaways

- SMEs learn most effectively through practical and experience-based approaches.
- Learning activities should be closely linked to real business challenges and digital practices.
- Interactive methods support behavioural change more effectively than lecture-based training.
- Case studies and problem-solving activities help learners apply digital sustainability concepts.
- Peer learning encourages knowledge sharing and the exchange of practical solutions.
- Simulations and workshops create safe environments for experimentation and innovation.
- Trainers should focus on facilitating action and reflection rather than simply transferring knowledge.

Trainer Reflection Questions

1. Which interactive methods are currently most effective in your training practice?
2. How can you connect learning activities more closely to participants' real digital practices?
3. Which methods would best support behavioural change in your target SME group?
4. How can peer learning be integrated into your training sessions?
5. What opportunities exist to incorporate simulations, workshops, or real-world problem-solving activities?

Trainer Tip

When working with SMEs, avoid relying on a single training method. The most effective sessions combine short expert inputs with practical exercises, peer discussion, and action planning.

A useful rule is the 20–30–50 principle:

- 20% input and explanation
- 30% discussion and reflection
- 50% practical application

This balance helps participants connect digital sustainability concepts directly to their own business practices and increases the likelihood of implementation after the training.

At the end of each training module ask participants:

- What is one action you can implement next week?
- What resources do you need?
- Who should be involved?

Chapter 5 Training Design Principles

Related Annexes:

- Annex C.2 Quick Design Check
- Annex C.3 Scoping and Baseline Intake Tool

6. Trainer Workflow

This section presents a concrete set of actions based on the main principles mentioned above.

SMEs in adopting digital sustainability practices require trainers to guide a structured process of analysis, adaptation, action, and follow-up aligned with SMEs' operational realities. Given SMEs' informal learning culture and limited resources, training must be practical, targeted, and embedded in real business practices. (OECD, 2021; CEDEFOP, 2023; Eraut, 2004).

The workflow suggested in the next paragraphs provides a step-by-step approach to help trainers design and implement effective training initiatives focused on reducing the environmental impact of digital technologies used by SMEs. Such structured approaches are consistent with research on SME capability development, which highlights the importance of incremental, context-driven, and practice-based learning processes (European Commission, 2023; OECD, 2013).

Why This Chapter Matters

Many SMEs understand the importance of digital sustainability but struggle to translate awareness into practical action. This chapter provides trainers with a structured workflow for assessing digital practices, adapting training to different maturity levels, implementing practical improvements, and supporting continuous organisational change. Rather than presenting a fixed methodology, the workflow offers a flexible framework that can be adapted to different sectors, company sizes, and levels of digital maturity.

6.1 Scoping and Baseline Intake

The first phase of the training process should consist of developing a clear understanding of how the SME currently uses digital technologies and where inefficiencies may generate unnecessary environmental impact. Unlike large organizations, SMEs typically lack formal monitoring systems, making it essential for trainers to conduct a rapid and pragmatic baseline assessment.

This process should not be framed as a formal audit, but rather as a structured exploration of the company's digital practices. Trainers should engage both management and staff in short, focused discussions aimed at identifying how digital tools are used in everyday operations. Particular attention should be paid to areas such as device usage, data storage, cloud services, and workflow organization.



Figure 6.1. Baseline Intake Process

For example, trainers may explore whether devices are left running outside working hours, whether data is stored without clear retention criteria, or whether multiple systems are used redundantly for similar tasks. These practices often lead to increased energy consumption and inefficient use of digital resources (IEA, 2023; Malmodin & Lundén, 2018).

The outcome of this phase should be a "digital footprint snapshot", capturing key patterns of digital use and highlighting two or three priority areas where improvements are both necessary and feasible. Research shows that SME learning is most effective when it is grounded in immediate operational contexts and clearly linked to existing practices (OECD, 2021; Eraut, 2004).

Trainer Tip

Focus on identifying a small number of high-impact improvement opportunities rather than conducting a comprehensive audit. SMEs are more likely to engage when the assessment is practical, collaborative, and directly linked to everyday business operations.

Practical Example

A trainer begins a workshop by interviewing employees from administration, sales, and IT. Within one hour, the team identifies duplicate cloud storage, unused user accounts, outdated shared folders, and devices routinely left running overnight. Together, they prioritise three actions that can be implemented within the following month, creating immediate cost savings while reducing digital waste.

6.2 SME Maturity Model (L0–L3)

Once baseline information is collected, the trainer should position the SME within a simple digital sustainability maturity model. This step is critical to ensure that training interventions are realistic and aligned with the company's capabilities.

A four-level model can be used:

- **L0 – Unstructured:** Digital technologies are used inconsistently, with no awareness of their environmental impact. Practices are ad hoc and inefficient.
- **L1 – Basic**: Digital tools are used for core operations, but there is no intentional effort to optimize their use or reduce their impact.
- **L2 – Managed:** The company has introduced some structured practices (e.g., basic data organization, device management), but these are not systematically monitored.

- L3 – Optimised: Digital systems are actively managed with attention to efficiency, resource use, and environmental impact, often supported by monitoring practices.

Level	Description	Training Focus
L0 – Unstructured	Ad hoc digital practices with limited awareness	Build awareness and introduce basic digital sustainability habits
L1 – Basic	Core digital tools are used but without optimisation	Improve digital efficiency and reduce unnecessary resource use
L2 – Managed	Structured practices are emerging	Monitor performance and optimise digital processes
L3 – Optimised	Digital sustainability is integrated into management	Continuous improvement and innovation

The trainer should validate this positioning with concrete examples drawn from the baseline assessment. This helps SMEs understand their current level and creates a shared reference point for the training process.

The use of maturity models is widely supported in digital transformation and organisational development literature, as it allows for **progressive capability building and differentiated intervention strategies** (European Commission, 2023; Becker et al., 2009). Importantly, each level implies different training priorities. For example, SMEs at L0–L1 require a focus on basic behavioural changes (e.g., device usage, data organisation), while L2–L3 companies can engage with more advanced optimisation practices.

Recommended Tool

Open Digital Maturity Assessment Tool (Open DMAT)

To further support the analysis of SMEs' digital practices, trainers can make use of the Open Digital Maturity Assessment Tool (Open DMAT) developed within the European Digital Innovation Hubs (EDIH) Network under the European Commission's Digital Europe Programme. This tool allows SMEs to assess their current level of digital maturity across key dimensions such as digital strategy, data management, and green digitalisation, providing a structured overview of strengths and areas for improvement .

The Open DMAT can be used by trainers as a complementary diagnostic instrument during the scoping phase, helping to identify digital inefficiencies and prioritise intervention areas. It can be completed directly by the SME as a self-assessment or facilitated by the trainer, and the results can

be used to inform training design, align activities with the company's maturity level, and support a more targeted and evidence-based approach to digital sustainability.

6.3 Delivery Playbook

The delivery phase translates analysis and design into concrete learning experiences. Given the characteristics of SMEs, training sessions should follow a structured but flexible sequence that combines awareness, interaction, and application.

1. An effective session typically begins by raising awareness of digital inefficiencies through examples derived from the baseline assessment. This helps participants recognise the relevance of the topic and connect it to their own experience.
2. The next phase involves guided exploration, where participants analyse their own digital practices in more detail. This may include mapping workflows, reviewing data usage, or identifying patterns of device use. The trainer's role is to facilitate reflection and encourage participants to identify inefficiencies themselves.
3. This is followed by an action-oriented phase, where participants work on micro-interventions—small, concrete actions aimed at improving digital efficiency. Examples may include cleaning up unnecessary data, reorganising shared folders, or defining simple rules for device usage.
4. Finally, a reflection phase allows participants to assess the potential impact of these actions, both in terms of environmental benefits and business value. This reinforces learning and supports motivation.

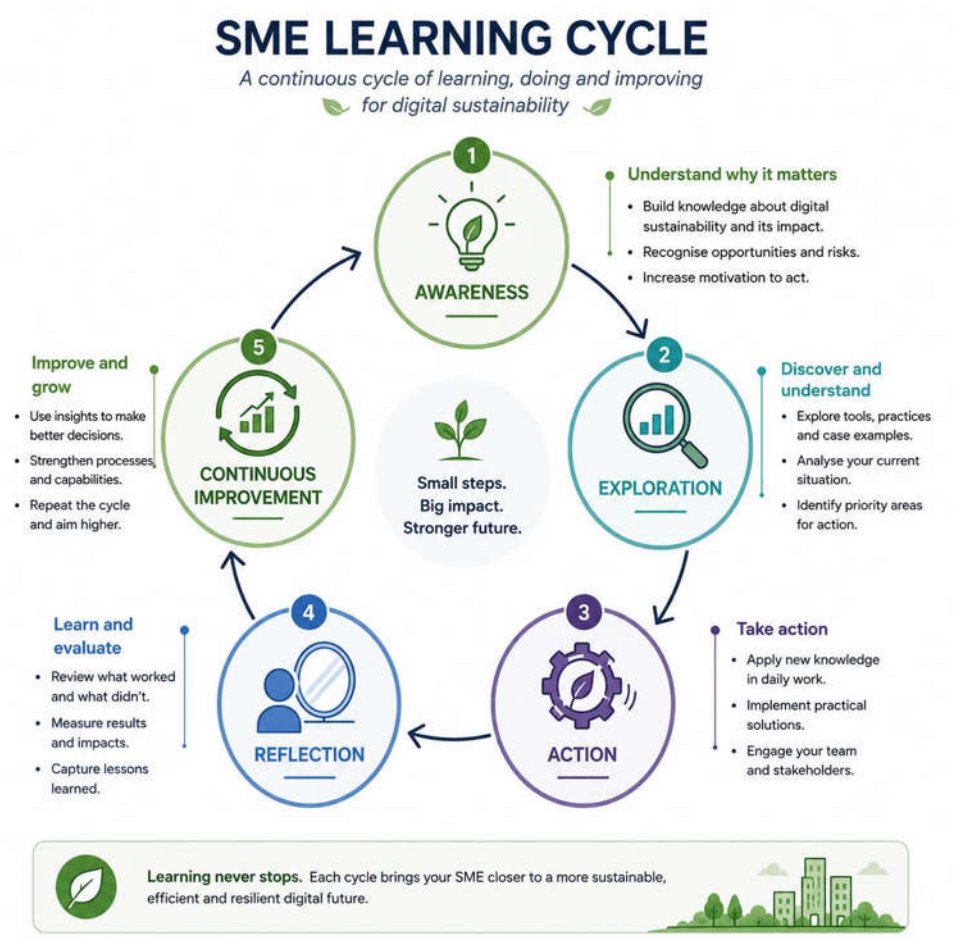

Figure 6.2. SME Learning Cycle

Practical Example

During a workshop, participants first review their current digital practices using a simple checklist. They then identify one inefficient process in their daily work and develop a small improvement plan. By the end of the session, every participant leaves with one concrete action to implement within the following week.

6.4 30/60/90-Day Follow-Up

One of the main risks in SME training is that learning remains at the level of intention without leading to sustained change. For this reason, follow-up is an essential component of the workflow.

A simple 30/60/90-day structure can be used to support implementation over time. In the first 30 days, SMEs should focus on implementing the initial micro-actions identified during training. These are typically low-effort interventions that can be quickly integrated into daily routines.

At 60 days, the focus shifts to monitoring and adjustment. SMEs can review the actions taken, identify what is working, and make necessary improvements. This phase may involve simple indicators, such as reductions in data storage volume or changes in device usage patterns.

By 90 days, the objective is to consolidate practices and, where possible, extend them to other areas of the organisation. At this stage, digital sustainability should begin to emerge as a **routine aspect of how digital technologies are managed**.

Trainers can support this process through light-touch follow-up activities, such as check-ins, feedback sessions, or remote support. Research on SME learning and organisational change highlights that **continuous reinforcement, feedback loops, and iterative learning cycles are critical for achieving lasting behavioural change** (OECD, 2021; European Commission, 2023; Kotter, 2012).

Chapter 6 Trainer Workflow

Related Annexes:

- Annex C.2 Quick Design Check
- Annex C.3 Scoping and Baseline Intake Tool
- Annex C.14 Digital Sustainability Action Plan

Key Takeaways

- Effective SME training starts with understanding existing digital practices.
- Baseline assessments help prioritise practical improvement opportunities.
- Maturity models enable trainers to adapt learning to organisational readiness.
- Practical learning should progress from awareness to implementation.
- Small improvements often create significant long-term business and sustainability benefits.
- Continuous follow-up reinforces behavioural change and organisational learning.

Trainer Reflection Questions

1. How can you quickly assess an SME's current digital sustainability practices?
2. Which maturity level best describes the SMEs you typically work with?
3. How can you adapt training activities to different maturity levels?
4. Which follow-up mechanisms are most realistic for your target group?
5. How will you measure whether training has resulted in actual behavioural change?
6. Which three actions would you prioritise first when supporting a new SME client?

Trainer Tip

Follow-up conversations do not need to be lengthy. Even short online check-ins or email reflections can significantly increase implementation rates and help SMEs maintain momentum.
Effective digital sustainability training is a continuous process rather than a single learning event. By combining baseline assessment, maturity-based learning, practical implementation, and structured follow-up, trainers can help SMEs build lasting capabilities and integrate sustainable digital practices into everyday business operations.

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7. Personas and SME Segmentation

Chapter Overview

SMEs are highly diverse organisations. They differ in terms of size, sector, digital maturity, organisational structure, and sustainability ambitions. Consequently, training programmes should not assume that all participants have the same responsibilities, motivations, or learning needs.

This chapter introduces a persona-based approach to SME training design. By understanding the different roles involved in digital sustainability, trainers can adapt content, examples, activities, and learning pathways to maximise relevance and engagement. Persona-based learning also supports collaboration across functions and helps ensure that digital sustainability becomes a shared organisational responsibility.

Why This Chapter Matters

SMEs differ significantly in their organisational structure, decision-making processes, digital maturity, and sustainability ambitions. As a result, a one-size-fits-all training approach is rarely effective. This chapter helps trainers recognise different SME personas and adapt training methods, learning pathways, and practical activities to maximise relevance, engagement, and long-term implementation.

7.1 Why SMEs Differ

Small and Medium-sized Enterprises (SMEs) differ significantly from larger organizations in how decisions are made, how roles are distributed, and how learning processes unfold.

In SMEs, roles are often overlapping and fluid, with individuals covering multiple responsibilities. Decision-making tends to be centralized, frequently concentrated in the owner-manager, while operational staff are directly involved in implementing day-to-day practices. At the same time, formal structures for training and knowledge management are often limited or absent (OECD, 2021; CEDEFOP, 2023; Storey, 2004).

These characteristics mean that a generic, standardized training approach is unlikely to be effective. Instead, training must be adapted to the specific roles, motivations, and responsibilities of different actors within the SME. This is particularly important in digital sustainability, where change depends both on strategic decisions (e.g., investment choices, policies) and on everyday behaviours (e.g., how digital tools are used, managed, and optimized).

Research highlights that learning in SMEs is most effective when it is **contextualised, role-specific, and directly linked to practical responsibilities**, reflecting the embedded and informal nature of workplace learning (European Commission, 2023; Eraut, 2004; Kitching & Blackburn, 2002). For trainers, this implies the need to identify key personas within the organization and tailor training content accordingly.

Understanding these organisational characteristics provides the foundation for persona-based training design. By recognising who makes decisions, who implements digital practices, and who can influence organisational change, trainers can better align learning activities with the realities of SME operations.

7.2 Persona Descriptions

While SMEs vary widely, several recurring roles can be identified. These personas help trainers design targeted interventions that reflect both decision-making dynamics and operational realities. The use of personas as a segmentation tool is supported in organisational learning and design literature, as it allows for **more precise alignment between user needs and learning interventions** (Pruitt & Adlin, 2006).

SME Owner-Manager

The owner-manager is typically the central decision-maker in the SME. This role combines strategic, financial, and operational responsibilities, often with limited time available for training activities.

From a digital sustainability perspective, the owner-manager is primarily concerned with cost implications, efficiency gains, and risk management. Environmental considerations are often secondary unless clearly linked to business value.

Training for this persona should therefore:

- emphasise the economic benefits of reducing digital inefficiencies (e.g., lower energy costs, reduced cloud expenses)
- provide clear, concise insights rather than detailed technical explanations
- support decision-making by presenting realistic, scalable actions

Engagement is more likely when digital sustainability is framed as a **business optimisation strategy**, rather than as a compliance requirement. This aligns with research showing that SME decision-

makers are more responsive to initiatives that demonstrate direct economic value and operational relevance (OECD, 2021; European Commission, 2023).

Operations or Administrative Lead

This persona is responsible for the coordination of daily activities, including workflows, documentation, and internal processes. In many SMEs, this role has direct control over how digital tools are used in practice.

From a digital sustainability perspective, the operations or administrative lead plays a key role in implementing efficient digital practices, such as managing data storage, organising digital workflows, and ensuring consistent use of tools.

Training for this persona should:

- focus on practical actions (e.g., reducing data duplication, optimising file management, improving workflow efficiency)
- provide clear procedures and routines that can be implemented immediately
- support monitoring and coordination across teams

Because this role sits at the intersection between strategy and execution, it is critical for translating training into **systematic organisational practices**. Research on workplace learning highlights that such intermediary roles are essential for embedding new practices into daily routines (Eraut, 2004; CEDEFOP, 2023).

ICT / Digital Lead

In some SMEs, digital responsibilities are managed by a dedicated ICT or digital lead, although this role may also be external or part-time. This persona is responsible for selecting, managing, and maintaining digital systems.

In the context of digital sustainability, the ICT lead is essential for technical optimisation, including:

- managing cloud usage and infrastructure
- selecting energy-efficient hardware and software
- implementing data lifecycle policies

Training for this persona should:

- provide deeper technical insights into efficient digital system management
- introduce tools and methods for monitoring and optimisation
- support the alignment between technical choices and sustainability objectives

This persona is often the key enabler of more advanced digital sustainability practices, particularly in SMEs at higher maturity levels. Literature on digital transformation highlights the importance of technical roles in enabling organisational change and system optimisation (Bharadwaj et al., 2013; Vial, 2019).

Sustainability or Innovation Champion

Some SMEs identify a person—formally or informally—who is responsible for driving sustainability or innovation initiatives. This role may not have formal authority but plays a critical role in promoting change.

In digital sustainability, this persona acts as a bridge between awareness and action, helping to:

- raise awareness within the organisation
- coordinate initiatives across roles
- maintain momentum over time

Training for this persona should:

- provide a holistic understanding of digital sustainability
- support facilitation and communication skills
- offer tools for engaging colleagues and promoting behavioural change

This role is particularly important in sustaining long-term transformation, especially in SMEs where formal structures are limited. Research on organisational change highlights the importance of **internal champions** in driving and maintaining innovation and behavioural change (Kotter, 2012; Rogers, 2003).

This role is particularly important in sustaining long-term transformation, especially in SMEs where formal structures are limited. Beyond coordinating initiatives, Sustainability or Innovation Champions also act as internal change ambassadors. They encourage communication across departments, motivate colleagues, promote collaboration, and help embed digital sustainability into the organisation’s culture and everyday decision-making. Research on organisational change

highlights the importance of internal champions in driving and maintaining innovation and behavioural change (Kotter, 2012; Rogers, 2003).

Marketing and Communication Specialist

Digital sustainability increasingly depends on how organisations create, manage, and distribute digital content. Marketing and communication specialists influence website management, social media, digital campaigns, visual assets, newsletters, and AI-generated content.

Training for this persona should:

- reduce unnecessary digital content and duplication;
- improve management of digital assets;
- optimise AI-supported content creation;
- promote sustainable communication practices;
- strengthen data-driven decision-making.

Understanding these organisational characteristics provides the foundation for persona-based training design. By recognising who makes strategic decisions, who implements digital practices, and who influences organisational change, trainers can better align learning activities with the realities of SME operations.

7.3 Persona-Based Learning Pathways

To maximise effectiveness, training should not follow a single linear path, but rather be structured into **modular pathways adapted to different personas**.

Suggested Learning Pathways

Persona	Primary Focus
Owner-Manager	Business value, competitiveness, investment decisions
Operations Lead	Workflow efficiency, data management, coordination
ICT Lead	Technical optimisation, cloud management, system efficiency
Sustainability Champion	Awareness, engagement, behavioural change, cross-functional collaboration, internal communication

For **owner-managers,** training pathways should be short, focused, and strategic.

Modules may include:

- understanding the cost implications of inefficient digital practices
- identifying priority areas for optimisation
- making informed decisions on digital investments

For operations or administrative leads, pathways should be more operational and practice-oriented, including:

- organising digital workflows to reduce redundancy
- implementing data management routines
- monitoring everyday digital practices

For ICT or digital leads, modules should address more advanced topics, such as:

- optimisation of cloud and data infrastructures
- device and system efficiency
- technical strategies for reducing digital resource consumption

For sustainability or innovation champions, training pathways should be integrative, focusing on:

- connecting digital practices to environmental impact
- facilitating internal change processes
- supporting continuous improvement and engagement

Importantly, these pathways should not be completely separate. Joint sessions can be used to align perspectives and foster collaboration, while persona-specific modules deepen competences where needed.

This differentiated approach reflects evidence from SME training research, which shows that **customisation, segmentation, and role-specific learning significantly increase relevance, engagement, and implementation** (OECD, 2021; CEDEFOP, 2023; European Commission, 2023).

Practical Example

During a digital sustainability workshop, participants are grouped according to their organisational roles. The owner-manager focuses on business priorities and investment decisions, the ICT lead reviews digital infrastructure and cloud services, the operations lead maps inefficient workflows,

while the Sustainability Champion facilitates discussion on behavioural change and employee engagement. At the end of the workshop, all groups combine their findings into a shared Digital Sustainability Action Plan, ensuring that strategic decisions and operational improvements support one another.

Related Annexes:

- Annex A.1 Understanding Sustainability and Digitalisation Worksheet
- Annex B.1 Systems Thinking Exercise

Key Takeaways

- SMEs consist of multiple stakeholder groups with different responsibilities and learning needs.
- Persona-based training improves relevance, engagement, and implementation.
- Different organisational roles contribute to digital sustainability in different ways.
- Cross-functional collaboration strengthens organisational learning and long-term change.
- Sustainability Champions play an important role in embedding digital sustainability into organisational culture.

Trainer Reflection Questions

Before delivering a session, consider:

1. What are the most common misconceptions SMEs may have about digital sustainability?
2. Which examples will be most relevant for this audience?
3. How can learners actively participate instead of only listening?
4. What practical outcome should participants achieve by the end of the session?
5. Which personas are represented in your target SME group?
6. How might different roles perceive the value of digital sustainability?
7. Which training activities would be most relevant for each persona?
8. How can you balance role-specific learning with organisational alignment?
9. Which personas are likely to become change agents within the organisation?
10. Which personas should participate together in the same workshop to maximise collaboration and organisational learning?

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8. Facilitation, Engagement and Change Management

Supporting SMEs in adopting digital sustainability practices requires enabling **behavioural and organisational change**, particularly in how digital technologies are used on a daily basis. Given the informal structures and limited resources of SMEs, change processes are often non-linear, dependent on individual behaviours, and influenced by both practical constraints and cultural factors (OECD, 2021; CEDEFOP, 2022).

Research shows that SMEs face specific challenges in adopting new practices due to time pressure, limited strategic capacity, and resistance to change when benefits are not immediately visible (OECD, 2021; European Commission, 2023). Trainers must therefore act not only as facilitators of learning, but also as **enablers of change**, supporting SMEs in transitioning from awareness to sustained practice. This aligns with organisational change theory, which emphasises that sustainable transformation requires both individual and systemic adaptation (Kotter, 2012; Lewin, 1951).

Why This Chapter Matters

Supporting digital sustainability in SMEs requires more than providing knowledge. Lasting improvements depend on changing everyday behaviours, engaging employees, and embedding new practices into organisational routines. This chapter equips trainers with practical approaches for overcoming resistance, facilitating engagement, and supporting sustainable organisational change through simple, people-centred methods.

8.1 Barriers and Resistance

Understanding barriers to change is a critical first step. In SMEs, resistance is rarely ideological; it is typically pragmatic and context-driven. Employees and managers may resist changes in digital practices not because they disagree with sustainability goals, but because they perceive them as time-consuming, complex, or irrelevant to immediate business needs.

One of the most common barriers is **time pressure**. Employees in SMEs often operate under tight schedules, leaving little room for reflection or experimentation. Introducing new practices—such as data clean-up routines or more structured device management—may be perceived as additional workload.

Another significant barrier is **lack of awareness of digital impact**. Many SMEs do not recognize that everyday digital practices—such as excessive data storage, inefficient use of cloud services, or leaving devices running unnecessarily—have environmental and economic consequences (IEA, 2023; Malmodin & Lundén, 2018).

A further barrier is **habitual behaviour**. Digital practices are often deeply embedded in daily routines and rarely questioned. Behavioural science research shows that habits are reinforced through repetition and convenience, making them resistant to change unless alternatives are simple and accessible (Verplanken & Aarts, 1999; Thaler & Sunstein, 2008).

Finally, **uncertainty and perceived complexity** can hinder change. If digital sustainability is presented in overly technical terms or requires unfamiliar tools, SMEs may disengage.

Research in organisational change highlights that resistance is often linked to **perceived effort versus perceived benefit**, and that change is more likely when benefits are immediate, visible, and relevant (OECD, 2021; CEDEFOP, 2022; Rogers, 2003).

Practical Example

An SME introduces a monthly digital clean-up routine but initially experiences low participation because employees view it as additional work. The trainer helps the company simplify the process by limiting the activity to 15 minutes at the end of each month and explaining the business benefits, such as improved file management and reduced storage costs. Participation increases significantly once employees experience the immediate benefits of the new routine.

8.2 Systems Thinking and Complexity

To effectively support change, trainers must adopt a **systems thinking perspective**. In SMEs, digital practices are not isolated; they are embedded in interconnected workflows, tools, and behaviours.

For example, data storage practices are linked to workflow design, communication habits, and the choice of digital tools. Similarly, device usage patterns are influenced by organisational routines, individual behaviours, and technical configurations. Changing one element often has ripple effects across the system.

Systems thinking, as developed in organisational theory, emphasises the importance of understanding **interdependencies and feedback loops within systems** (Senge, 1990). This is particularly relevant in digital sustainability, where improvements in one area (e.g., reducing data storage) may depend on changes in others (e.g., file organisation, communication practices).

However, SMEs also operate in conditions of **limited complexity tolerance**. Solutions must therefore remain simple and manageable. The role of the trainer is to simplify complexity without ignoring it, helping SMEs identify **leverage points** where small changes can produce meaningful impact.

For instance, introducing a simple data retention rule (e.g., periodic review and deletion of unused files) can influence multiple aspects of digital practice, including storage, workflows, and user behaviour.

Research on SME innovation and learning emphasizes the importance of **incremental and adaptive approaches**, where change is introduced gradually and adjusted based on feedback (European Commission, 2023; OECD, 2021).

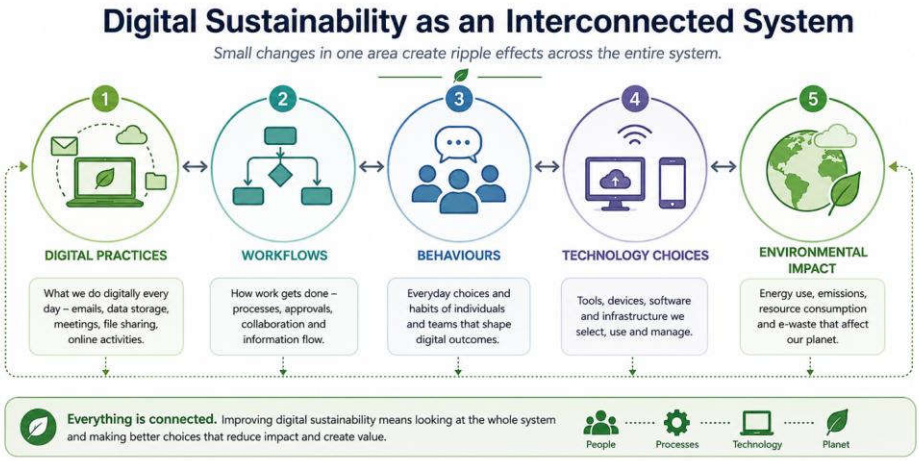

Figure 8.1. Digital Sustainability as an Interconnected System

8.3 Engagement Strategies

Effective engagement is essential to translate training into action. In SME contexts, engagement depends less on formal incentives and more on **relevance, simplicity, and participation**.

One of the most effective strategies is to **anchor engagement in real business problems**. When participants see a direct connection between digital sustainability practices and their daily work—such as reducing inefficiencies or simplifying processes—they are more likely to engage.

Another key strategy is to focus on **small, achievable actions**. Rather than proposing large-scale transformations, trainers should guide SMEs toward incremental changes that can be implemented quickly. These "quick wins" build confidence and demonstrate value, consistent with change management models that emphasise early wins as a driver of momentum (Kotter, 2012).

Participation is also critical. Engagement increases when employees are actively involved in identifying problems and developing solutions. Interactive methods such as problem-based learning and peer exchange are particularly effective in this regard, as they create a sense of ownership (Wenger, 1998; CEDEFOP, 2022).
Communication plays an important role as well. Trainers should use clear, non-technical language and avoid framing digital sustainability as an abstract or purely environmental issue. Instead, it should be presented as a **practical way to improve efficiency and reduce waste in digital systems**.

Behavioural research suggests that change is more likely when new practices are:

- easy to adopt
- socially reinforced
- integrated into existing routines

For example, introducing simple team agreements on file management or device usage can help normalise new behaviours (Thaler & Sunstein, 2008; Rogers, 2003).

Trainer Tip

Frame digital sustainability as a practical business improvement rather than an environmental obligation. SMEs are more likely to engage when improvements are directly linked to efficiency, cost savings, productivity, or customer value.

8.4 Change Agent Development

Sustainable change in SMEs often depends on the presence of internal **change agents**—individuals who promote, support, and maintain new practices over time. These individuals may not hold formal leadership roles, but they play a crucial role in influencing behaviour and maintaining momentum.
Trainers should actively identify and support these change agents during training. This may include individuals who show interest, initiative, or influence within the organisation. In some cases, this role may overlap with the sustainability or innovation champion described earlier.

Developing change agents involves building their capacity to:

- communicate effectively with colleagues;

- facilitate small improvements in everyday practices;
- encourage collaboration across different organisational roles;
- motivate and support behavioural change;
- monitor progress and celebrate early successes;
- act as ambassadors for digital sustainability within the organisation.



Figure 8.2. Role of the Internal Change Agent

For example, a change agent might take responsibility for coordinating periodic data clean-up activities or promoting more efficient device usage within the team.

Importantly, change agents should be supported with **simple tools and clear responsibilities**, rather than complex frameworks. Their role is to embed practices into everyday work, not to manage formal programmes.

Research on organisational change and innovation diffusion highlights that internal champions play a critical role in **accelerating adoption and sustaining change**, particularly in small and resource-constrained organisations (Rogers, 2003; Kotter, 2012; CEDEFOP, 2022).

8.5 Key Implication for Trainers

Across all dimensions, the success of digital sustainability training depends on the ability to move from awareness to **sustained behavioural and organisational change**.

This requires trainers to:

- understand and address practical barriers
- simplify complex systems into actionable steps
- actively engage participants through relevant and participatory methods
- support the development of internal change agents

In SME contexts, change does not occur through top-down strategies alone, but through the gradual transformation of **daily practices and routines**. Trainers play a critical role in enabling this process by connecting knowledge, action, and continuity.

This perspective is consistent with contemporary models of organisational learning, which emphasise that sustainable change emerges through **iterative learning cycles, behavioural reinforcement, and integration into everyday practices** (OECD, 2021; Senge, 1990).

Successful digital sustainability training combines technical knowledge with behavioural and organisational change. Trainers create the greatest impact when they help SMEs simplify complex challenges, engage employees through practical improvements, and support continuous learning beyond the training session. Sustainable change is achieved through consistent practice, collaboration, and ongoing reinforcement rather than one-time interventions.

Key Takeaways

- Resistance in SMEs is usually practical rather than ideological.
- Behavioural habits are often stronger barriers than technical limitations.

- Systems thinking helps identify opportunities for high-impact improvements.
- Engagement increases when digital sustainability is linked to real business challenges.
- Small, visible improvements build confidence and momentum.
- Internal change agents help embed sustainable practices into organisational culture.
- Trainers facilitate lasting change by connecting knowledge, action, and continuous improvement.

Trainer Reflection Questions

1. What barriers are most common among the SMEs you work with?
2. How can digital sustainability be presented in ways that feel relevant and achievable?
3. Which quick wins could help build early momentum?
4. Who could act as a change agent within the organisation?
5. How can you reinforce behavioural change after training has ended?

Chapter 8 Sustainable ICT Practices

Related Annexes:

- Annex B.2 Opportunity Assessment
- Annex C.4 Digital Footprint Snapshot

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PART 3 — CORE DIGITAL SUSTAINABILITY MODULES

9. Green IT and Energy Efficiency

Chapter Overview

Digital technologies play an increasingly important role in modern business operations. While they enable efficiency, innovation, and connectivity, they also consume energy, require significant material resources, and generate environmental impacts throughout their lifecycle. Green IT aims to reduce these impacts by improving energy efficiency, extending device lifetimes, reducing digital waste, and optimising digital infrastructure.

This chapter introduces the fundamental concepts of Green IT and provides practical guidance for SMEs on managing digital resources more sustainably. Trainers can use this chapter to help organisations understand the environmental impacts of ICT systems and identify opportunities for reducing energy consumption, extending device lifecycles, and improving operational efficiency.

Why This Chapter Matters

Green IT is often associated with technical infrastructure, servers, and energy consumption. However, for many SMEs the greatest opportunities lie in everyday digital practices. This chapter helps trainers explain how device lifecycle management, energy-efficient technologies, cloud optimisation, and better information management can reduce environmental impacts while improving operational efficiency and business performance.

9.1 Device lifecycle basics

Green IT is based on the idea of a device life cycle, which takes into account the environmental effects of digital devices from production to disposal. The extraction of raw materials, production, distribution, use, and end-of-life management are usually included in this life cycle. Life Cycle Assessment (LCA) is a commonly used framework to evaluate these impacts and assesses environmental burdens at every stage of a product's life. LCA emphasizes that a large amount of a device's carbon footprint frequently starts during the manufacturing stage, especially because of energy-intensive procedures and the extraction of rare materials (Belkhir & Elmeligi, 2018).

Aside from evaluation, the lifecycle perspective is strongly related with circular economic principles, which aim to decrease waste and increase the useful life of devices. Reuse, refurbishment, remanufacturing, and recycling are strategies that are being encouraged more and more to reduce their impact on the environment. Organizations can lower overall emissions and the demand for new resource extraction by extending the life of products and materials. For sustainable IT practices, this change from a linear "take-make-dispose" model to a circular one is thought to be crucial (Bocken et al., 2016).

Another crucial stage of a device's lifecycle is its use phase, which includes continuous energy use and operational effectiveness. Studies reveal that prolonging the lifespan of devices can frequently have a greater overall benefit, even though energy-efficient hardware and responsible usage can reduce the environmental impact during this stage. By delaying the need for new production, prolonged device use helps prevent additional embodied emissions related to manufacturing (Andrae & Edler, 2015).

Lastly, end-of-life care is essential to reduce the negative environmental effects of digital technologies. The growing global problem of electronic waste, or "e-waste," includes both valuable and hazardous materials and is compounded by improper disposal. Policies like Extended Producer Responsibility (EPR), which support efficient recycling systems, can help recover valuable resources and decrease environmental damage. Global e-waste recycling rates are still low, though, emphasizing the need for greater awareness and infrastructure (Forti et al., 2020).

Figure 1. *A New Circular Vision for Electronics* (AI elaboration)

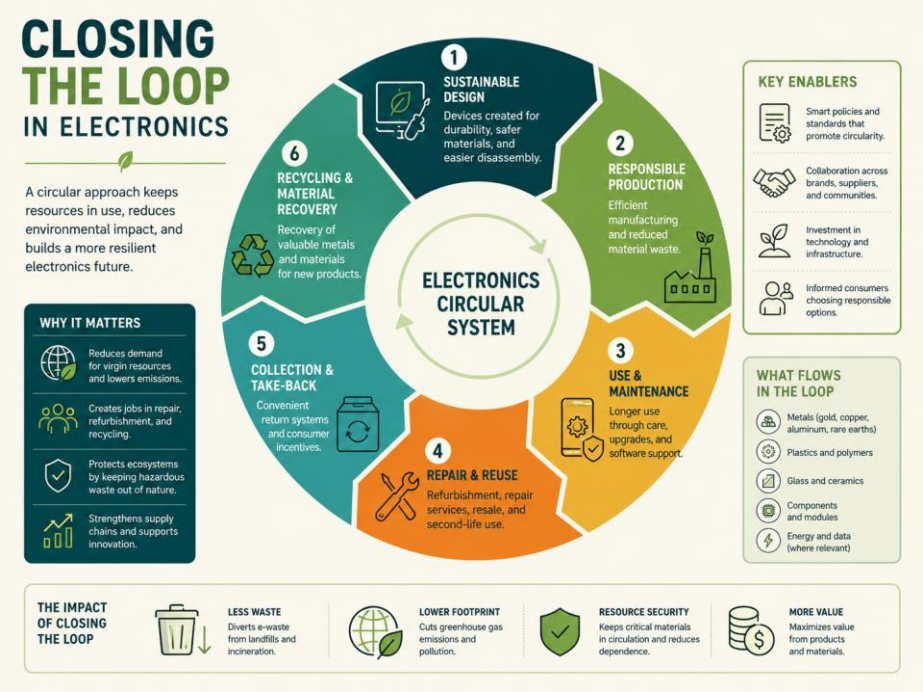

Figure 1. A new circular vision for electronics (created with AI)

Practical Example

A small company replaces employee laptops every three years regardless of their condition. After reviewing device performance and introducing refurbishment and repair policies, the organisation extends the average device lifespan to five years. This reduces procurement costs, avoids unnecessary embodied carbon emissions, and decreases electronic waste while maintaining business performance.

9.2 Energy efficiency practices

The goal of energy efficiency in Green IT is to decrease the amount of electricity needed to complete computing tasks while preserving service quality and performance. According to recent studies, the fastest-growing sources of the world's electricity demand are data centers and cloud infrastructures, which are primarily being driven by rising digitalisation and AI workloads. The workload optimization, intelligent resource allocation, and cutting down on useless computational processes are the main goals of contemporary energy-efficient strategies. In cloud environments, these methods can drastically cut operational emissions while preserving system scalability and dependability (Buyya et al., 2023).

In modern IT systems, software efficiency plays a major role in reducing energy consumption. Green AI research reveals that algorithm design, model complexity, and redundant processing have a significant impact on computational demand. Reducing pointless computations, optimizing code structure, and employing effective algorithms can all help save energy. This demonstrates that software design decisions are just as important to sustainable IT as hardware (Verdecchia et al., 2022).

By consolidating workloads into fewer physical servers, virtualization and dynamic resource management are commonly used to increase energy efficiency in cloud environments. This lowers unused hardware and overall power consumption. According to recent research, adaptive virtual machine consolidation can improve data center efficiency and scalability by dynamically reallocating computing resources based on demand, further reducing energy consumption. Additionally, intelligent system-level methods like carbon-aware scheduling and dynamic voltage and frequency scaling (DVFS), which modify computing performance based on workload demand and environmental factors like energy source availability, improve energy efficiency. In order to reduce wasteful energy use while preserving service performance, modern cloud systems are increasingly integrating these strategies (Higuera et al., 2017; Manikandan et al., 2024).

Trainer Tip

Energy efficiency is not only about purchasing efficient devices. Encourage SMEs to review software, cloud services, user behaviour, and device settings, as these often provide the quickest and most cost-effective improvements.

9.3 Cloud and server optimisation

The goal of cloud and server optimization is to reduce data center energy consumption by allocating and managing computer resources more effectively. Virtual machine (VM) consolidation is an essential strategy that enables unused machines to be turned off or put into low-power states by dynamically packing workloads onto fewer physical servers. According to research, when guided by workload prediction models and real-time monitoring systems, consolidated and adaptive resource management may significantly decrease energy consumption without affecting service performance (Panwar et al., 2022).

Virtual machine (VM) consolidation is a central optimization technique that allows idle machines to be turned off or put into low-power states by dynamically moving workloads onto fewer physical servers. This method lowers overall power consumption while increasing server utilization rates. In order to reduce operational energy costs without sacrificing service quality, advanced consolidation techniques employ adaptive algorithms to strike a balance between energy savings and performance requirements (Manikandan et al., 2024).

Moreover, sustainable cloud computing increasingly relies on carbon-aware optimization and energy-aware scheduling in addition to consolidation. These methods distribute workloads according to regional carbon intensity, energy efficiency, and resource availability. Cloud systems can lower emissions by moving computation to more environmentally friendly data centers by taking into account where and when workloads are carried out. Additionally, research emphasises how important it is to incorporate carbon accounting systems to quantify and optimize emissions distributed upon cloud infrastructures, promoting more sustainable and transparent cloud operations (Khodayarseresht et al., 2023; Schneider & Mattia, 2024).

9.4 Digital waste reduction

Digital waste is the term used to describe digital data and computing processes that are superfluous, redundant, or outdated and that use computational, energy, and storage resources without offering any real value. Because large-scale data generation, long-term storage methods, and ineffective data lifecycle management contribute to needless energy consumption and environmental impact, digital waste is becoming more widely acknowledged as a sustainability challenge in contemporary cloud and AI-driven environments. According to recent studies, minimizing the environmental impact of cloud computing and digital transformation requires addressing digital waste (Utz, 2025).

One of the primary methods for lowering digital waste is effective data lifecycle management, which incorporates techniques like data minimization, deduplication, compression, and prompt deletion of

outdated data. Research indicates that storage demand and energy consumption in data centers are greatly increased by needless data retention in cloud and AI systems. Reducing redundant data storage and increasing overall system efficiency can be achieved by putting in place automated cleanup procedures and structured data governance policies. Further preventing needless digital accumulation is the use of edge computing and lightweight AI models, which help lower the volume of data sent and stored in centralized cloud systems (Durga Rao Manchikanti, 2025).

Another important strategy is adopting sustainable software and system design principles that cut down on computational waste at its source. This is another crucial strategy, green computing research reveals that a large amount of hidden digital waste is produced through IT systems by ineffective algorithms, excessive logging, and poorly optimized workloads. Emerging strategies address this by fusing organizational practices like responsible data management and sustainable coding standards with technological advancements. By encouraging the effective use, reuse, and retirement of digital resources to reduce long-term environmental impact, these tactics are consistent with the principles of the circular economy (Yazdi et al., 2024).

Practical Example

An SME reviews its shared cloud storage and discovers that more than 40% of stored files have not been accessed for over three years. By introducing retention rules, removing duplicate files, and archiving completed projects, the company reduces storage requirements, improves information retrieval, and lowers recurring cloud service costs.

9.5 Core KPIs

To measure and control the environmental impact of cloud and data center operations requires the use of core KPIs in digital sustainability. Organizations can measure energy use, carbon emissions, resource efficiency, and infrastructure performance using these indicators. According to recent research, it is challenging to compare the environmental performance of various infrastructures or optimize cloud systems without standardized sustainability KPIs (Kuzay et al., 2026).

Power Usage Effectiveness (PUE), Data Centre Infrastructure Efficiency (DCIE), and workload-based efficiency indicators such as performance-per-watt are among the most widely used KPIs for assessing energy efficiency in data centres. These metrics help evaluate how effectively consumed energy is translated into useful IT output. Recent studies have also proposed more workload-sensitive indicators, such as workload-per-unit-energy or energy waste metrics, to capture operational inefficiencies that are not fully reflected by infrastructure-level indicators alone. In cloud

environments, these KPIs are increasingly combined with workload monitoring systems to optimise server utilisation, reduce idle energy consumption, and improve the alignment between computational demand and energy use (Safari et al., 2025).

Furthermore, carbon, water, and lifecycle KPIs are included in contemporary sustainability frameworks in addition to energy metrics. Greenhouse gas emissions from both operational energy use and embodied carbon in hardware are measured by carbon-based indicators. The increasing water demand for data center cooling systems has also made water usage effectiveness (WUE) crucial. According to research, integrating energy, carbon, and resource-based KPIs results in a more thorough sustainability assessment, allowing organizations to match digital infrastructure with net-zero and circular economy goals (Lin et al., 2024).

9.6 Digital Waste Across Business Functions

Why This Matters for SMEs

Many SMEs associate digital sustainability with ICT infrastructure, cloud services, data centres, or energy consumption. While these topics are important, a significant share of digital waste is generated through everyday business activities.

Marketing teams create and store digital content. Sales teams manage customer data. Finance departments generate reports and archives. Human resource teams maintain employee records. Collaboration tools accumulate files, recordings, and messages. Over time, digital information continues to grow, often without clear ownership, retention rules, or business value.

Digital waste increases storage requirements, software costs, cybersecurity risks, data management complexity, and employee workload. It can also contribute to the environmental footprint of digital technologies through unnecessary storage, processing, and data transmission (Freitag et al., 2021; Lange et al., 2022).

For many SMEs, improving information management is one of the fastest and most cost-effective ways to improve both sustainability and operational efficiency.

Digital Waste Across Business Functions

Digital waste is not only an ICT issue. Every business function contributes to the organisation's digital footprint. Although Green IT is often viewed as an ICT responsibility, digital waste is generated throughout the organisation. Every department creates, stores, shares, and manages digital information. Understanding these role-specific contributions helps SMEs identify practical improvement opportunities beyond technical infrastructure.

Business Function	Typical Digital Waste	Sustainability Opportunity
Marketing and E-commerce	Duplicate images, unused videos, obsolete campaigns, outdated product descriptions, archived newsletters	Content lifecycle management, image optimisation, content audits
Sales and CRM	Duplicate customer records, inactive leads, outdated contact information	Improved data quality and customer data governance
ERP and Business Systems	Duplicate products, inactive suppliers, unused reports, obsolete records	Data governance and lifecycle management
Finance and Accounting	Duplicate invoices, unnecessary exports, unmanaged archives, multiple document copies	Retention policies and document governance
Human Resources	Obsolete CV databases, duplicate employee files, outdated training materials	Information governance and compliance
Collaboration Platforms	Unused Teams channels, obsolete SharePoint sites, duplicate files, unnecessary recordings	Workspace governance and lifecycle management
Management and Administration	Duplicate reports, outdated spreadsheets, multiple document versions	Version control and simplified reporting

Marketing, E-commerce and Social Media

Marketing departments are among the largest creators of digital content within SMEs. Websites, newsletters, social media campaigns, online advertisements, videos, product images, blogs, and downloadable materials generate significant volumes of data.

Many organisations store thousands of images, videos, and campaign files that are never reused. Product catalogues may contain outdated content, duplicate images, obsolete landing pages, and unused promotional materials.

As video content becomes increasingly important for digital marketing, file sizes and storage requirements continue to grow. Content should therefore be managed throughout its lifecycle—from creation to archiving or deletion.

Common Good Practices

- Conduct annual content audits.
- Remove outdated campaign assets.
- Optimise image and video sizes.
- Archive completed campaigns.
- Define ownership of digital assets.
- Review social media libraries regularly.

Trainer Tip

Ask participants to estimate how much of their current marketing content is actively used. Many SMEs discover that only a small proportion of stored content continues to create value.

CRM, Customer Data and Sales Systems

Customer Relationship Management (CRM) systems often accumulate duplicate contacts, inactive leads, incomplete records, and outdated customer information.

Poor data quality reduces productivity and may affect reporting accuracy, customer service, and decision-making. Sustainable digitalisation includes maintaining customer information that is accurate, relevant, and necessary.

Common Good Practices

- Remove duplicate customer records.
- Archive inactive leads.
- Review customer data regularly.

- Establish data ownership.
- Define retention periods for inactive records.

ERP and Business Systems

Enterprise Resource Planning (ERP) systems frequently contain inactive products, obsolete suppliers, outdated inventory records, duplicate master data, and unused reports.

Over time, poor data governance increases system complexity and reduces reporting quality. Sustainable business systems management focuses on maintaining accurate and relevant data throughout its lifecycle.

Common Good Practices

- Review inactive product codes annually.
- Remove duplicate suppliers and customers.
- Retire unused reports and dashboards.
- Establish clear ownership for master data.
- Define data lifecycle rules.

Practical Example

An SME discovers more than 3,000 inactive products in its ERP system. After a structured data clean-up exercise, reporting becomes faster, data quality improves, and employees spend less time searching for information.

Finance and Accounting Systems

Accounting and financial management systems generate large quantities of invoices, reports, exports, attachments, and supporting documentation.

While legal retention requirements must always be respected, organisations frequently maintain duplicate copies across email systems, shared drives, ERP systems, and local computers.

Common Good Practices

- Apply document retention policies.
- Eliminate duplicate archives.
- Use version control procedures.
- Store financial records in designated repositories.
- Review archive structures periodically.

Email and Document Management

Email remains one of the most widely used digital communication tools in SMEs. Large mailboxes, unnecessary attachments, duplicate communications, and indefinite storage of historical messages increase storage requirements and information management complexity.
Similarly, document repositories often contain multiple versions of the same file.

Examples include:

- Final_v2.docx
- Final_v2_new.docx
- Final_v2_final.docx
- Final_v2_final_latest.docx

Without clear ownership and version control, organisations spend valuable time searching for information and maintaining duplicate content.

Common Good Practices

- Establish document naming conventions.
- Use shared repositories instead of email attachments.
- Archive completed projects.
- Define retention periods.
- Delete obsolete files regularly.

Collaboration Platforms and Digital Workspaces

Collaboration tools such as Microsoft Teams, SharePoint, Google Workspace, Zoom, Slack, and similar platforms have transformed how organisations communicate and work together.
However, they also generate substantial amounts of digital information. Meeting recordings, duplicate files, inactive channels, abandoned projects, and unmanaged permissions frequently remain stored long after they are needed.

Common Good Practices

- Create rules for meeting recordings.
- Archive inactive projects.
- Assign workspace owners.
- Conduct annual clean-up reviews.
- Remove inactive users and permissions.

9.7 Delivering Training to Different SME Audiences

Adapting Training to Different SME Sizes

Not all SMEs face the same challenges. Training should be adapted according to company size, available resources and organisational maturity.

Characteristic	Micro Enterprise	Small Enterprise	Medium Enterprise
Employees	1–9	10–49	50–249
Resources	Very limited	Moderate	More structured
Decision making	Owner-led	Shared management	Formal management
Recommended approach	Quick wins and practical actions	Structured action plans	Strategic sustainability integration

Examples	Email clean-up, cloud optimisation	Device lifecycle management	ICT sustainability strategy

Trainer Tip

Use different examples and exercises depending on the participants' organisational context.

Training should always be adapted to organisational maturity, available resources, and business priorities. By aligning examples, exercises, and action plans with the realities of different SME sizes, trainers can improve engagement and increase the likelihood that digital sustainability practices are successfully implemented.

Green IT combines responsible technology management with practical improvements that reduce environmental impacts while strengthening business performance. By extending device lifecycles, improving energy efficiency, optimising cloud services, reducing digital waste, and strengthening information governance across all business functions, SMEs can achieve measurable sustainability and operational benefits.

Related Annexes

- Annex C.4 Digital Footprint Snapshot
- Annex C.5–C.11 Cleanup and Governance Tools

Key Takeaways

- Green IT considers the environmental impacts of digital technologies throughout their lifecycle.
- Extending device lifetimes is one of the most effective strategies for reducing environmental impacts.
- Energy efficiency depends on both hardware and software optimisation.
- Cloud optimisation can significantly reduce energy consumption and operational emissions.
- Digital waste is generated across all business functions, not only within ICT departments.
- Better information governance improves efficiency, data quality, cybersecurity, and business resilience.
- KPIs enable organisations to monitor progress and continuously improve digital sustainability performance.

Trainer Reflection Questions

1. Which stages of the ICT lifecycle create the greatest environmental impact?
2. How can SMEs extend the lifespan of their digital devices?
3. Which energy efficiency practices are easiest to implement in small organisations?
4. What forms of digital waste exist within your organisation?
5. Which KPIs would provide the most useful insights for your business?
6. Which business function in your organisation offers the greatest opportunity to reduce digital waste?

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10. Digital Tools for Sustainability

Chapter Overview

Digital tools play an essential role in supporting sustainability initiatives within SMEs. They enable organisations to measure, monitor, analyse, and optimise environmental and operational performance while improving decision-making and transparency. When selected and implemented appropriately, digital tools can help reduce resource consumption, improve energy efficiency, support compliance requirements, and facilitate continuous improvement.

This chapter introduces the main categories of digital tools relevant to sustainability management and provides practical guidance for selecting and applying tools within SME environments. The emphasis is not on technology for its own sake, but on choosing tools that deliver measurable business and sustainability value.

Why This Chapter Matters

Digital tools help SMEs turn sustainability ambitions into measurable actions. Rather than collecting data for its own sake, organisations should select tools that simplify everyday work, improve decision-making, reduce resource consumption, and generate measurable business value. This chapter helps trainers identify appropriate digital tools for different SME contexts and explains how to select solutions that are practical, affordable, and aligned with organisational needs.

10.1 Monitoring and calculators

Digital sustainability systems use sustainability calculators and monitoring tools to quantify environmental impacts in an organized and data-driven way. Important metrics like material flows, energy use, water use, and greenhouse gas emissions are measured by these devices. By converting operational data into standardized environmental metrics, carbon calculators and digital dashboards promote more transparent and evidence-based sustainability management (Sassanelli et al., 2019).

According to recent scholarly research, environmental monitoring systems are increasingly incorporating digitalization technologies like cloud computing, big data analytics, and the Internet of Things (IoT). By enabling real-time data collection from tangible assets and production processes, these technologies enhance the precision and promptness of sustainability reporting. Based on studies published in the Journal of Cleaner Production, IoT-enabled monitoring systems greatly improve

carbon visibility and aid in decision-making by locating emission hotspots throughout operational systems (Choon & ali, 2025).

Typical monitoring tools include the following:

- Carbon footprint calculators (product and organisation level)
- IoT-based smart energy monitoring systems and dashboards
- Life Cycle Assessment (LCA) software tools and databases

These tools greatly benefit SMEs by simplifying the process of gathering environmental data and increasing the effectiveness of reporting. Additionally, they facilitate adherence to newly developed frameworks for sustainability disclosure and enable organizations to measure environmental performance over time, enhancing their capacity to monitor advancement toward sustainability goals (Ghobakhloo, 2020).

Practical Example

A manufacturing SME installs smart electricity meters and a simple carbon footprint calculator. Within three months, the company identifies peak energy consumption periods and adjusts equipment usage schedules, reducing electricity costs while improving environmental performance.

10.2 Data optimisation tools

Data optimization tools are crucial for lowering the environmental impact of digital systems. By enhancing the way data is stored, processed, and reused, inefficient processing and storage greatly increase the amount of energy used in IT infrastructures as data volumes rise. According to green IT research, optimizing data handling is a crucial tactic for reducing emissions and energy consumption. (Charfeddine & Umlai, 2023; Milić, 2024) .

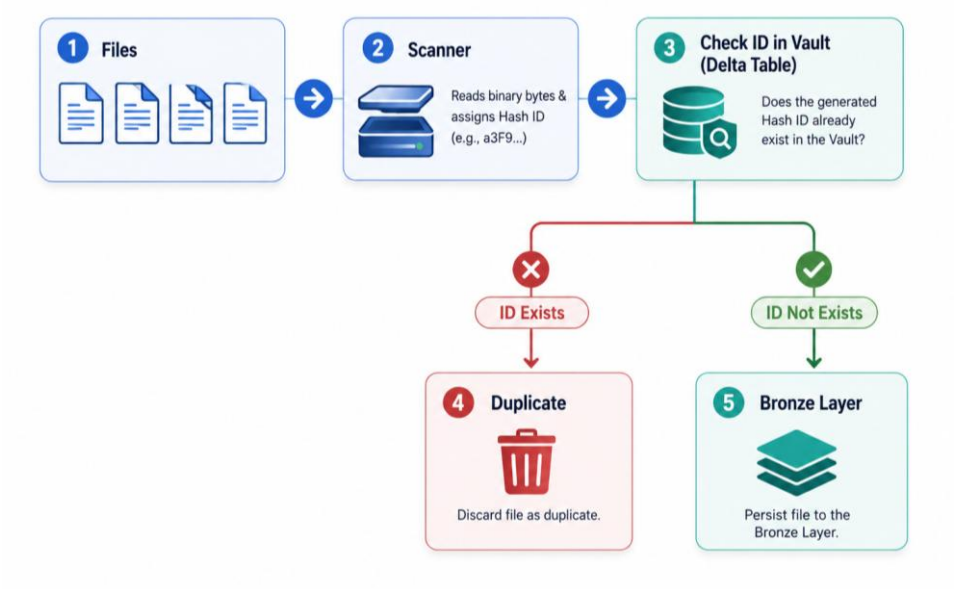

Figure 2. File ingestion & deduplication process (AI Elaboration)

Reducing redundant and obsolete data, also known as ROT (redundant, obsolete, trivial data), is a fundamental type of optimization tool. According to research, excessive data storage directly raises energy consumption and carbon emissions, especially in cloud-based environments. Deduplication, compression, and automated data cleanup systems are examples of tools that can greatly lower storage requirements and boost productivity (Mersico et al., 2024).

Another crucial strategy, data lifecycle management (DLM), which employs automated tools to categorize, preserve, archive, and remove data according to its value. In addition to increasing system efficiency, effective DLM minimizes the long-term storage of low-value data. Furthermore, for more

effective and long-lasting digital operations, intelligent data management techniques like dismantling data silos and enhancing data quality are essential (Püchel et al., 2024).

Trainer Tip

Many SMEs already possess sufficient data but struggle to manage it effectively. Before investing in new software, encourage organisations to review existing data quality, remove redundant information, and establish simple data governance practices.

10.3 Tool selection logic (low-cost vs advanced)

Cost, functionality, and organizational needs must all be taken into account when choosing digital sustainability tools. Basic functions like monitoring, compression, and basic optimization are offered by cheap tools, such as open-source or lightweight solutions. Due to their low cost and quantifiable efficiency gains, these tools are especially well-suited for smaller businesses or early-stage sustainability projects (Charfeddine & Umlai, 2023).

However, advanced tools provide automation, AI-driven optimization, and real-time analytics, which help businesses handle complicated digital infrastructures more effectively. For example, predictive models and ongoing monitoring are used by data-driven energy management systems in data centers to optimize operations and lower energy usage. Large-scale settings are particularly helpful for these systems since efficiency improvements can drastically lower emissions (Milić, 2024).

Moreover, a cost-benefit and scalability analysis should guide the decision between inexpensive and sophisticated tools. Advanced tools frequently offer greater long-term operational and environmental benefits, despite their higher initial cost. In sustainability transitions, a phased approach is generally advised, beginning with basic tools and moving up to more sophisticated systems as organizational maturity rises (Püchel et al., 2024).

10.4 Using toolcards

Toolcards are organized frameworks that are used to assess and contrast digital sustainability tools according to predetermined standards. Functionality, cost, energy impact, scalability, and technical requirements are usually included. Toolcards facilitate more transparent and knowledgeable decision-making when choosing sustainability tools by arranging this data in a consistent format (Püchel et al., 2024).

The ability of toolcards to combine traditional technical criteria with sustainability metrics like energy efficiency and carbon impact is a major benefit. This assures that environmental factors are specifically taken into account when making decisions. According to research, integrating these metrics is crucial for coordinating digital infrastructure with more general sustainability and decarbonization objectives (Milić, 2024).

Additionally, by giving technical and non-technical stakeholders a common framework, toolcards promote cross-functional cooperation. They permit organizations to continuously evaluate performance and improve sustainability outcomes at every stage of the tool lifecycle, from selection to evaluation. This methodical approach supports long-term sustainability strategies while managing the increasing complexity of digital systems (Mersico et al., 2024).

Practical Example

Before purchasing new sustainability software, an SME compares three solutions using a toolcard that evaluates functionality, cost, implementation effort, scalability, and sustainability impact. This structured comparison helps management select a solution that meets business needs without unnecessary complexity or expenditure.

Key Takeaways

- Digital tools help organisations measure, monitor, and improve sustainability performance.
- Effective sustainability management depends on reliable data and actionable insights.
- Simple tools often provide the greatest value for SMEs.
- Tool selection should be driven by business needs rather than technology trends.
- Automation can reduce administrative workload and improve efficiency.
- Toolcards and practical resources support implementation and learning.

Digital tools enable SMEs to monitor, analyse, and improve sustainability performance. By selecting solutions that match organisational needs and digital maturity, businesses can simplify reporting, improve decision-making, optimise resource use, and support continuous improvement without unnecessary technological complexity.

Related Annexes:

- Annex C.12 KPI Worksheet
- Annex C.13 Roadmap Template

Trainer Reflection Questions

1. Which sustainability challenges are most difficult for SMEs to measure?
2. How can digital tools simplify data collection and reporting?
3. What criteria should SMEs use when selecting new digital tools?
4. How can organisations avoid collecting unnecessary data?
5. Which tools would provide the greatest value for your target group?

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11. AI for Sustainability

Chapter Overview

Artificial Intelligence (AI) is increasingly recognised as a powerful enabler of sustainability. By analysing large volumes of data, identifying patterns, automating processes, and supporting decision-making, AI can help organisations improve resource efficiency, reduce waste, optimise operations, and enhance sustainability performance.

At the same time, AI systems themselves require significant computational resources, energy consumption, and digital infrastructure. Sustainable use of AI therefore requires balancing its benefits against its environmental, social, and ethical impacts.

This chapter introduces the role of AI in sustainability, explores practical applications for SMEs, and highlights key principles for responsible and sustainable AI adoption

Why This Chapter Matters

Artificial Intelligence offers significant opportunities to improve efficiency, optimise resource use, and support sustainability decision-making. However, responsible AI adoption requires organisations to balance business value with environmental impacts, ethical considerations, and responsible governance. This chapter helps trainers introduce AI in ways that are practical, accessible, and appropriate for SMEs.

11.1 AI as efficiency driver

Artificial intelligence (AI) is becoming more widely acknowledged as a major factor in digital system efficiency, allowing businesses to automate procedures, maximize resource utilization, and enhance decision-making. By eliminating repetitive tasks and enhancing workflow efficiency, AI applications like automation, predictive analytics, and natural language processing help SMEs lower operating costs and boost productivity (Badghish & Soomro, 2024).

From a sustainability perspective, AI helps make more efficient use of resources by cutting waste and enhancing process optimization. According to recent studies, AI-enabled systems can greatly improve resource efficiency and cut down on material waste in production and service settings, supporting the ideas of the circular economy (de Lucas López et al., 2026).

Additionally, SMEs can increase efficiency through AI-driven automation without having to make significant infrastructure investments. This is especially crucial for smaller businesses, whose limited resources make efficiency gains essential for long-term environmental and economic viability (Fonseca et al., 2024).

Practical Example

A small accounting company introduces an AI assistant to automate document classification, draft client emails, and summarise meeting notes. Employees spend less time on repetitive administrative work and more time on customer service, improving both productivity and employee satisfaction.

11.2 AI for measurement and optimisation

AI makes it possible for organizations to analyze massive datasets and produce useful insights; it is essential to sustainability measurement. Real-time monitoring of energy use, emissions, and operational performance by AI-based systems enables businesses to spot inefficiencies and maximize resource utilization more successfully than with conventional techniques (Fonseca et al., 2024).

AI facilitates optimization through predictive and adaptive models in addition to measurement. Machine learning algorithms, for instance, can forecast demand, optimize supply chains, and dynamically modify operations to cut waste and energy use. These features make sustainability management more accurate and proactive, especially in settings with a lot of data (Alsaadi et al., 2026).

Furthermore, AI also improves decision-making by converting unprocessed data into insights that bolster sustainability plans. Organizations can improve efficiency and environmental results by aligning business performance with sustainability goals through the integration of environmental data into operational systems (Milić, 2024).

Trainer Tip

AI should support better decisions rather than replace human judgement. Encourage SMEs to validate AI-generated recommendations before implementing operational changes.

11.3 Lightweight AI for SMEs

Lightweight AI is AI that is easy to use, cheap, and does not require a lot of technical knowledge or infrastructure to set up. For small and medium-sized businesses (SMEs), these tools include cloud-based AI services, generative AI apps, and simple automation tools that are easy to set up and use right away. Studies show that how easy it is to use and how useful it seems are two of the most important factors that affect how small and medium-sized businesses use AI. (Bahaw et al., 2025)2025; Fonseca(Fonseca et al., 2024)

Furthermore, lightweight AI tools are especially useful because they make it easier for businesses to try out AI and slowly improve their skills without having to spend a lot of money up front. People often suggest a phased adoption approach, starting with general-purpose tools like chatbots and data analytics platforms and moving on to more specialised apps as the organization gets more mature. This step-by-step approach lets small and medium-sized businesses (SMEs) balance innovation with limited resources while getting the most long-term benefits from AI (Hussain & Rizwan, 2024).

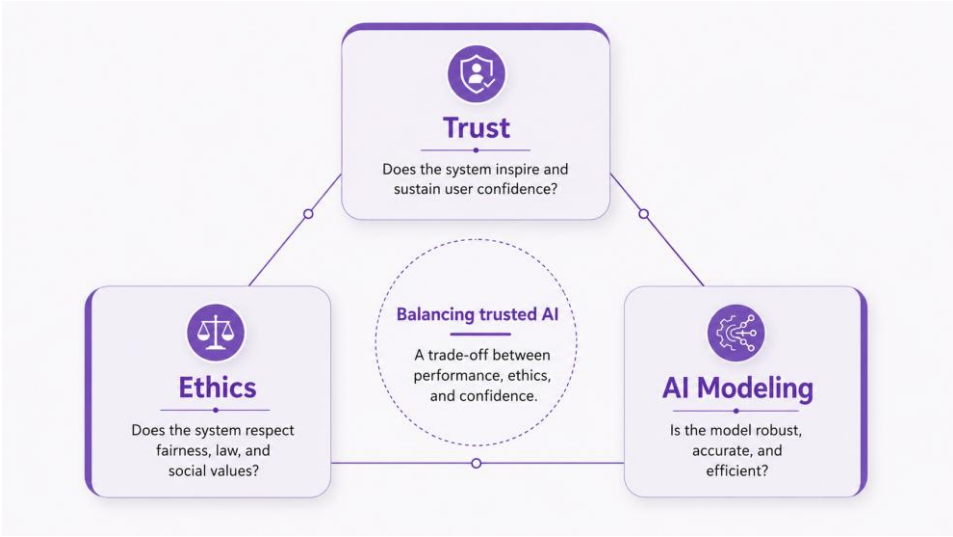

Figure 3. Trust, ethics, and AI modeling trade-off (AI elaboration)

Typical SME Applications

- AI-assisted document creation
- Customer service chatbots
- Meeting transcription

- Translation
- Image generation
- Marketing content optimisation
- Forecasting and reporting
- Email summarisation

11.4 Responsible AI use

Adoption of AI presents significant ethical and governance issues even though it offers potential substantial sustainability benefits. To ensure responsible AI use, concerns like algorithmic bias, data privacy, and lack of transparency must be addressed. These issues are especially pertinent to SMEs since they might not have the means or know-how to handle complicated ethical risks (Leslie et al., 2023)

The necessity of accountability, transparency, and human oversight throughout the AI lifecycle is emphasized by responsible AI frameworks. Organizations can prevent unforeseen negative effects and foster stakeholder trust by incorporating ethical considerations into AI design and implementation (Kittipanya-ngam et al., 2025)

Moreover, by ensuring that technological innovation is in line with social and environmental values, incorporating ethical principles into AI adoption promotes long-term sustainability. The responsible use of AI can be greatly enhanced for SMEs by implementing basic governance practices, such as explicit data policies and human-in-the-loop decision-making. (Sarker et al., 2025a)

Practical Example

Before introducing an AI-powered customer support tool, an SME develops simple internal guidelines covering data privacy, human review of AI-generated responses, and responsible handling of confidential information. These measures help build trust while reducing operational risks.

11.5 AI footprint basics (SME proxy approach)

Despite its advantages, AI has an environmental impact because of the energy needed for infrastructure use, data processing, and model training. To ensure that AI positively contributes to sustainability goals, it is necessary to understand and regulate this footprint. However, assessing the environmental impact of AI can be challenging, especially for SMEs with limited technical resources (Leslie et al., 2023).

For SMEs, a proxy approach is frequently suggested as a solution to this issue. Organizations can estimate AI-related impacts using simplified indicators like cloud usage, computation time, or energy consumption of digital services rather than measuring intricate AI-specific metrics. This method offers a useful way to estimate AI's footprint without the need for sophisticated measurement equipment (Milić, 2024).

Additionally, SMEs may also reduce their AI footprint by implementing efficiency-focused strategies, like using smaller models, cutting back on pointless computations, and choosing cloud providers that use less energy. These tactics support the adoption of AI in a way that is both economically and environmentally feasible and are consistent with more general sustainable IT principles (de Lucas López et al., 2026).

Trainer Tip.

Most SMEs do not need to calculate the exact carbon footprint of every AI interaction. Instead, encourage organisations to focus on reducing unnecessary AI usage, selecting efficient digital tools, and avoiding the generation of low-value digital content.

Artificial Intelligence can become a valuable sustainability tool when it is used purposefully, responsibly, and in alignment with business needs. By focusing on practical applications, responsible governance, and efficient use of digital resources, SMEs can benefit from AI while minimising unnecessary environmental impacts.

Key Takeaways

- AI improves efficiency through automation, optimisation, and better decision-making.
- Many SMEs already use AI-enabled tools in their everyday work.
- Responsible AI requires transparency, human oversight, and appropriate governance.
- AI itself consumes energy and digital resources that should be managed responsibly.
- Lightweight AI solutions provide practical entry points for SMEs.
- The objective is not to use more AI, but to use AI more effectively and sustainably.

Related Annexes:

- Annex B.3 Risk Assessment
- Annex C.11 Retention Policy

Trainer Reflection Questions

1. Which sustainability challenges in your organisation could potentially be supported by AI?

2. What AI-enabled tools are already being used within the organisation?
3. How can AI improve efficiency without increasing unnecessary complexity?
4. What risks should be considered when adopting AI solutions?
5. How can organisations balance AI benefits with environmental impacts?

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12. Cybersecurity and Data Ethics

Chapter Overview

As organisations become increasingly dependent on digital technologies, data, cloud services, and connected systems, cybersecurity and data ethics have become essential components of digital sustainability. Sustainable digitalisation is not only about reducing environmental impacts but also about ensuring that digital systems are secure, trustworthy, transparent, and used responsibly.

Cybersecurity protects organisations against threats such as data breaches, cyberattacks, ransomware, and unauthorised access. Data ethics focuses on the responsible collection, management, use, and sharing of information while respecting privacy, fairness, accountability, and human rights.

For SMEs, cybersecurity and data ethics are often closely linked. Effective digital sustainability requires organisations to protect digital assets while ensuring that technologies support both organisational objectives and societal wellbeing.

Why This Chapter Matters

Cybersecurity and responsible data management are fundamental building blocks of digital sustainability. As SMEs increasingly rely on cloud services, AI, digital platforms, and connected devices, protecting digital assets and using data responsibly become essential for business continuity, customer trust, regulatory compliance, and organisational resilience. This chapter helps trainers explain how cybersecurity and data ethics support both sustainability objectives and long-term business performance.

12.1 Data minimisation and retention

Data minimization and retention emphasize restricting data collection and storage to what is absolutely necessary, they are key concepts in cybersecurity and ethical data management. Excessive data accumulation has become a significant problem as digitalization picks up speed, raising security and environmental risks. Large-scale data storage dramatically increases energy consumption in digital infrastructures, according to research, which emphasizes the need to minimize needless data processing and storage (Mersico et al., 2024).

Excessive data retention increases an organization's attack surface and increases its susceptibility to ransomware attacks and breaches. Minimizing stored data streamlines data protection procedures and lowers the quantity of private information vulnerable to possible threats. Furthermore, responsible

data management highlights how needless data retention adds to "digital waste," which has ethical and environmental ramifications (Püchel et al., 2024; Utz, 2025)

In addition, structured data governance procedures, such as explicit retention guidelines, automated deletion procedures, and frequent data audits, are necessary for the successful implementation of data minimization. These procedures guarantee that data is only kept for the purpose for which it was intended and is deleted when it is no longer required. Adopting straightforward lifecycle-based data management techniques can greatly improve cybersecurity resilience while reducing operational complexity and sustainability impacts for SMEs (Mersico et al., 2024).

Practical Example

A small consulting company stores thousands of outdated customer files, duplicate reports, and archived project documents in multiple cloud platforms. After introducing a simple retention policy, deleting obsolete data, and archiving completed projects, the company reduces cloud storage costs, simplifies information retrieval, and lowers cybersecurity risks while reducing unnecessary digital waste.

Reducing unnecessary data not only strengthens cybersecurity but also decreases digital waste by reducing storage requirements, energy consumption, and the environmental footprint of digital infrastructure.

12.2 Secure-by-design principles

Secure-by-design principles emphasise integrating security measures into systems from the earliest stages of development rather than applying them as afterthoughts. This proactive approach is in line with modern digital transformation strategies, which call for the early integration of security into data processes, applications, and infrastructure. Early security integration increases system resilience and operational efficiency, according to research on sustainable digital systems (Buyya et al., 2023).

important components of secure-by-design are encryption, access control, system monitoring, and secure default configurations. By taking these measures, vulnerabilities are avoided and systems are kept safe for the duration of their existence. By lowering redundant procedures and system failures, integrating security with resource management techniques in cloud and data-driven environments also improves energy efficiency (Khodayarseresht et al., 2023; Manikandan et al., 2024)

Secure-by-design can be put into practice for SMEs using low-cost, workable solutions like using reliable cloud services, applying frequent updates, and restricting user access by role. These methods

lower cybersecurity risks without requiring sophisticated infrastructure, which makes them especially appropriate for smaller businesses with constrained funding(Hussain & Rizwan, 2024)

Trainer Tip

Secure-by-design does not require expensive technology. For most SMEs, simple measures such as multi-factor authentication, automatic software updates, strong password policies, encrypted cloud services, and role-based access provide significant improvements in cybersecurity and digital resilience.

12.3 Responsible data use

The term "responsible data use" defines the ethical, transparent, and responsible management of data at every stage of its lifecycle. Making sure that data is used responsibly has become essential to sustainability as organizations depend more and more on data-driven technologies and AI systems. According to research, establishing trust and coordinating digital innovation with social and environmental objectives depend on ethical data practices (Sarker et al., 2025a)

Transparency, equity, accountability, and privacy protection are fundamental tenets of responsible data use. In AI-driven systems, where biased or improperly managed data can produce unfair or negative results, these principles are especially important. Research on sustainable AI emphasizes that in order to prevent unexpected negative effects and guarantee long-term sustainability, ethical considerations must be incorporated into data management procedures (Leslie et al., 2023; Verdecchia et al., 2022).

It is important to mention how simple governance practices like explicit data policies, informed consent procedures, and frequent data usage reviews can help SMEs implement responsible data use. These strategies improve regulatory framework compliance, foster stakeholder trust, and assist organizations in striking a balance between innovation and ethical responsibility (Fonseca et al., 2024).

As SMEs increasingly adopt artificial intelligence, responsible data use also includes ensuring that AI systems are trained and used with accurate, relevant, and ethically managed data. Organisations should establish simple governance practices that define how AI-generated content is reviewed, how sensitive information is protected, and how human oversight is maintained when AI supports business decisions.

12.4 Training scenario exercise

Since human error continues to be one of the main causes of data breaches and security incidents, training and awareness are essential elements of cybersecurity and ethical data management. According to research, users' ignorance of fundamental security procedures can compromise even well-designed systems, underscoring the significance of ongoing training (Sarker et al., 2025).

Particularly successful in raising cybersecurity awareness and behavior are scenario-based training exercises. Employees can practice recognizing risks and taking appropriate action by participating in these exercises, which mimic real-world scenarios like phishing attacks or data breaches. It has been demonstrated that experiential learning techniques greatly improve comprehension and memory of cybersecurity procedures. (Kittipanya-ngam et al., 2025).

For example, a data handling case study or a phishing email simulation could serve as a basic training scenario for SMEs. Workers are asked to determine possible risks, choose the best course of action, and discuss the results. This method requires little resources to implement while reinforcing important ideas like data minimization, secure handling, and responsible data use (Fonseca et al., 2024).

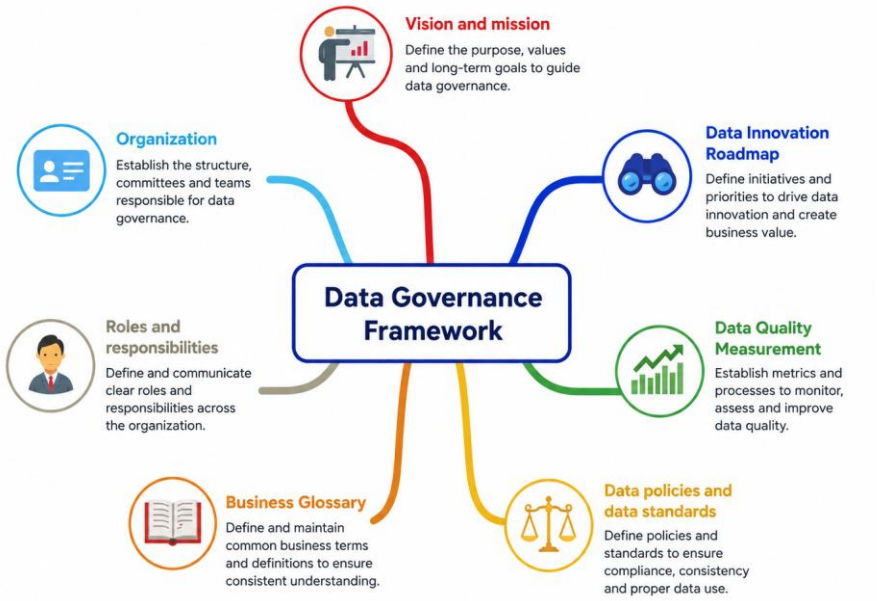

Figure 4. Data governance framework (AI Elaboration)

Example Scenario

Scenario: An employee receives an email appearing to come from the company's managing director requesting an urgent bank transfer and containing an unexpected attachment.

Participants discuss:

- What warning signs can be identified?
- What should the employee do?
- How should the incident be reported?
- What organisational practices could prevent similar incidents?

Key Takeaways

- Cybersecurity is a critical component of digital sustainability.
- Secure systems support organisational resilience and long-term viability.
- Data governance helps organisations manage information responsibly throughout its lifecycle.
- Data ethics promotes transparency, fairness, accountability, and trust.
- Data minimisation reduces cybersecurity risks, costs, and environmental impacts.
- Sustainable digitalisation requires both technological safeguards and responsible human behaviour.

Cybersecurity and responsible data governance are essential components of digital sustainability. By minimising unnecessary data, implementing secure-by-design principles, promoting ethical data use, and strengthening employee awareness, SMEs can reduce operational risks while improving resilience, trust, and responsible digital transformation.

Related Annexes:

- Annex B.3 Risk Assessment
- Annex A.3 Role-Based Discussion Cards

Trainer Reflection Questions

1. What are the most significant cybersecurity risks facing SMEs today?
2. How does data governance contribute to sustainability objectives?
3. What forms of unnecessary data exist within organisations?
4. How can SMEs balance innovation with privacy and security requirements?
5. What actions can help create a stronger culture of cybersecurity?
6. Which current data management practice within your organisation could be simplified to improve both cybersecurity and digital sustainability?

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Verdecchia, R., Cruz, L., Sallo

13. Circular Economy and Lifecycle Thinking

Circular economy principles are becoming increasingly important in the management of digital technologies and ICT systems. Traditional linear models of production and consumption follow a "take-make-dispose" approach, where resources are extracted, transformed into products, used, and eventually discarded. This model contributes to resource depletion, greenhouse gas emissions, and growing volumes of electronic waste.

Circular economy approaches seek to keep products, materials, and resources in use for as long as possible through strategies such as reuse, repair, refurbishment, remanufacturing, and recycling. When applied to ICT systems, circular thinking helps organisations reduce environmental impacts, improve resource efficiency, and create long-term value from digital assets.

This chapter introduces lifecycle thinking, Life Cycle Assessment (LCA), circular practices for ICT systems, and key indicators that support more sustainable management of digital resources.

Why This Chapter Matters

Most environmental impacts of digital technologies occur long before devices are switched on and continue after they are discarded. Understanding lifecycle thinking and circular economy principles helps SMEs make better purchasing decisions, extend the lifespan of digital equipment, reduce electronic waste, and improve resource efficiency while lowering operational costs.

13.1 ICT lifecycle overview

Information and communication technology (ICT) systems go through several phases in their lifecycle, including the extraction of raw materials, production, distribution, use, and recycling or disposal at the end of their useful lives. Every stage has an impact on the environment, including energy use, carbon emissions, and the production of electronic waste. According to recent research, lifecycle thinking is crucial for sustainable ICT management since the quick development of digital technologies has increased these effects (Charfeddine & Umlai, 2023; Lin et al., 2024).

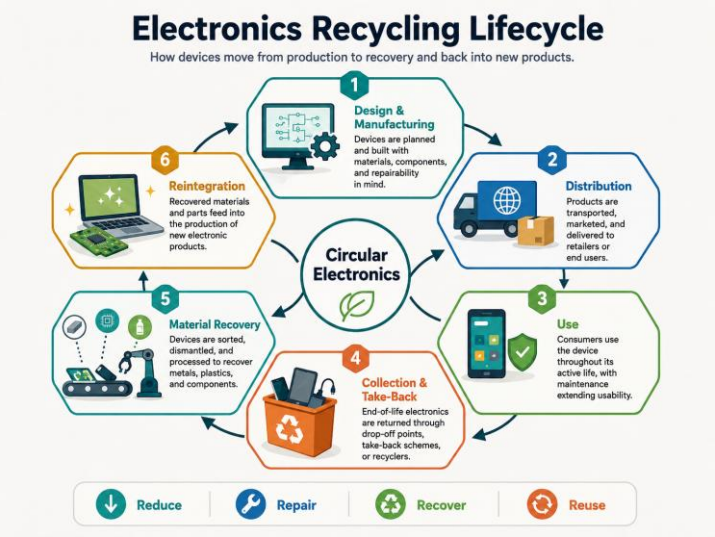

Figure 5. Lifecycle Overview (AI Elaboration)

Due to constant processing and storage requirements, the use phase accounts for a significant amount of ICT-related energy consumption, especially in data centers and cloud computing. Optimizing resource allocation and increasing energy efficiency during operation can significantly reduce environmental impacts, according to studies on sustainable cloud infrastructure. However, because of resource extraction and production processes, upstream stages like manufacturing also have significant environmental costs (Buyya et al., 2023).

Lifecycle thinking encourages organizations to consider the full environmental footprint of digital systems rather than focusing solely on operational efficiency. For SMEs, this means selecting energy-efficient hardware, extending device lifespans, and considering end-of-life strategies such as reuse and recycling. Integrating lifecycle perspectives supports more informed decision-making and aligns digital transformation with sustainability objectives (Püchel et al., 2024).

Practical Example

An SME replaces employee laptops every three years as standard practice. After reviewing actual device performance, the company upgrades memory and storage instead of purchasing new equipment. The average device lifespan increases to five years, reducing procurement costs, electronic waste, and embodied carbon emissions while maintaining business performance.

13.2 LCA basics (light approach)

A methodological framework called life cycle assessment (LCA) is used to assess how a system or product affects the environment over the course of its whole lifecycle. Goal and scope definition, inventory analysis, impact assessment, and interpretation are the four primary stages of a typical life cycle assessment. Organizations can prioritize improvement initiatives and identify environmental hotspots with this methodical approach (Yazdi et al., 2024).

SMEs benefit greatly from a "light" LCA approach since it streamlines the procedure while still offering insightful information. Organizations can concentrate on key indicators like energy consumption, carbon emissions, and material usage across major lifecycle stages rather than performing in-depth and resource-intensive analyses. According to research, even more straightforward evaluations can help improve sustainability decision-making, particularly in cloud-based and digital systems (Milić, 2024; Schneider & Mattia, 2024).

By applying life cycle assessment (LCA) principles to ICT systems, organizations can better understand trade-offs between various solutions, such as on-premise versus cloud infrastructure or device replacement versus refurbishment, as well as, SMEs can prioritize actions that maximize environmental benefits while preserving operational efficiency by identifying high-impact stages (Püchel et al., 2024).

Trainer Tip

SMEs do not need to conduct complex Life Cycle Assessments. A simplified lifecycle review focusing on energy use, device lifespan, repair opportunities, and end-of-life management is often sufficient to support better purchasing and management decisions.

13.3 Circular practices in digital assets

Circular economy principles seek to reduce waste and maximize resource efficiency by extending the useful life of goods and materials. This includes methods like recycling, refurbishing, reuse, and effective resource management when it comes to digital assets. According to research, reducing the environmental impact of ICT systems requires a shift from linear "take-make-dispose" models to circular approaches (Bocken et al., 2016; Yazdi et al., 2024).

Repairing and refurbishing digital devices to increase their lifespan is a crucial circular practice. This lessens the need to produce new hardware, which lowers emissions and resource extraction. Furthermore, effective e-waste management guarantees the recovery and reuse of valuable materials, promoting sustainable supply chains (Yazdi et al., 2024).

Optimizing resource utilization in cloud environments is another way to achieve circularity in digital infrastructures. The need for extra hardware and energy consumption is decreased by strategies like virtualization, workload consolidation, and effective data management. Research indicates that these methods, especially for SMEs using cloud-based solutions, support cost-effectiveness and environmental sustainability (Manikandan et al., 2024).

Practical Example

A company evaluates whether refurbished laptops can meet the needs of administrative staff while reserving new devices for specialised technical work. This reduces procurement costs, extends the use of existing resources, and supports circular economy principles without compromising operational performance.

Circular economy practices also contribute directly to reducing digital waste. Extending the lifespan of devices, improving asset management, reducing unnecessary hardware purchases, and responsibly managing obsolete equipment all support more sustainable digital resource use.

13.4 Lifecycle KPIs

Lifecycle Key Performance Indicators (KPIs) are essential tools for measuring and managing the environmental performance of ICT systems. These indicators provide quantifiable metrics that help organizations track progress, identify inefficiencies, and support data-driven decision-making. Common lifecycle KPIs include energy consumption, carbon footprint, hardware utilization rates, and e-waste generation (Milić, 2024).



Figure 6. The circular economy of digital devices (AI Elaboration)

In data centers and cloud environments, specific metrics such as Power Usage Effectiveness (PUE) and resource utilization rates are widely used to assess operational efficiency. Research on sustainable computing emphasizes that monitoring these indicators enables organizations to optimize performance while reducing environmental impact (Lin et al., 2024; Safari et al., 2025).

For circular economy practices, additional KPIs such as device lifespan, reuse rates, and recycling efficiency are important. These metrics help organizations evaluate how effectively they are implementing circular strategies and reducing waste. For SMEs, adopting a small set of relevant and easy-to-measure KPIs can provide significant insights without requiring complex monitoring systems (Püchel et al., 2024).

Key Takeaways

- ICT systems create environmental impacts throughout their lifecycle.
- Lifecycle thinking supports more informed technology decisions.
- Extending device lifetimes is one of the most effective circular economy strategies.
- Repair, refurbishment, and reuse reduce both costs and environmental impacts.

- Circular economy principles help reduce electronic and digital waste.
- Simple lifecycle KPIs enable SMEs to monitor continuous improvement.

Related Annexes:

- Annex C.13 Roadmap Template
- Annex C.14 Action Plan

Trainer Reflection Questions

1. Which lifecycle stage creates the greatest environmental impact for digital devices?
2. How can SMEs extend the useful life of ICT equipment?
3. What barriers exist to adopting refurbished or repaired devices?
4. Which circular economy practices are most realistic for your organisation?
5. Which lifecycle KPIs would be easiest to implement and monitor?
6. Which digital devices in your organisation could realistically remain in use for one or two additional years?

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14. Sustainable Business Models

Chapter Overview

Sustainability is increasingly becoming a strategic business issue rather than simply an environmental or compliance concern. Customers, investors, regulators, employees, and supply chain partners are placing growing expectations on organisations to demonstrate responsible and sustainable business practices. At the same time, digital technologies are transforming how value is created, delivered, and captured.

For SMEs, sustainable business models provide an opportunity to improve competitiveness, strengthen resilience, reduce costs, and respond to changing market demands. Digital sustainability can support this transition by enabling more efficient resource use, improving transparency, supporting circular economy practices, and creating new forms of customer value.

This chapter explores the relationship between sustainability and business value, examines how digital technologies support sustainable business models, and provides practical guidance for SMEs seeking to integrate sustainability into their strategy and operations.

Why This Chapter Matters

Sustainability is no longer only a compliance requirement or environmental commitment—it is becoming a source of business innovation and competitive advantage. This chapter helps trainers demonstrate how SMEs can redesign their business models by combining digital technologies with sustainability principles to create value for customers, improve operational efficiency, reduce digital waste, and strengthen long-term resilience.

14.1 Sustainability as value proposition

Sustainability is becoming a key component of business value propositions, particularly in digital and ICT-driven industries. A sustainability-oriented value proposition links organizational objectives with more general sustainability transitions by combining economic value with social and environmental benefits. According to research, sustainability and digital transformation are now closely related, with ICT systems being crucial in enabling low-carbon and resource-efficient business models (Charfeddine & Umlai, 2023; Ghobakhloo, 2020)

In this case, sustainability serves as both a differentiator in highly competitive markets and a requirement for compliance. Businesses can lower operating costs, increase productivity, and

improve brand reputation by incorporating sustainability into their value propositions. Research indicates that artificial intelligence (AI) and digital technologies can facilitate circular and sustainable production systems by optimizing resource utilization and cutting waste, thereby strengthening sustainability as a fundamental business value (Alsaadi et al., 2026).

This change is especially significant for SMEs since sustainability can be a tool for strategic positioning. Without requiring significant investment, even simple digital solutions like cloud services, automation tools, and AI-driven optimization can support sustainability-driven value creation (Fonseca et al., 2024).

Practical Example

A small software company reviews its subscription model and identifies opportunities to reduce unnecessary cloud storage, optimise AI usage, and improve digital service efficiency. These improvements lower operational costs while enabling the company to market its services as more sustainable and resource-efficient, creating additional value for environmentally conscious customers.

For many SMEs, integrating sustainability into the value proposition also supports Environmental, Social and Governance (ESG) objectives and Corporate Social Responsibility (CSR) commitments. Even when formal reporting is not required, demonstrating responsible digital practices can strengthen customer trust, improve brand reputation, and create new market opportunities.

14.2 ICT service SMEs

SMEs that provide ICT services work in a highly digitalized environment where efficiency, scalability, and service optimization are closely related to sustainability. These companies frequently use data-driven systems, cloud computing, and software-as-a-service (SaaS), which offer chances for both operational effectiveness and environmental improvement (Buyya et al., 2023).

According to research, ICT SMEs can greatly enhance their sustainability performance by implementing digital tools that minimize resource consumption, automate procedures, and optimize energy use. However, they frequently have to prioritize scalable and lightweight solutions over complicated infrastructure investments due to their limited financial and technical resources (Badghish & Soomro, 2024; Hussain & Rizwan, 2024)

Cloud-based service models are especially pertinent to SMEs because they enable flexible and scalable operations while reducing the need for physical infrastructure. Research indicates that when

cloud computing is managed effectively, workload optimization and virtualization techniques can enhance resource efficiency and lessen environmental impact (Manikandan et al., 2024).

Trainer Tip

Encourage ICT SMEs to view sustainability not only as an operational improvement but also as a market differentiator. Efficient cloud services, responsible AI, secure digital solutions, and transparent sustainability practices can become part of the organisation's competitive positioning.

14.3 Competitiveness and customer demands

Customers' growing demand for ecologically friendly goods and services has made sustainability a major factor in the ICT industry's competitiveness. Businesses that do not incorporate sustainability into their operations run the risk of losing market share to rivals with better environmental credentials. According to research, customer trust, purchasing decisions, and long-term business relationships are now significantly influenced by sustainability performance (Choon & ali, 2025).

Customers in digital markets are becoming more conscious of how cloud computing, AI systems, and data storage affect the environment. Demand for energy-efficient services, transparent carbon reporting, and ethical data practices has increased as a result. Research indicates that integrating sustainability strategies with digital transformation enhances customer satisfaction and operational performance, thereby boosting competitiveness (Püchel et al., 2024).

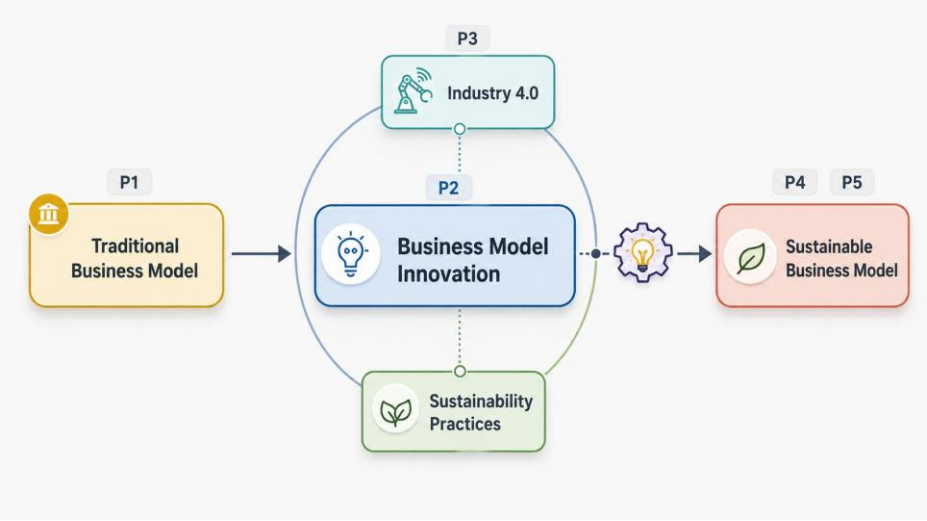

Figure 7. Conceptual framework (AI Elaboration)

Furthermore, business-to-business (B2B) ICT services are increasingly expected to take environmental, social, and governance (ESG) factors into account. SMEs can gain a competitive edge in markets that are becoming more and more focused on sustainability by differentiating themselves through the provision of greener digital services, reduced carbon footprints, and more effective solutions (Safari et al., 2025).

A digital marketing agency introduces internal guidelines for reducing unnecessary AI-generated content, optimising cloud storage, and managing digital assets more efficiently. These practices reduce operational costs while enabling the agency to demonstrate responsible digital practices to clients seeking sustainable suppliers.

14.4 Value proposition redesign exercise

Redesigning a value proposition for sustainability entails reconsidering how a business generates, provides, and obtains value while incorporating social and environmental factors. Simplified business model tools, like a sustainability-focused value proposition canvas, are frequently used to help organizations find inefficiencies and areas for improvement (Bocken et al., 2016).

Mapping current digital services and identifying environmental "hotspots," such as high energy consumption, inefficient data usage, or needless resource duplication, is usually the first step in this process for SMEs. Reducing digital waste and increasing data efficiency are important starting points for rethinking business models, according to research on digital sustainability (Manikandan et al., 2024; Utz, 2025).

Organizations then investigate how digital tools, like automation, artificial intelligence, and cloud optimization, can facilitate more sustainable service delivery. Research indicates that by increasing productivity, cutting waste, and facilitating circular processes throughout supply chains and services, generative AI and digital technologies can improve sustainability (Alsaadi et al., 2026; Bahaw et al., 2025).

Lastly, by incorporating sustainability outcomes like lower carbon emissions, increased energy efficiency, and longer lifecycle use of digital assets, SMEs redefine their value proposition. This ensures that value creation is balanced both economically and environmentally by bringing business competitiveness into line with sustainability goals (Fonseca et al., 2024).

Business Value Questions

Before redesigning a value proposition, ask:

- Which digital activities create the greatest value?
- Which activities create digital waste?
- Which resources are underutilised?
- How could AI improve efficiency?
- How could sustainability strengthen customer relationships?

Sustainable business models combine environmental responsibility with long-term business success. By redesigning value propositions, improving resource efficiency, reducing digital waste, and integrating responsible digital technologies, SMEs can strengthen competitiveness, build customer trust, and create measurable business and sustainability value.

Throughout this handbook, digital sustainability has been presented as more than an environmental objective. It is a practical business optimisation approach that helps SMEs reduce costs, improve efficiency, strengthen resilience, and create new sources of customer value. Sustainable business models bring together these concepts by integrating responsible digital practices into everyday business strategy.

Key Takeaways

- Sustainability creates business value beyond regulatory compliance.
- Digital technologies enable new sustainable business models and services.
- Sustainable value propositions strengthen competitiveness and customer trust.
- Digital waste reduction improves both operational efficiency and profitability.
- ESG and responsible digital practices increasingly influence customer and partner expectations.
- Sustainable business model innovation can begin with small, practical improvements.

Related Annexes:

- Annex C.1 Business Case Canvas
- Annex C.14 Action Plan

Trainer Reflection Questions

1. How can sustainability create competitive advantages for SMEs?
2. Which digital technologies could support sustainable business model innovation?
3. How might customer expectations change over the next decade?
4. Which sustainability-related opportunities are most relevant to your sector?
5. How can organisations integrate environmental and social value into their value propositions?
6. Which aspect of your current business model could create additional value through digital sustainability?

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Part 4 – Measurement & Governance

Parts 1–3 of this handbook introduced the foundations of digital sustainability, practical training approaches, and the core technical topics relevant to SMEs. Part 4 focuses on implementation. It helps trainers and consultants answer three practical questions:

- **How do we measure progress?**
- **Who is responsible?**
- **How do we sustain change over time?**

The chapters in this section provide practical guidance on measurement, governance, and continuous improvement. Each chapter is supported by ready-to-use quizzes, checklists, templates, and workshop materials that trainers can immediately apply when working with SMEs.

Together, these resources help transform digital sustainability from awareness into measurable, well-governed, and lasting organisational practice.

Annexes included in Part 4

Chapter 4.1 handouts (KPI Framework and Monitoring)

- 4.1.A — Two KPI quizzes with answer key & rationale
- 4.1.B — KPI Implementation Checklist
- 4.1.C — Template: One-page KPI Scorecard
- 4.1.D — Template: Per-indicator KPI Definition Sheet

Chapter 4.2 handouts (Governance and Role Definitions)

- 4.2.A — Two Governance quizzes with answer key & rationale
- 4.2.B — Governance Quick-Set Checklist
- 4.2.C — Template: RACI Matrix + Decision-rights table
- 4.2.D — Template: ICT Sustainability Policy + Steering Group Charter

Chapter 4.3 handouts (Change Implementation Planning)

- 4.3.A — Two Change Implementation quizzes with answer key & rationale
- 4.3.B — Change-Readiness Checklist (Diagnose / Pilot / Scale / Embed)
- 4.3.C — Template: 12-month Change Roadmap
- 4.3.D — Template: Pilot Plan + signed Exit-Decision

15. KPI Framework and Monitoring

15.1 Short introduction

Measurement is the bridge between ambition and accountability. SMEs face a paradox: they are responsible for around 99% of EU businesses and a significant share of indirect ICT-related emissions, yet the vast majority lack the time, data and expertise to track environmental and social performance of their digital operations (European Commission, 2023; OECD, 2021). A Key Performance Indicator (KPI) framework, when tailored to SME scale, can turn that constraint into an advantage: a few well-chosen indicators, monitored consistently, deliver more value than dashboards full of unread numbers.

This chapter offers VET trainers and consultants a workable structure for designing, deploying and reviewing an ICT-sustainability KPI system inside an SME. It draws on internationally recognised references – the ITU L.1410 and L.1420 methodologies, the ISO/IEC 30134 series on data-centre KPIs, the GHG Protocol ICT Sector Guidance, and the European Sustainability Reporting Standards (ESRS) under the CSRD – and translates them into language that fits a 0- to 250-person company (ITU-T, 2014; ISO/IEC, 2016; GHG Protocol, 2017; EFRAG, 2023).

Why This Chapter Matters

SMEs often want to improve digital sustainability but struggle to answer a simple question: *Are we making progress?* A practical KPI framework helps organisations measure results, prioritise actions, demonstrate business value, and support continuous improvement without creating unnecessary reporting burdens.

15.2 Building an SME-fit KPI framework

From principles to indicators

A KPI framework is built top-down from sustainability objectives, not bottom-up from data availability. Trainers should encourage SMEs to begin with three or four strategic outcomes – for example "reduce ICT-related electricity consumption", "extend hardware lifetime", "improve digital-skill resilience" – and then derive indicators that make each outcome measurable. The classic *SMART* criteria (Specific, Measurable, Achievable, Relevant, Time-bound) remain useful, but the D-GREEN approach adds two further filters: indicators must be *collectable* with existing SME

systems (invoices, MDM (Master Data Management) tools, HR records) and actionable by the team that owns them.

Four KPI domains

For coherence with European reporting practice and the CSRD/ESRS taxonomy, D-GREEN organises ICT-sustainability KPIs into four domains: **Environmental**, **Social**, **Economic-Operational**, and **Governance & Maturity**. The table below shows a minimum viable set – the "core 12" – that any SME can implement, plus advanced indicators for more mature companies.

Domain	Core KPIs (start here)	Advanced KPIs
Environmental	ICT electricity consumption (kWh/year); Scope 2 emissions from ICT (kg CO_2e); Average device age (years); Share of devices reused/refurbished (%); E-waste correctly recycled (%)	Power Usage Effectiveness (PUE) of on-premise rooms; Digital carbon intensity per employee (kg CO_2e/FTE); Cloud-provider renewable energy share (%); Data storage per FTE (GB)
Social	Staff trained on ICT sustainability (% of headcount); Accessibility compliance of digital workplace (% of systems); Reported digital-wellbeing incidents	Supplier code-of-conduct coverage (% of ICT spend); Conflict-mineral due-diligence score; Inclusion of digital-sustainability clauses in tenders
Economic-Operational	ICT total cost of ownership (TCO) per FTE; Energy cost per workstation (€/year); Cost avoided through device life-extension (€)	Avoided emissions from cloud migration (kg CO_2e); Productivity gain per digital-sustainability project (% or hours saved)
Governance & Maturity	Existence of ICT sustainability policy (yes/no); Frequency of management review (per year);	Internal audit coverage; CSRD-readiness score; Supplier sustainability assessment coverage

	D-GREEN maturity score (self-evaluation tool)	

Targets, baselines and benchmarks

A KPI without a target is a thermometer without a temperature: informative but inert. Trainers should help SMEs set a baseline year (usually the most recent full calendar year), define a target horizon aligned with the European Green Deal (2030 / 2050) and the Science Based Targets initiative for SMEs (SBTi, 2024), and choose between absolute targets (e.g. "−25% ICT kWh by 2028") and intensity targets (e.g. "kg CO2e per €1,000 turnover"). Where benchmarks exist – such as average PUE (Power Usage Effectiveness) values published by the Uptime Institute or sector averages from the JRC's ICT-Footprint methodology – they should be used as context, not as fixed obligations.

Trainer Tip

Encourage SMEs to start with a small number of meaningful KPIs. Four to eight well-managed indicators usually create more value than a large dashboard that is rarely reviewed.

15.3 Monitoring routines that survive in an SME

Data sources and frequency

Most SMEs already produce the raw data needed; the challenge is to make collection routine. Electricity invoices give annual and monthly Scope 2 inputs; asset-management or MDM platforms supply device age and reuse data; HR systems hold training records; finance systems hold ICT TCO. A monthly five-minute "data check" by the ICT or Operations lead, plus a quarterly review by the management team, is usually sufficient for the core set. Advanced KPIs may require automated metering, supplier surveys or specialised software, and should only be introduced once core monitoring is stable.

From dashboard to decision

Indicators only create value when they trigger decisions. The D-GREEN monitoring loop follows four steps – *collect, compare, communicate, correct*. Data is collected by a named owner (see Chapter 4.2 on roles), compared against baseline and target, communicated to management in a short standardised format (a one-page scorecard works well for SMEs), and used to commission corrective actions. The Plan-Do-Check-Act cycle of ISO 14001 fits this logic and is familiar to SMEs that already hold quality certifications (ISO, 2015).

Visualisation and reporting

For internal use, simple colour-coded scorecards (green/amber/red versus target) outperform complex dashboards. For external reporting – important as CSRD (Corporate Sustainability Reporting Directive) obligations cascade into SME value chains via large customers – trainers should familiarise consultants with the ESRS (European Sustainability Reporting Standards) E1 (climate change), E5 (resources and circular economy), S1 (own workforce) and G1 (business conduct) datapoints most relevant to ICT (EFRAG, 2023). Even non-listed SMEs increasingly receive sustainability questionnaires from clients; a tidy KPI framework drastically reduces the cost of responding.

Common pitfalls

Five recurrent mistakes deserve explicit attention in training: (1) measuring everything and acting on nothing; (2) confusing activity indicators ("number of trainings delivered") with outcome indicators ("share of trained staff applying knowledge"); (3) ignoring Scope 3 / supply-chain ICT emissions, which dominate the footprint of most service SMEs; (4) using vendor-supplied metrics uncritically (especially cloud-provider carbon dashboards, whose methodologies differ widely); and (5) treating measurement as a compliance ritual rather than a management tool (Mytton, 2020; Freitag et al., 2021).

15.3.1 Practical relevance for trainers and consultants

For VET trainers, KPI literacy is the single most leveraged competence to develop in SME participants. A workshop on KPIs should not become an accounting class: it should be a guided design session in which participants choose their own "core 12", identify the data owner for each, and draft their first one-page scorecard. The accompanying handouts to this chapter (Handout 4.1.A quizzes, 4.1.B checklist and 4.1.C/D templates) are designed precisely for this purpose: a 90- to 120-minute working session can produce a ready-to-use draft KPI system.

Consultants supporting SMEs should resist the temptation to import enterprise-grade frameworks. The reference methodologies (ITU L.1420, GHG Protocol, ISO 14064-1) are scientifically rigorous

but heavy for a 30-person company; their role is to *inform* the SME framework, not to dictate it. The D-GREEN self-evaluation tool (Project Result 4) serves as the entry point for any KPI conversation with SMEs.

Practical Example

An SME assigns responsibility for monitoring ICT electricity consumption to the Operations Manager, device lifecycle data to the IT administrator, and staff training records to HR. Once every quarter, the management team reviews a one-page KPI scorecard and agrees on two or three improvement actions for the following quarter.

15.3.2 Key takeaways

- Build the framework top-down from 3–4 strategic outcomes, not from available data.
- Cover four domains – Environmental, Social, Economic-Operational, Governance & Maturity – with a SME-fit indicator set .
- Pair every indicator with a baseline, a target, an owner and a frequency.
- Run a simple collect–compare–communicate–correct loop monthly and quarterly.
- Use external standards (ITU, ISO, GHG Protocol, ESRS) as references, not as templates.
- Visualise progress on one page; report externally using ESRS-aligned datapoints when required.

Related Annexes:

- Annex B.5 D-GREEN Digital Sustainability Maturity Self-Assessment Questionnaire
- Annex G.2 KPI Implementation Checklist
- Annex G.3 One-page KPI Scorecard
- Annex G.4 KPI Definition Sheet

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16. Governance and Role Definitions

16.1 Short overview

A KPI framework without governance is a map without a driver. The most carefully designed indicator set will deliver no change if responsibilities are diffuse, decision rights unclear or top management uninvolved. This chapter equips trainers and consultants with a pragmatic governance model that respects SME realities – flat hierarchies, limited dedicated headcount, and decision-makers who already wear several hats – while still meeting the substantive requirements of emerging European regulation (CSRD/ESRS G1, Corporate Sustainability Due Diligence Directive, NIS2 where applicable).

The guiding principle is *proportionate clarity*: every key activity has one named owner, decisions follow a known path, and the model is documented in one or two pages – not in an internal-audit manual. The chapter follows three layers: strategic (board / owner-manager), tactical (a small ICT sustainability team or committee), and operational (line roles).

Why This Matters

Many digital sustainability initiatives fail not because organisations lack good ideas, but because responsibilities are unclear. Defining governance roles helps SMEs turn plans into action by ensuring that people know who is responsible, who makes decisions, and how progress is monitored.

16.2 Three governance layers for SMEs

Strategic layer – ownership and direction

Top management commitment is the single strongest predictor of sustainability programme success in SMEs (OECD, 2021; ILO, 2022). In practice, this means the owner-manager, CEO or managing director must (a) formally adopt an ICT-sustainability policy, (b) approve targets and budget, and (c) review performance at least once a year. In micro-enterprises this can be a one-page signed charter; in medium-sized companies it should sit alongside the quality, health-and-safety and information-security policies, ideally integrated into an existing management system rather than created as a parallel structure.

Tactical layer – the ICT sustainability lead and steering group

The main role is the **ICT Sustainability Lead** (sometimes called Digital Sustainability Coordinator). In SMEs this is rarely a full-time job: it is typically attached to an existing role such as IT Manager, Operations Manager, HSE Manager or Quality Manager. The Lead is the single accountable person for the KPI framework defined in Chapter 4.1, for liaison with suppliers and customers, and for reporting upward. A small **Steering Group**– three to six people, meeting quarterly – provides cross-functional input from IT, Operations, Procurement, HR/Training and Finance. Top management chairs or sponsors the group.

Operational layer – distributed responsibilities

Day-to-day actions are distributed across line functions:

- **IT / Operations:** hardware lifecycle, energy efficiency of infrastructure, cloud-contract management, data-storage hygiene.
- **Procurement:** green ICT criteria in tenders, supplier sustainability questionnaires, end-of-life disposal contracts.
- **Finance:** ICT TCO data, energy-cost tracking, support for Scope 2 calculations.
- **HR / Training:** digital-skills programmes, accessibility, digital wellbeing, integration of sustainability into onboarding.
- **Line managers:** enforce policies inside their teams, escalate issues, model behaviours.
- **All employees:** follow the digital-sustainability code of practice (printing, video, storage, device care).

For most SMEs, governance does not require creating new positions. In many cases, digital sustainability responsibilities can be integrated into existing management roles and supported through regular cross-functional collaboration.

16.3 RACI in practice

A lightweight RACI matrix (Responsible, Accountable, Consulted, Informed) is the most useful single tool to disambiguate roles in an SME. Trainers should resist over-engineering it – a one-page RACI covering 10–15 key activities is enough. The example below illustrates how the layers interact for typical ICT-sustainability activities.

Activity	Top Mgmt	ICT Sust. Lead	IT Operators	Procu-rement	HR / Training	Finance
Approve ICT sustainability policy	A	R	C	C	C	I
Define and update the KPI set	A	R	C	C	C	C
Monthly KPI data collection	I	A	R	R	R	R
Quarterly KPI review meeting	A/C	R	C	C	C	C
Procure ICT hardware / cloud services	I	C	C	R/A	I	C
Manage end-of-life ICT	I	A	R	R	I	C

equipment						
Deliver staff training on sustainability	I	C	I	I	R/A	I
Respond to client sustainability questionnaires	I	R/A	C	C	C	C
Annual management review	A	R	C	C	C	C

Legend: R = Responsible (does the work); A = Accountable (single point of decision); C = Consulted; I = Informed.

Trainer Tip

Start with a simple RACI covering the most important 10–15 activities. Additional responsibilities can be added as organisational maturity increases.

16.4 Policy, charter and decision rights

The minimum documented set

Even small companies benefit from three short documents: an **ICT Sustainability Policy** (one page, signed by top management, restating commitment, scope and priorities); a **Steering Group Charter** (one page, naming members, frequency, decision rights, escalation path); and a **Code of Practice for**

Employees (one to two pages, in plain language). These are not bureaucratic overhead: in audits and supplier assessments they materially reduce the time required to demonstrate due diligence.

Decision rights and escalation

Trainers should ensure SME participants are explicit about *who can decide what, up to what value, and what happens when limits are exceeded.* A typical SME pattern: the ICT Sustainability Lead can approve operational changes and supplier-questionnaire responses; investment decisions above a defined threshold (e.g. €5,000) escalate to the management team; changes affecting customers or external commitments escalate to top management. Documenting the threshold removes the most common cause of stalled green-IT projects: ambiguity about who can say "yes".

Aligning with existing management systems

Where the SME already operates an ISO 9001, ISO 14001 or ISO/IEC 27001 system, the most efficient route is to *integrate* rather than duplicate: extend existing risk registers, internal audit plans and management reviews to cover ICT sustainability objectives (ISO, 2015, 2022). This integrated approach is also explicitly favoured by ESRS G1 (Business Conduct), which expects governance arrangements to be coherent across topics.

Practical Example

A manufacturing SME appoints its Operations Manager as ICT Sustainability Lead. Quarterly meetings are added to existing management meetings, where energy use, device replacement, cybersecurity, and digital waste indicators are reviewed. Procurement follows agreed sustainability criteria when purchasing new equipment, while HR includes digital sustainability in employee onboarding.

16.5 Practical relevance for trainers and consultants

A frequent pitfall in SME engagements is to discuss strategy and KPIs at length while leaving governance implicit. Experience from Erasmus+ green-digital projects shows that one hour spent producing a named ICT Sustainability Lead, a RACI on a single page and a one-page steering group charter delivers more durable change than a full day of theoretical training. Trainers should therefore include a governance-design block in every multi-day course, supported by Handout 4.2.B (Governance Quick-Set Checklist) and Handout 4.2.C (RACI Template) accompanying this chapter.

Consultants should be alert to two recurring symptoms of weak governance: (1) decisions being repeatedly re-opened because no one is formally accountable; and (2) sustainability KPIs reported to no one in particular, with no review meeting in the calendar. Both are addressed by the layered model described above.

Governance should be viewed as an enabler rather than an administrative requirement. Clear responsibilities improve communication, accelerate decision-making, strengthen accountability, and help SMEs sustain digital sustainability initiatives over time.

Key takeaways

- Governance follows three layers: strategic (top management), tactical (Lead + Steering Group), operational (line functions).
- Always name one accountable ICT Sustainability Lead – ideally attached to an existing role.
- Use a one-page RACI to clarify who does what for 10–15 key activities.
- Produce three short documents: policy, steering group charter, employee code of practice.
- Define decision-right thresholds explicitly to avoid stalled projects.
- Integrate with existing ISO management systems wherever possible.
- Good governance supports continuous improvement, not only compliance.

Related Annexes:

- Annex G.6 Governance Quick-Set Checklist
- Annex G.7 RACI Matrix
- Annex G.8 ICT Sustainability Policy & Steering Group Charter

Trainer Reflection Questions

1. Who should take overall responsibility for digital sustainability in an SME?
2. Which departments should be involved in governance decisions?
3. How can governance responsibilities be integrated into existing organisational roles?
4. Which governance documents would be most valuable for the SMEs you support?

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17 Change Implementation Planning

17.1 Short introduction

KPIs and governance create the conditions for change; an implementation plan delivers it. SMEs rarely have the capacity to run formal change-management programmes, but they consistently benefit from a lightweight, phased roadmap that turns the ambition of digital sustainability into sequenced, owned actions.

Why This Matters

Many improvement initiatives fail not because the proposed solutions are ineffective, but because implementation loses momentum after the initial training. A structured implementation plan helps SMEs prioritise actions, assign responsibilities, monitor progress, and embed new practices into everyday operations.

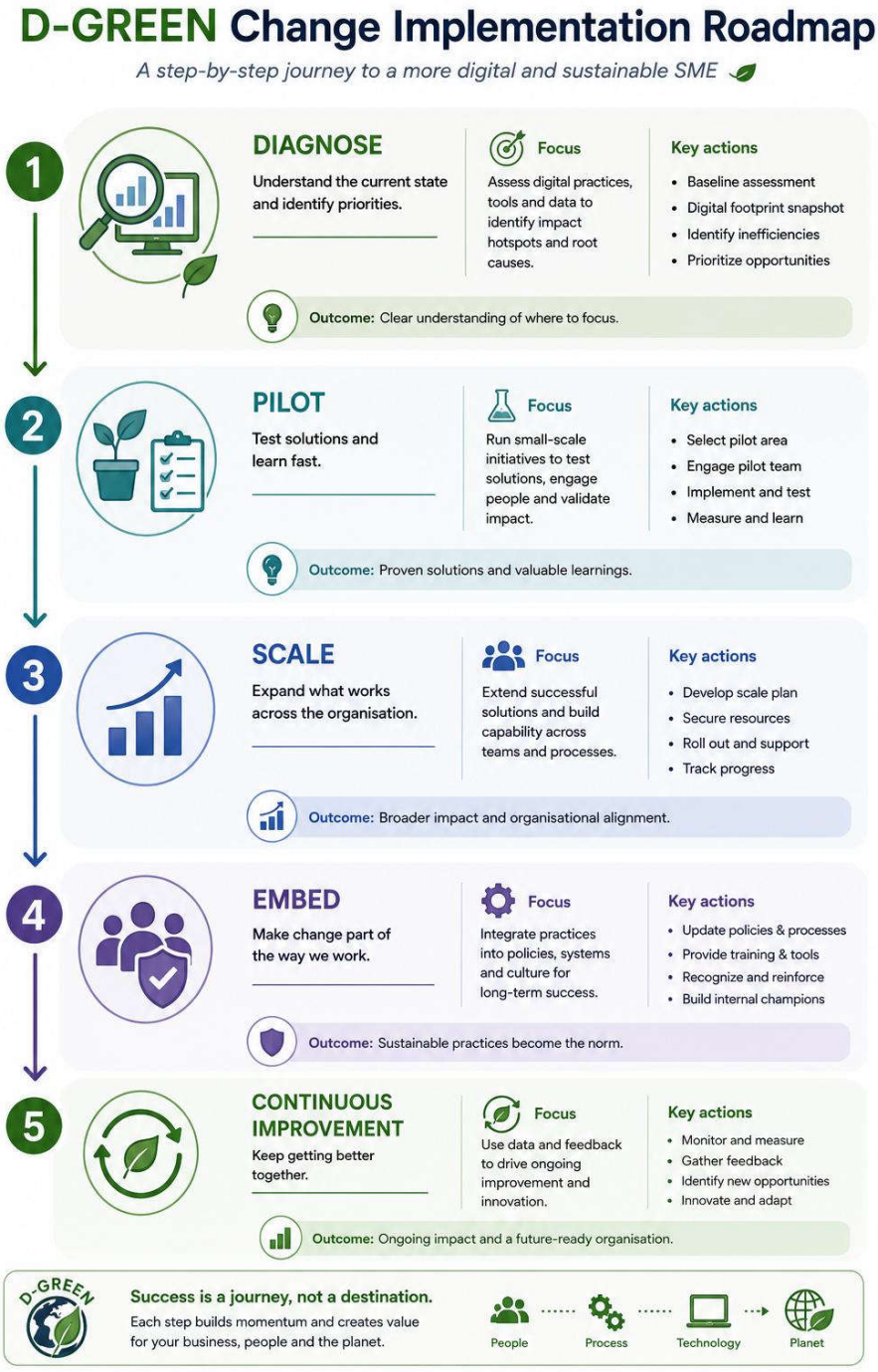

Figure 17.1 D-GREEN Change Implementation Roadmap

17.2 A four-phase SME roadmap

D-GREEN recommends a compact four-phase sequence: **Diagnose – Pilot – Scale – Embed**. The *Diagnose* phase (typically one month) uses the D-GREEN self-evaluation tool plus a short interview round to establish the baseline KPIs and identify two or three high-value, low-effort interventions. The *Pilot* phase (two to three months) implements those interventions in one department or process, with weekly check-ins and a defined exit decision. The *Scale* phase (three to six months) extends successful pilots company-wide, formalises governance and updates the KPI scorecard. The *Embed* phase (continuous) integrates indicators into the annual management review, training calendar and supplier-management cycles. The duration of each phase may vary depending on the size, maturity, and priorities of the SME. The roadmap should therefore be viewed as a flexible guide rather than a fixed project plan.

17.3 Communication and engagement

Change adoption in SMEs depends less on formal communication channels and more on visible leadership and peer influence. Trainers should encourage SMEs to (a) launch publicly via a short all-staff meeting with the owner-manager, (b) celebrate quick wins within the first 90 days, (c) name internal "ambassadors" beyond the ICT team, and (d) loop external stakeholders (clients, suppliers) into milestone communications. The ADKAR model (Awareness, Desire, Knowledge, Ability, Reinforcement) is a useful self-check for trainers designing the engagement plan (Hiatt, 2006). Communication should be continuous rather than limited to the launch of the initiative. Regular updates, recognition of achievements, and visible management support help reinforce new behaviours and maintain engagement over time.

17.4 Example Assessment Matrix

Assessment should measure not only knowledge acquisition but also participants' ability to apply sustainable ICT practices in real-world SME environments.

Learning Outcome	Suggested Assessment Method
Understand digital sustainability concepts	Quiz or knowledge test
Identify digital waste sources	Individual analysis exercise
Evaluate SME digital sustainability performance	Self-assessment activity
Develop improvement actions	Group assignment
Create a digital sustainability action plan	Final project

Digital sustainability is not achieved through a single project or training session. It is built through continuous learning, responsible leadership, practical action, and regular improvement. By combining measurement, governance, and structured implementation, SMEs can transform digital sustainability from an abstract concept into everyday business practice that creates value for organisations, people, and the environment.

Trainer Tip

Combine formative and summative assessment methods to capture both learning progress and practical application.

Practical Example

An SME begins by piloting digital clean-up activities within its finance department. After three months, storage requirements decrease, duplicate files are removed, and employees report faster access to information. Based on these results, the organisation extends the approach to all departments and integrates digital sustainability into annual planning and staff onboarding.

Key takeaways

- Follow a compact Diagnose – Pilot – Scale – Embed sequence.
- Pilot small, measure tightly, decide explicitly before scaling.
- Combine visible leadership with peer "ambassadors" to drive adoption.
- Anchor the change inside existing review cycles, not as a parallel programme.

- Successful implementation depends on continuous communication and employee engagement.
- Continuous improvement should become part of normal business operations rather than a separate sustainability project.

Trainer Reflection

1. Which phase of the implementation roadmap is likely to be most challenging for the SMEs you support?
2. How can you help SMEs maintain momentum after the initial training?
3. Which quick wins could demonstrate early business value?
4. Who should act as implementation champions within the organisation?
5. How will you know that digital sustainability has become part of everyday practice?

Related Annexes:

- Annex B.5 D-GREEN Digital Sustainability Maturity Self-Assessment Questionnaire
- Annex G.10 Change-Readiness Checklist
- Annex G.11 12-Month Change Roadmap
- Annex G.12 Pilot Plan & Exit Decision
- Annex C.14 Digital Sustainability Action Plan

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PART 5 — CASE LIBRARY & TRAINER MATERIALS

Chapter Overview

The purpose of this part is to support trainers, consultants, and SME advisors in translating digital sustainability concepts into practical action. While Parts 1–4 introduced the foundations, methodologies, sustainability topics, governance structures, and implementation approaches, Part 5 provides concrete examples and ready-to-use training materials that can be directly applied in workshops, coaching sessions, and SME development programmes.

The case library illustrates how SMEs can address common digital sustainability challenges, while the trainer materials provide practical exercises, reflection tools, and facilitation resources that support learning and organisational change.

18. SME Case Library

18.1 How to Use the Case Library

The cases presented in this chapter are illustrative learning scenarios rather than reports of specific organisations. They have been developed by the D-GREEN project team by combining common SME digital sustainability challenges, practices, and improvement opportunities addressed throughout the Handbook and its supporting evidence base. The organisations, situations, and outcomes presented in these cases are illustrative and are intended to support training, discussion, and action planning. They should not be interpreted as documented or measured results from specific companies.

Trainers may use them as:

- discussion starters;
- workshop exercises;
- group assignments;
- scenario analysis activities;
- action-planning examples.

Each case demonstrates how digital sustainability principles discussed throughout the handbook can be translated into practical actions within SMEs.

18.2 Case 1 – Reducing Digital Waste in a Small Service Company

Context

A small consultancy employing 15 people relied heavily on cloud storage and collaborative digital platforms. Over time, the organisation accumulated large volumes of duplicated files, outdated documents, and unused data.

Challenge

The company experienced:

- increasing cloud storage costs;
- difficulties locating current documents;
- duplicated information;
- lack of data-retention practices.

Actions

The company:

- conducted a digital storage audit;
- introduced data-retention rules;
- archived inactive documents;
- removed duplicate files;
- established ownership for shared folders.

Results

Potential Outcomes

- Possible outcomes of these actions may include:
- reduced cloud storage volume;
- improved information retrieval;

- lower storage costs;
- clearer data governance practices.

Related Handbook Chapters

- Chapter 9 – Green IT and Energy Efficiency
- Chapter 10 – Digital Tools for Sustainability
- Chapter 12 – Cybersecurity and Data Ethics

18.3 Case 2 – Energy-Efficient Cloud Management

Context

A growing software company increasingly relied on cloud infrastructure for service delivery.

Challenge

Energy consumption and cloud-service costs increased significantly as workloads expanded.

Actions

The organisation:

- reviewed server utilisation;
- consolidated workloads;
- removed inactive virtual machines;
- implemented monitoring dashboards;
- introduced cloud optimisation practices.

Potential Outcomes

- Possible outcomes of these actions may include:
- improved resource utilisation;
- lower operational costs;
- reduced energy demand associated with cloud services;
- better visibility into digital resource consumption.

Related Handbook Chapters

- Chapter 9 – Green IT and Energy Efficiency
- Chapter 15 – KPI Framework and Monitoring

18.4 Case 3 – Responsible AI Adoption in an SME

Context

A marketing agency introduced AI tools to support content development, customer communication, and internal administration.

Challenge

Employees used multiple AI systems without guidance, creating concerns related to data quality, privacy, and resource efficiency.

Actions

The company:

- developed an internal AI-use policy;
- established guidance for prompt design;
- defined acceptable data-use practices;
- trained employees on responsible AI use.

Potential Outcomes

- Possible outcomes of these actions may include:
- improved consistency in AI-supported work;
- reduced duplication of work;
- stronger data-protection practices;
- increased employee confidence in responsible AI use.

Related Handbook Chapters

- Chapter 11 – AI for Sustainability
- Chapter 12 – Cybersecurity and Data Ethics

18.5 Case 4 – Circular ICT Procurement

Context

A medium-sized service company replaced digital devices every three years regardless of actual condition.

Challenge

The organisation generated increasing amounts of electronic waste and faced rising procurement costs.

Actions

The company:

- extended device replacement cycles;
- introduced refurbishment options;
- improved maintenance procedures;
- incorporated sustainability criteria into procurement decisions.

Potential Outcomes

- Possible outcomes of these actions may include:
- longer device lifespans;
- lower procurement costs;
- reduced e-waste generation;
- increased employee awareness of circular ICT practices.

Related Handbook Chapters

- Chapter 13 – Circular Economy and Lifecycle Thinking
- Chapter 14 – Sustainable Business Models

18.6 Case 5 – Improving Data Management and Reducing Information Overload

Context

A medium-sized consulting company with 40 employees used multiple digital platforms for document management, communication, and project collaboration. Over several years, information became scattered across email systems, cloud storage, local drives, and collaboration platforms.

Challenge

Employees frequently experienced:

- difficulties finding current versions of documents;
- duplication of files across different systems;
- excessive storage of outdated information;
- reduced productivity due to information overload.

Actions

The organisation:

- conducted an internal data management review;
- established document ownership responsibilities;
- created file naming conventions;
- introduced document retention and archiving procedures;
- trained employees on information management practices.

Potential Outcomes

Possible outcomes of these actions may include:

- fewer duplicate files;
- faster and more reliable document retrieval;
- reduced storage requirements;
- improved efficiency and collaboration.

Related Handbook Chapters

- Chapter 10 – Digital Tools for Sustainability
- Chapter 12 – Cybersecurity and Data Ethics
- Chapter 15 – KPI Framework and Monitoring

18.7 Case 6 – Sustainable Digital Collaboration in a Hybrid Workplace

Context

A small professional services company adopted hybrid working arrangements following organisational changes. Employees increasingly relied on video conferencing, messaging platforms, shared documents, and cloud-based collaboration tools.

Challenge

The company observed:

- duplicated communication channels;
- unnecessary online meetings;
- excessive file sharing and storage;
- inconsistent use of collaboration tools.

Actions

The organisation:

- mapped existing collaboration practices;
- established digital collaboration guidelines;
- reduced unnecessary meetings;
- standardised communication platforms;
- introduced shared workspace governance rules.

Potential Outcomes

- Possible outcomes of these actions may include:
- more efficient communication;
- reduced duplication of information flows;
- improved employee experience;
- reduced unnecessary digital resource consumption.

Related Handbook Chapters

- Chapter 10 – Digital Tools for Sustainability
- Chapter 14 – Sustainable Business Models
- Chapter 16 – Governance and Change Management

18.8 Case 7 – Digital Sustainability through Website Optimisation

Context

A small e-commerce business relied heavily on its website and digital marketing activities to attract customers and generate sales.

Challenge

Website performance analysis revealed:

- slow loading times;
- excessive image sizes;
- unnecessary plugins and scripts;
- increasing hosting costs.

Actions

The company:

- optimised images and multimedia content;
- removed unnecessary website functions;
- improved code efficiency;
- reduced data transfer requirements;
- implemented website performance monitoring.

Potential Outcomes

Possible outcomes of these actions may include:

- faster website loading times;
- reduced hosting requirements;
- improved user experience;
- reduced digital resource consumption.

Related Handbook Chapters

- Chapter 9 – Green IT and Energy Efficiency
- Chapter 10 – Digital Tools for Sustainability
- Chapter 14 – Sustainable Business Models

18.9 Case 8 – Building Employee Awareness for Digital Sustainability

Context

A growing SME recognised that many sustainability challenges originated from everyday digital behaviours rather than technology itself.

Challenge

Employees demonstrated:

- low awareness of digital sustainability impacts;
- inconsistent device management practices;
- excessive data storage;
- limited understanding of digital waste.

Actions

The organisation:

- launched an internal digital sustainability awareness programme;
- organised workshops and training sessions;
- introduced simple behavioural guidelines;
- established sustainability champions within teams;
- communicated progress through internal reporting.

Potential Outcomes

Possible outcomes of these actions may include:

- increased employee awareness of digital sustainability;
- improved digital housekeeping practices;
- reduced unnecessary data storage;
- stronger integration of digital sustainability into everyday operations.

Related Handbook Chapters

- Chapter 2 – Digital Sustainability for SMEs
- Chapter 8 – Facilitation, Engagement and Change Management
- Chapter 16 – Governance and Role Definitions
- Chapter 17 – Change Implementation Planning

18.10 Lessons Illustrated Across Cases

Although the illustrative cases represent different sectors, organisational sizes, and digital sustainability challenges, they highlight several recurring factors that can support successful implementation.

Effective digital sustainability initiatives can begin with understanding current digital practices and identifying priority areas for improvement. Small, practical actions can create meaningful benefits when implemented consistently over time. Management support, clear ownership, employee engagement, and continuous monitoring can further strengthen implementation.

The cases also illustrate that digital sustainability can create value beyond environmental performance. **Potential benefits include improved operational efficiency, better information management, reduced costs, stronger employee engagement, improved risk management, and greater organisational resilience.**

Digital sustainability is not only a technology issue. It involves people, processes, governance, and technology working together to create more efficient and responsible digital practices.

The scenarios further illustrate the value of linking digital sustainability initiatives to business priorities and integrating them into everyday organisational activities rather than treating them as standalone environmental projects.

These examples are intended to support discussion and action planning. Actual outcomes will depend on the organisation, its starting point, the actions implemented, and how progress is monitored and measured.

19. ANNEXES – TRAINER TOOLKIT AND PRACTICAL RESOURCES

The following annexes provide practical tools, worksheets, reflection exercises, planning templates and learning resources that support trainers in designing and delivering digital sustainability training for SMEs.

The annexes are modular and may be used independently or combined according to the needs, maturity level and learning objectives of participating SMEs.

Purpose and Use of the Trainer Toolkit

The D-GREEN Trainer Toolkit provides a collection of practical exercises, worksheets, facilitation tools, and planning templates that support the delivery of digital sustainability training for SMEs.
The toolkit is designed to help trainers:

- introduce digital sustainability concepts;
- facilitate reflection and discussion;
- assess organisational readiness;
- identify opportunities and risks;
- support action planning and implementation;
- strengthen information governance practices;
- improve digital resource management;
- adapt learning to different SME roles and maturity levels.

The materials can be used in workshops, mentoring sessions, training programmes, organisational assessments, and follow-up activities.
Trainers are encouraged to select the most relevant tools according to the learning objectives, sector, and maturity level of participating SMEs.

19.1 Reflection and Awareness Tools

These exercises help participants connect sustainability and digitalisation concepts to their own organisational context and stimulate discussion.

Included resources:

- Understanding Sustainability and Digitalisation Worksheet
- Future Vision Exercise (Looking Towards 2030)
- Role-Based Discussion Cards

These tools support awareness-building, strategic reflection, and stakeholder engagement.
Detailed versions are provided in Annex A.

19.2 Assessment and Analysis Tools

These materials help organisations analyse their current situation and identify opportunities for improvement.

Included resources:

- Systems Thinking Exercise
- Opportunity Assessment
- Risk Assessment
- Skills and Capability Mapping Tool
- Digital Sustainability Maturity Self-Assessment Questionnaire,

The exercises support systems thinking, organisational assessment, and prioritisation of sustainability actions.
Detailed versions are provided in Annex B.

19.3 Digital Information and Business Systems Tools

Many digital sustainability challenges originate from everyday information management practices rather than ICT infrastructure alone. These tools help SMEs improve information governance, reduce digital waste, and strengthen operational efficiency.

Included Resources

- Email Cleanup Toolkit
- Shared Drive Cleanup Toolkit
- ERP Data Quality Checklist
- CRM Cleanup Toolkit
- Social Media Asset Management Checklist
- Teams and SharePoint Governance Checklist
- Digital Records Retention Policy Template

These tools support sustainable information management, improved data quality, cybersecurity, collaboration governance, and digital waste reduction.

Detailed versions are provided in Annex C.

19.4 Planning and Implementation Tools

The following tools support action planning, implementation, monitoring, and continuous improvement.

Included Resources

- Sustainability Business Case Canvas
- Quick Design Check
- Scoping and Baseline Intake Tool
- Digital Footprint Snapshot
- Email Cleanup Toolkit
- Shared Drive Cleanup Toolkit
- ERP Data Quality Checklist
- CRM Cleanup Toolkit
- Social Media Asset Management Checklist
- Teams and SharePoint Governance Checklist
- Digital Records Retention Policy Template
- Digital Sustainability KPI Worksheet
- Digital Sustainability Roadmap Template
- Digital Sustainability Action Plan

These resources help organisations move from assessment to implementation and measurable results.
Detailed versions are provided in Annex C.

19.5 Persona-Based Training Resources

The Persona-Based Training Pathways support adaptation of training to different SME roles, responsibilities, and learning needs.

Included Personas

- SME Owner or Managing Director
- Operations Manager
- ICT Manager or Digital Lead
- Marketing and Communication Specialist
- HR and Learning Coordinator
- Sustainability Coordinator
- Administrative and Support Staff

The pathways help trainers select appropriate content, examples, exercises, and implementation activities.
Detailed guidance is provided in Annex E.

19.6 Additional Learning Resources

To support further learning, the toolkit includes a curated collection of external resources covering:

- Planetary Boundaries and global sustainability challenges;
- Climate change and Earth system resilience;
- Digital sustainability and Green ICT;
- Circular economy and lifecycle thinking;
- Sustainable business transformation;
- Artificial intelligence and responsible digitalisation;
- SME sustainability and innovation;

- Digital Cleanup and digital waste reduction initiatives.

These resources can be used as preparation materials, supplementary reading, workshop inputs, or post-training learning activities.

Additional videos, readings, tools, and learning resources are provided in Annex F.

Trainer Guidance

Not all exercises need to be used within every training programme. Trainers should select activities according to:

- organisational size;
- sector context;
- digital maturity level;
- participant roles;
- available training time;
- desired learning outcomes.

As a general principle, it is recommended to combine:

- one reflection activity;
- one assessment activity;
- one implementation-planning activity.

For organisations with more advanced digital maturity, trainers may additionally include:

- one governance activity;
- one digital waste or information management activity;
- one KPI or monitoring activity.

This combination helps participants move from awareness to analysis, implementation, and continuous improvement.

The toolkit is intended to be flexible. Trainers are encouraged to adapt exercises, combine tools, and contextualise examples to ensure relevance for participating SMEs.

ANNEX STRUCTURE

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Annex G

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G.2 — KPI Implementation Checklist
G.3 — Template: One-page KPI Scorecard
G.4 — Template: Per-indicator KPI Definition Sheet
G.5 — Two Governance quizzes with answer key & rationale
G.6 — Governance Quick-Set Checklist
G.7 — Template: RACI Matrix + Decision-rights table
G.8 — Template: ICT Sustainability Policy + Steering Group Charter

Chapter 4.3 handouts (Change Implementation Planning)
G.9 — Two Change Implementation quizzes with answer key & rationale
G.10 — Change-Readiness Checklist (Diagnose / Pilot / Scale / Embed)
G.11 — Template: 12-month Change Roadmap
G.12 — Template: Pilot Plan + signed Exit-Decision

ANNEX A – Reflection and Awareness Tools

A.1 Understanding Sustainability and Digitalisation Worksheet

Purpose

Help SME participants connect global sustainability challenges to their own business context.

Individual Reflection (10 min)

Which sustainability challenges are most relevant to your organisation?

1. Climate change
2. Resource scarcity
3. Biodiversity loss
4. Energy costs
5. Supply chain disruptions
6. Other

How do these challenges affect:

1. your customers?
2. your suppliers?
3. your costs?
4. your competitiveness?

Which of these challenges are likely to become more important during the next 5–10 years?

Group Discussion (15 min)

Discuss:

- Which risks create the greatest uncertainty?
- Which opportunities emerge from sustainability transitions?
- What surprised you during the discussion?

A.2 Future Vision Exercise

Looking Towards 2030

Imagine your organisation in 2030.

Describe:

1. technologies used;
2. customer expectations;
3. sustainability performance;
4. competitive position;
5. organisational culture.

Reflection

What actions should begin today to move towards this vision?

Trainer Tip

Not all questions need to be used in every training session. Select the exercises most relevant to the maturity level, sector, and learning objectives of the SME group. Start with business relevance and practical challenges before moving to broader sustainability concepts.

A.3 Role-Based Discussion Cards

Purpose

This activity helps participants explore digital sustainability challenges from different organisational perspectives. By adopting specific roles, participants gain a better understanding of how priorities, responsibilities and decision-making influence sustainability outcomes within SMEs.

Instructions for Trainers

1. Divide participants into small groups.
2. Assign one discussion card to each participant or group.
3. Present a sustainability challenge, scenario or case study.
4. Ask participants to discuss the issue from the perspective of their assigned role.

5. Facilitate a plenary discussion comparing different viewpoints.

Suggested duration: 15–30 minutes.

Card 1 – SME Owner-Manager

Your Role

You are responsible for the overall performance, competitiveness and long-term sustainability of the business.

Key Questions

- How does this issue affect profitability?
- What business risks could arise if no action is taken?
- Which actions offer the best return on investment?
- How could sustainability strengthen competitiveness?
- Which improvements are realistic within current resources?

Card 2 – ICT / Digital Lead

Your Role

You are responsible for digital systems, infrastructure and technology decisions.

Key Questions

- Which digital systems contribute most to this issue?
- Where are the greatest inefficiencies?
- How can technology be optimised?
- What digital tools could support improvement?
- How can data be used to measure progress?

Card 3 – Operations Lead

Your Role

You are responsible for daily operations and organisational efficiency.

Key Questions

- Which operational processes contribute to this challenge?
- What inefficiencies exist in daily workflows?
- Which actions would be easiest to implement?
- How can employees be involved?
- What practical barriers may occur?

Card 4 – Procurement Manager

Your Role

You are responsible for purchasing equipment, software and services.

Key Questions

- How can procurement decisions support sustainability?
- Are lifecycle costs considered when purchasing?
- Can products be repaired or refurbished?
- Are suppliers providing sustainability information?
- Which purchasing practices could be improved?

Card 5 – Sustainability Champion

Your Role

You promote sustainability initiatives and organisational change.

Key Questions

- What environmental impacts are most relevant?
- How can awareness be increased?
- How can progress be monitored?
- Which sustainability goals are affected?
- How can engagement be maintained over time?

Card 6 – Finance Manager

Your Role

You are responsible for budgets, costs and financial performance.

Key Questions

- What are the financial implications of this issue?
- Which improvements could reduce costs?
- What investments may be required?
- How can benefits be measured?
- What risks could affect future financial performance?

Card 7 – Customer Relations and Sales

Your Role

You work directly with customers and market expectations.

Key Questions

- How do customers view this issue?
- Could sustainability create additional customer value?
- Would customers benefit from improved transparency?
- How could this influence reputation?
- Could sustainability strengthen customer loyalty?

Debrief Questions

After the discussion, ask participants:

1. Which role identified the most important risks?
2. Which role identified the most opportunities?
3. Were any perspectives overlooked initially?
4. How can these different viewpoints be balanced in decision-making?
5. What actions should the organisation prioritise?

ANNEX B – Assessment and Analysis Tools

B.1 Systems Thinking Exercise

Purpose

Help participants understand how environmental, social, economic, and digital systems are interconnected.

Activity

Draw a simple systems map of your organisation.

Identify connections between:

1. digital technologies
2. energy use
3. customers
4. suppliers
5. employees
6. waste generation
7. business performance

Discussion Questions

1. Which connections are strongest?
2. Where do unintended consequences occur?
3. Which actions could create the greatest positive impact?

B.2 Digital Sustainability Opportunity Assessment

Purpose

Identify where digitalisation can support sustainability goals.

Worksheet

Current challenges:

Challenge	Current Situation
Energy use	
Resource use	
Waste generation	
Customer transparency	
Supply chain visibility	

Potential digital solutions:

Challenge	Possible Digital Solution

Reflection

Which opportunity appears most realistic to implement within the next 12 months?

B.3 Digital Sustainability Risk Assessment

Purpose

Identify negative impacts of digitalisation.

Discussion Questions:

1. What forms of digital waste exist in your organisation?
2. Are devices replaced too early?
3. How much unused data is stored?
4. Are cloud services actively managed?
5. What cybersecurity risks exist?
6. What sustainability impacts are currently not measured?

Critical Question

How can we ensure that our digital systems do not undermine sustainability principles?

B.4 Skills and Capability Mapping Tool

Purpose

Assess organisational readiness.

Rate your organisation (1–5)

Area	Score
Digital skills	
Sustainability knowledge	
Data management	
Green ICT awareness	
AI understanding	
Circular economy understanding	
Change management	

Reflection

Which capability gaps should be addressed first?

B.5 D-GREEN Digital Sustainability Maturity Self-Assessment Questionnaire

D-GREEN

Digital Sustainability Maturity Self-Assessment Questionnaire

Sustainable Digital Practices for SMEs – Erasmus+ Project

Introduction

This questionnaire is a self-assessment tool developed as part of the Erasmus+ D-GREEN project, which supports European small and medium-sized enterprises (SMEs) in integrating environmental sustainability into their digital transformation. It comprises 10 dual-answer questions (A/B) covering the core themes of the D-GREEN framework: Green IT, sustainable cloud computing, circular economy, data ethics, responsible AI and energy efficiency. For each question, both the correct and incorrect answers are shown with a full explanation, promoting understanding and learning.

Instructions: Read each question and select the answer (A or B) you believe is correct. Then review the correct answer and explanation provided. Record your score in the final grid.

QUESTION 1 | *GREEN IT – DEFINITION*

What does 'Green IT' mean?

A) The use of digital technologies that are coloured green for aesthetic purposes.

B) The adoption of IT practices that reduce the environmental impact of ICT in terms of energy, resources and emissions.

✔ CORRECT (B) **The adoption of IT practices that reduce the environmental impact of ICT in terms of energy, resources and emissions.**

Why?	✔ Correct. Green IT encompasses all strategies and practices aimed at reducing energy consumption, CO_2 emissions and electronic waste generated by information technologies throughout their entire lifecycle.
✗ INCORRECT (A)	**The use of digital technologies that are coloured green for aesthetic purposes.**
Why?	✗ Incorrect. The colour green has no relation to the concept of Green IT, which is about the real environmental sustainability of digital infrastructures and processes.

QUESTION 2 | *D-GREEN PROJECT – OBJECTIVE*

What is the main objective of the Erasmus+ D-GREEN project?

A) To develop accounting software for European SMEs.

B) To support SMEs in integrating environmental sustainability into their digital transformation.

✔ CORRECT (B)	**To support SMEs in integrating environmental sustainability into their digital transformation.**
Why?	✔ Correct. D-GREEN was created to bridge the gap between digital transformation and environmental responsibility in SMEs, providing a handbook, online courses and a digital sustainability maturity assessment tool.
✗ INCORRECT (A)	**To develop accounting software for European SMEs.**
Why?	✗ Incorrect. D-GREEN is not a management software. It is a training and assessment ecosystem focused entirely on digital sustainability for small and medium-sized enterprises.

QUESTION 3 | *CIRCULAR ECONOMY IN ICT*

What does 'circular economy' mean when applied to ICT?

A) Purchasing new electronic devices every year to stay up to date with the latest technology.

B) Reusing, repairing and recycling ICT devices to reduce electronic waste (e-waste) and extend their useful life.

✔ CORRECT (B)	**Reusing, repairing and recycling ICT devices to reduce electronic waste (e-waste) and extend their useful life.**
Why?	✔ Correct. The circular economy applied to ICT aims to maximise the useful life of devices, reduce the extraction of raw materials and minimise electronic waste, creating a closed-loop system.
✗ INCORRECT (A)	**Purchasing new electronic devices every year to stay up to date with the latest technology.**
Why?	✗ Incorrect. Replacing devices frequently increases e-waste and the consumption of natural resources, moving in the opposite direction to the principles of the circular economy.

QUESTION 4 | *ENVIRONMENTAL IMPACT OF CLOUD*

Are cloud services completely free of environmental impact because they dematerialise physical infrastructure?

A) Yes, cloud is always 'green' and produces no CO_2 emissions.

B) No, data centres consume large amounts of energy and produce emissions, although they can be more efficient than traditional on-premise IT.

✔ CORRECT (B)	**No, data centres consume large amounts of energy and produce emissions, although they can be more efficient than traditional on-premise IT.**
Why?	✔ Correct. Global data centres consume about 2% of the world's electricity. Cloud efficiency compared to traditional IT depends on the provider's choices (renewable energy, PUE, virtualisation) and how the organisation uses the services.
✗ INCORRECT (A)	**Yes, cloud is always 'green' and produces no CO_2 emissions.**
Why?	✗ Incorrect. The cloud is not impact-free: it simply shifts energy responsibility from local servers to data centres. Non-optimised use (oversized resources, duplicated data) can actually increase the carbon footprint.

QUESTION 5 | *DIGITAL SUSTAINABILITY KPIS*

What are digital sustainability KPIs?

A) Key performance indicators that measure an organisation's progress towards environmental sustainability goals related to digital technology use.

B) Programming codes used to optimise the performance of business software applications.

✔ CORRECT (A)	**Key performance indicators that measure an organisation's progress towards environmental sustainability goals related to digital technology use.**
Why?	✔ Correct. Digital sustainability KPIs allow organisations to monitor, for example, IT energy consumption, Scope 3 emissions linked to ICT, device recycling rates and data centre efficiency (PUE), enabling evidence-based decision-making.
✗ INCORRECT (B)	**Programming codes used to optimise the performance of business software applications.**
Why?	✗ Incorrect. KPIs are not software code. They are strategic measurement metrics used to evaluate and communicate sustainability performance over time to stakeholders.

QUESTION 6 | *IT ENERGY EFFICIENCY*

Which of the following practices contributes most to energy efficiency in IT?

A) Keeping physical servers running 24/7, even during periods of inactivity.

B) Implementing server virtualisation to optimise hardware resource utilisation and reduce the number of physical machines required.

✔ CORRECT (B)	**Implementing server virtualisation to optimise hardware resource utilisation and reduce the number of physical machines required.**
Why?	✔ Correct. Virtualisation increases server utilisation rates (often from a typical 5-15% to over 70%), reducing the number of physical machines, energy consumption and heat generated in data centres.

✗ INCORRECT (A)	**Keeping physical servers running 24/7, even during periods of inactivity.**
Why?	✗ Incorrect. Idle but powered-on servers still consume up to 80% of full-load energy. This practice wastes resources and unnecessarily increases CO_2 emissions.

QUESTION 7 | *DATA ETHICS*

What does 'data ethics' mean in the context of D-GREEN digital sustainability?

A) The unlimited collection of user data without consent, in order to optimise digital services.

B) The responsible, transparent and compliant management of data, ensuring privacy, informed consent and respect for individuals' rights.

✔ CORRECT (B)	**The responsible, transparent and compliant management of data, ensuring privacy, informed consent and respect for individuals' rights.**
Why?	✔ Correct. Data ethics is a pillar of digital sustainability: it involves data minimisation (which also reduces storage energy), explicit consent, algorithmic transparency and GDPR compliance, building trust while reducing environmental impact.
✗ INCORRECT (A)	**The unlimited collection of user data without consent, in order to optimise digital services.**
Why?	✗ Incorrect. Indiscriminate data collection violates GDPR, erodes user trust and generates inefficiencies (more data = more energy to store and process), directly contradicting sustainability principles.

QUESTION 8 | *RESPONSIBLE ARTIFICIAL INTELLIGENCE*

How can an organisation use AI responsibly to reduce environmental impact?

A) Always adopting the largest and most complex AI models available, to ensure the best results in every situation.

B) Choosing AI models proportionate to the task, optimising inference, and preferring providers that use renewable energy for their data centres.

✔ CORRECT (B)	**Choosing AI models proportionate to the task, optimising inference, and preferring providers that use renewable energy for their data centres.**
Why?	✔ Correct. Training and running large AI models consumes enormous amounts of energy. Selecting the right model for the context, reusing pre-trained models and choosing green providers significantly reduces the carbon footprint of AI.
✗ INCORRECT (A)	**Always adopting the largest and most complex AI models available, to ensure the best results in every situation.**
Why?	✗ Incorrect. Systematically using the largest models is energy-inefficient. A complex model for a simple task can consume hundreds of times more energy than an equivalent lightweight model.

QUESTION 9 | *MATURITY SELF-ASSESSMENT*

What is the correct first step to assess the digital sustainability maturity of an SME?

A) Immediately purchasing new green technologies without any preliminary analysis of the current situation.

B) Conducting an AS-IS assessment of the current situation to identify strengths, areas for improvement and intervention priorities.

✔ CORRECT (B)	**Conducting an AS-IS assessment of the current situation to identify strengths, areas for improvement and intervention priorities.**
Why?	✔ Correct. The D-GREEN self-assessment tool follows a 'measure before you act' approach: without a reliable baseline it is impossible to plan effective interventions, monitor progress or communicate results to stakeholders.
✗ INCORRECT (A)	**Immediately purchasing new green technologies without any preliminary analysis of the current situation.**
Why?	✗ Incorrect. Purchasing technologies without analysis is an inefficient and costly approach. It risks investing in solutions that are inadequate for the context and missing the most impactful improvement areas.

QUESTION 10 | *ELECTRONIC WASTE (E-WASTE)*

What does 'electronic waste' (e-waste) mean in the D-GREEN context?

A) Useless files and data accumulated in corporate servers and email inboxes.

B) End-of-life electronic devices (computers, smartphones, tablets, printers) that require certified disposal to prevent toxic substances from entering the environment.

✔ CORRECT (B)	**End-of-life electronic devices (computers, smartphones, tablets, printers) that require certified disposal to prevent toxic substances from entering the environment.**
Why?	✔ Correct. E-waste is the fastest-growing form of waste in the world. It contains valuable recoverable materials (copper, gold, lithium) but also hazardous substances (lead, mercury). D-GREEN promotes circular procurement practices to reduce it.
✗ INCORRECT (A)	**Useless files and data accumulated in corporate servers and email inboxes.**
Why?	✗ Incorrect. Digital data files are not 'electronic waste' in the physical sense. The term e-waste refers exclusively to discarded hardware devices and their physical end-of-life management.

Self-Assessment Score Grid

Fill in the grid with your answers. Award 1 point for each correct answer.

#	Topic	Your Answer	Correct?	Points
1	Green IT – Definition			
2	D-GREEN Project – Objective			
3	Circular Economy in ICT			

#	Topic	Your Answer	Correct?	Points
4	Environmental Impact of Cloud			
5	Digital Sustainability KPIs			
6	IT Energy Efficiency			
7	Data Ethics			
8	Responsible Artificial Intelligence			
9	Maturity Self-Assessment			
10	Electronic Waste (E-Waste)			
TOTAL SCORE (max 10):				**/10**

D-GREEN Maturity Levels

Find your score in the table below to identify your current maturity level and recommended next steps.

Score	Maturity Level	Description
0 – 3	**Initial**	Digital sustainability is absent or minimal. Initiate an awareness plan and train staff on the basics of Green IT and responsible ICT.
4 – 5	**Aware**	First green practices are in place, but not systematically. Define KPIs and a structured action plan with clear ownership.
6 – 7	**Developing**	Good foundation: practices are formalised. Focus on continuous optimisation, circular procurement and supply chain engagement.
8 – 9	**Advanced**	Digital sustainability is integrated into business processes. Measure, report and communicate results to stakeholders and partners.
10	**Leader**	Recognisable excellence. The organisation can become a role model and mentor for other SMEs in the sector and broader ecosystem.

ANNEX C – Planning and Implementation Tools

C.1 Sustainability Business Case Canvas

Purpose

Help SMEs identify business benefits, risks, opportunities and sustainability value.

Discussion Questions

How can sustainability contribute to:

- cost reduction?
- risk reduction?
- innovation?
- customer value?
- employee attraction and retention?
- access to finance?

Output

Identify three business benefits most relevant to your organisation.

Used after:

Chapter 3 Business Case and Urgency

C.2 Quick Design Check

Purpose:

Use this checklist to verify whether your training design effectively integrates digital sustainability principles and is adapted to SME learning characteristics.

Used before:

Training delivery.

1. Relevance to SME Context

☐ The training is based on **real digital practices** used in the SME

☐ The content reflects **actual operational workflows**, not generic examples

☐ The training considers **time constraints and resource limitations**

☐ The language used is **clear, practical, and non-technical**

2. Focus on Digital Sustainability (NOT generic sustainability)

☐ The training addresses the **environmental impact of digital technologies**

☐ Examples focus on **energy use, data storage, device usage, or system efficiency**

☐ Digital sustainability is framed as **optimising digital practices**, not adding new tools

☐ The content avoids abstract or purely theoretical sustainability concepts

3. Identification of Digital Impact Hotspots

☐ The training includes an activity to identify key inefficiencies in digital use

☐ At least 2–3 priority areas (hotspots) are clearly defined

☐ Hotspots are relevant and realistic for the SME

☐ Participants actively contribute to identifying these areas

4. Integration into ICT Content

☐ Sustainability is embedded in ICT topics, not treated as a separate module

☐ Each ICT topic includes a “sustainability angle”

☐ Participants understand how better digital use = lower environmental impact

☐ The training highlights practical optimisation strategies

5. Action-Oriented Design

☐ The training includes **hands-on activities based on real company data or practices**

☐ Participants complete at least one **micro-application task**

☐ Activities focus on **changing behaviours**, not just increasing knowledge

☐ Outputs are **immediately applicable in the workplace**

6. Business Value Connection

☐ The training clearly links sustainability to **cost savings**

☐ Efficiency gains are explicitly discussed (e.g., time, performance)

☐ Benefits are presented in **business terms**, not only environmental terms

☐ Participants recognise the **practical value** of the proposed changes

7. Adaptation to SME Maturity

☐ The level of the training matches the SME's **digital maturity**

☐ Recommendations are **realistic and feasible**

☐ The training avoids overly complex or resource-intensive solutions

☐ Different starting levels are considered

8. Continuity and Behavioural Change

☐ The training includes **simple actions that can be repeated over time**

☐ Responsibilities for follow-up actions are identified

☐ At least one **basic indicator** is suggested (e.g., storage reduction)

☐ The design encourages **long-term habit change**, not one-off actions

Self-Assessment Score

Count how many boxes you ticked:

- 28–32 – Strong design
- 20–27 - Good, but can be improved
- < 20 – Needs redesign (too theoretical or not SME-oriented)

Quick Reflection

You could add to the previsous checklist the following question:

What is the **ONE change** that participants will realistically implement after your training?

C.3 Scoping and Baseline Intake

This tool supports trainers in conducting a rapid baseline assessment of how an SME uses digital technologies and where inefficiencies may generate unnecessary environmental impact.

Used at the beginning of engagement.

Step 1 – Map Digital Practices

Analyse how digital tools are used in everyday operations, focusing on:

- device usage
- data storage
- cloud services
- digital workflows

  Focus on real practices, not formal procedures.

Step 2 – Identify Inefficiencies

Identify where digital resources are used inefficiently (e.g. unnecessary data storage, duplicate systems, unmanaged cloud use, devices left running).

Step 3 – Define Priority Hotspots

Select 2–3 key areas where improving digital practices can generate the highest impact and are feasible to address.

Step 4 – Build a Digital Footprint Snapshot

Summarise the current situation, highlighting main inefficiencies and opportunities for improvement.

Step 5 – Link to Training Design

Use the findings to define:

- priority training topics
- practices to be improved
- actions to be tested during training

The outcome of this process is a clear and practical baseline to design targeted and action-oriented training for SMEs.

C.4 Digital Footprint Snapshot

Purpose:

Create a quick overview of the organisation's digital footprint and identify priority areas.

Digital Footprint Snapshot

Area	Low	Medium	High
Email storage	□	□	□
Shared drives	□	□	□
Teams/SharePoint data	□	□	□
CRM records	□	□	□
ERP data	□	□	□
Website content	□	□	□
Social media assets	□	□	□
AI tool usage	□	□	□

Key Questions

- Which area generates most digital information?
- Which area has least governance?
- Which area offers quickest improvement opportunity?

Trainer Debrief:

Where does the organisation's digital footprint primarily originate?

C.5 Training Delivery Planner

This tool supports trainers in conducting a rapid baseline assessment of how an SME uses digital technologies and where inefficiencies may generate unnecessary environmental impact.

Step 1 – Map Digital Practices

Analyse how digital tools are used in everyday operations, focusing on:

- device usage
- data storage
- cloud services
- digital workflows

  Focus on real practices, not formal procedures.

Step 2 – Identify Inefficiencies

Identify where digital resources are used inefficiently (e.g. unnecessary data storage, duplicate systems, unmanaged cloud use, devices left running).

Step 3 – Define Priority Hotspots

Select 2–3 key areas where improving digital practices can generate the highest impact and are feasible to address.

Step 4 – Build a Digital Footprint Snapshot

Summarise the current situation, highlighting main inefficiencies and opportunities for improvement.

Step 5 – Link to Training Design

Use the findings to define:

- priority training topics
- practices to be improved
- actions to be tested during training

The outcome of this process is a clear and practical baseline to design targeted and action-oriented training for SMEs.

C.6 Email Cleanup Toolkit

Purpose

This toolkit helps SMEs identify and reduce unnecessary email-related digital waste while improving productivity, information management, and cybersecurity.

When to Use

- Digital sustainability audits
- Information management reviews
- Cybersecurity awareness training
- Office productivity improvement initiatives

Email Audit Checklist

Review the following:

Question	Yes	No
Do employees regularly delete obsolete emails?	□	□
Are email attachments duplicated elsewhere?	□	□
Are large attachments stored unnecessarily?	□	□
Are inactive mailboxes still maintained?	□	□
Is there an email retention policy?	□	□
Are distribution lists reviewed regularly?	□	□
Are shared mailboxes actively managed?	□	□

Quick Wins

1. Delete obsolete emails older than agreed retention periods.
2. Replace large attachments with shared links.
3. Archive completed projects.
4. Remove inactive mailboxes.
5. Establish mailbox ownership rules.

Action Plan

Improvement Action	Responsible Person	Deadline

Trainer Debrief Questions

- How much email content is actively used?
- Which email practices create the most digital waste?
- What changes could be implemented immediately?

C.7 Shared Drive Cleanup Toolkit

Purpose

This toolkit helps SMEs improve file management practices and reduce unnecessary storage, duplication, and information complexity.

When to Use

- SharePoint reviews
- Google Drive audits
- File server clean-up projects
- Digital sustainability assessments

Shared Drive Assessment

Question	Yes	No
Are duplicate files common?	□	□
Are inactive folders archived?	□	□
Are file naming conventions used consistently?	□	□
Are document owners clearly assigned?	□	□
Are permissions reviewed regularly?	□	□
Are obsolete project folders removed?	□	□
Are retention rules defined?	□	□

Common Digital Waste Indicators

- Final_v2.docx
- Final_v2_new.docx
- Final_v2_final.docx
- Final_v2_final_latest.docx
- Duplicate image libraries

- Obsolete project folders
- Unused templates
- Redundant backups

Recommended Actions

Immediate Actions

1. Delete duplicate files.
2. Archive completed projects.
3. Assign folder owners.

Medium-Term Actions

1. Implement naming conventions.
2. Create retention schedules.
3. Review access permissions.

Action Plan

Improvement Action	Responsible Person	Deadline

Trainer Debrief Questions

- How easy is it to find information?
- How much duplicated content exists?
- Who owns shared information?

C.8 ERP Data Quality Checklist

Purpose

This checklist helps SMEs improve ERP data quality, reduce information waste, and support better decision-making.

When to Use

- ERP implementation projects
- ERP optimisation initiatives
- Digital sustainability audits
- Process improvement programmes

Product Master Data

Question	Yes	No
Are inactive products regularly reviewed?	□	□
Are duplicate product records identified?	□	□
Are product descriptions up to date?	□	□
Are obsolete products archived?	□	□

Customer Data

Question	Yes	No
Are duplicate customers removed?	□	□
Are inactive customers reviewed?	□	□
Is customer ownership assigned?	□	□

Supplier Data

Question	Yes	No
Are inactive suppliers reviewed?	□	□
Are duplicate supplier records removed?	□	□
Are supplier details maintained?	□	□

Reports and Dashboards

Question	Yes	No
Are all reports actively used?	□	□
Are obsolete reports removed?	□	□
Are dashboards reviewed periodically?	□	□

ERP Sustainability Opportunities

1. Better reporting quality
2. Reduced system complexity
3. Improved process efficiency
4. Better decision-making
5. Reduced digital waste

Action Plan

Improvement Action	Responsible Person	Deadline

Trainer Debrief Questions

- Which ERP data creates the most complexity?
- How often are master data records reviewed?
- What data no longer creates business value?

C.9 CRM Cleanup Toolkit

Purpose

This toolkit helps SMEs improve customer data quality, reduce duplicate records, improve reporting accuracy, and minimise unnecessary digital storage.

When to Use

- CRM implementation projects
- Sales process reviews
- Customer data audits
- Digital sustainability assessments

CRM Data Quality Assessment

Customer Records

Question	Yes	No
Are duplicate customer records identified and removed?	□	□
Are inactive customers reviewed regularly?	□	□
Are customer contact details updated periodically?	□	□
Are customer ownership responsibilities assigned?	□	□

Sales Opportunities

Question	Yes	No
Are inactive opportunities archived?	□	□
Are outdated sales leads removed?	□	□

Are pipeline stages reviewed regularly?	□	□

CRM Governance

Question	Yes	No
Is there a CRM data owner?	□	□
Are data quality rules documented?	□	□
Is duplicate detection enabled?	□	□

Common Sources of CRM Digital Waste

- Duplicate contacts
- Inactive customers
- Outdated opportunities
- Incomplete customer records
- Unused custom fields
- Obsolete reports

Quick Wins

- Merge duplicate contacts.
- Archive inactive opportunities.
- Review customer ownership.
- Remove unused fields.
- Standardise data entry practices.

Action Plan

Improvement Action	Responsible Person	Deadline

Trainer Debrief Questions

- Which CRM data creates the least business value?
- How much duplicate information exists?
- How often is customer information reviewed?

C.10 Social Media Asset Management Checklist

Purpose

This checklist helps SMEs manage digital marketing assets more sustainably by reducing duplication, improving content governance, and optimising storage.

When to Use

- Marketing audits
- Website reviews
- Digital sustainability assessments
- Content management projects

Digital Marketing Asset Review

Content Inventory

Question	Yes	No
Is there a complete inventory of marketing assets?	□	□
Are duplicate images regularly removed?	□	□
Are unused videos archived or deleted?	□	□
Are outdated campaign assets reviewed?	□	□

Social Media Management

Question	Yes	No
Are social media assets organised by campaign?	□	□
Are obsolete files removed after campaigns end?	□	□

Are file ownership responsibilities defined?	□	□

Website Content

Question	Yes	No
Is website content reviewed regularly?	□	□
Are outdated pages removed?	□	□
Are images optimised for web use?	□	□

Common Sources of Digital Waste

- Duplicate images
- Obsolete videos
- Unused campaign assets
- Outdated landing pages
- Archived newsletters
- Unused website content

Content Lifecycle Checklist

Create

- Is the content needed?

Use

- Is it actively generating value?

Archive

- Should it be retained?

Delete

- Is it obsolete?

Trainer Exercise

Ask participants to estimate:

- Total number of stored images
- Total number of stored videos
- Percentage actively used today

The results often reveal significant opportunities for digital clean-up.

Action Plan

Improvement Action	Responsible Person	Deadline

C.11 Teams and SharePoint Governance Checklist

Purpose

This checklist supports sustainable management of collaboration platforms such as Microsoft Teams, SharePoint, Google Workspace, Slack, and similar tools.

When to Use

- Collaboration platform audits
- Information governance reviews
- Cybersecurity assessments
- Digital sustainability programmes

Workspace Governance

Question	Yes	No
Does each workspace have an owner?	□	□
Are inactive teams reviewed regularly?	□	□
Are completed projects archived?	□	□
Are permissions reviewed annually?	□	□

Meeting Recordings

Question	Yes	No
Is recording necessary for all meetings?	□	□
Are recordings automatically archived?	□	□
Are retention periods defined?	□	□

File Management

Question	Yes	No
Are duplicate files reviewed?	□	□
Are naming conventions used consistently?	□	□
Are obsolete project files removed?	□	□

Common Sources of Digital Waste

- Unused Teams channels
- Obsolete SharePoint sites
- Duplicate files
- Forgotten recordings
- Inactive project workspaces
- Excessive permissions

Recommended Governance Rules

- Assign workspace owners.
- Archive completed projects.
- Review permissions annually.
- Limit unnecessary recordings.
- Establish retention periods.

Trainer Reflection

How many inactive collaboration spaces exist within the organisation today?

Action Plan

Improvement Action	Responsible Person	Deadline

C.12 Digital Records Retention Policy Template

Purpose

This template helps SMEs establish clear rules for retaining, archiving, and deleting digital information throughout its lifecycle.

Why It Matters

Poor information retention practices increase:

- storage costs;
- cybersecurity risks;
- compliance challenges;
- information complexity;
- digital waste.

A retention policy helps organisations balance legal obligations, business needs, and sustainability objectives.

Digital Records Retention Matrix

Record Type	Retention Period	Responsible Owner	Archive	Delete
Customer records			□	□
Supplier records			□	□
Financial records			□	□
Marketing materials			□	□
Employee records			□	□
Project documentation			□	□

Meeting recordings			□	□
Website content			□	□

Retention Policy Principles

Create

Only create information that serves a business purpose.

Store

Store information in designated systems.

Maintain

Review information periodically to ensure relevance and accuracy.

Archive

Archive information required for legal, operational, or historical reasons.

Delete

Delete information that no longer creates value and is not required for compliance purposes.

Annual Review Checklist

Question	Yes	No
Are retention periods documented?	□	□
Are obsolete records deleted?	□	□
Are archives reviewed annually?	□	□
Are responsibilities assigned?	□	□

Trainer Exercise

Ask participants to identify:

1. Which digital records are stored indefinitely?
2. Which records could be archived?
3. Which records could be safely deleted?

Action Plan

Improvement Action	Responsible Person	Deadline

C.13 Digital Sustainability KPI Worksheet

Purpose:

Help SMEs define measurable indicators.

Suggested KPIs

Indicator	Current	Target
Cloud storage volume		
Number of inactive files		
Duplicate records		
Email storage volume		
Device lifespan		
Refurbished devices (%)		
Archived projects (%)		

Trainer Questions

Which KPIs are easiest to measure?

Which KPIs support business goals?

C.14 Digital Sustainability Roadmap Template

NEW

Purpose:

Support implementation planning.

Roadmap

0–3 Months

Quick wins:

- Email cleanup
- File cleanup
- Governance owners

3–6 Months

Process improvements:

- Retention rules
- ERP cleanup
- CRM review

6–12 Months

Strategic improvements:

- KPI monitoring
- Sustainable procurement
- AI governance

C.1 Digital Sustainability Action Plan

NEW

Purpose:

Convert workshop outcomes into actions.

Action Planning Table

Action	Benefit	Owner	Deadline
Cloud storage volume			
Number of inactive files			
Duplicate records			
Email storage volume			

Success Criteria

What will success look like?

Resources Required

What support is needed?

First Step

What can be done within the next 30 days?

ANNEX D – Persona-Based Training Resources

D.1 Persona-Based Training Pathways for SMEs

This handout supports trainers in adapting digital sustainability training to different roles within SMEs. Since responsibilities, motivations, and decision-making power vary across organisational roles, training should focus on the specific needs and priorities of each target group. Trainers can use this tool to select relevant topics, examples, activities, and learning approaches for different SME personas.

1. SME Owner-Manager

Main Training Focus

- Business impact of inefficient digital practices
- Cost reduction and operational efficiency
- Strategic digital investments
- Risk reduction and long-term sustainability

Possible Topics

- Energy and cost implications of digital inefficiencies
- Optimising digital tools without increasing complexity
- Extending hardware lifecycle
- Prioritising digital sustainability actions

Practical Examples

- Reducing cloud storage costs through data clean-up
- Lowering electricity consumption through better device management
- Avoiding unnecessary software subscriptions

Recommended Training Approach

- Short and focused sessions
- Strategic discussions
- Real business cases
- Clear economic benefits and quick wins

2. Operations or Administrative Lead

Main Training Focus

- Everyday digital practices
- Workflow efficiency

- Data management routines
- Coordination of sustainable digital behaviours

Possible Topics

- Organising shared folders and documentation
- Reducing data duplication
- Managing digital workflows more efficiently
- Monitoring routine digital practices

Practical Examples

- Creating file retention routines
- Simplifying internal communication flows
- Reducing redundant document versions

Recommended Training Approach

- Hands-on activities
- Workflow analysis
- Practice-oriented exercises
- Group problem-solving

3. ICT / Digital Lead

Main Training Focus

- Technical optimisation of digital systems
- Efficient infrastructure management
- Reduction of digital resource consumption
- Monitoring and optimisation strategies

Possible Topics

- Cloud optimisation strategies
- Energy-efficient hardware and software
- Data lifecycle management
- Monitoring digital energy consumption

Practical Examples

- Optimising server and cloud usage
- Identifying energy-intensive systems
- Reducing unnecessary background processes

Recommended Training Approach

- Technical workshops
- System analysis activities
- Scenario-based exercises
- Advanced problem-solving tasks

4. Sustainability or Innovation Champion

Main Training Focus

- Linking digital practices to environmental impact
- Facilitating organisational change
- Promoting engagement and continuity
- Supporting behavioural change

Possible Topics

- Awareness-building strategies
- Internal engagement methods
- Monitoring progress and impact
- Supporting continuous improvement

Practical Examples

- Coordinating digital clean-up initiatives
- Promoting responsible device usage
- Facilitating team discussions on digital sustainability

Recommended Training Approach

- Collaborative workshops
- Reflection activities
- Peer exchange and facilitation exercises
- Change management discussions

ANNEX E – Recommended Learning Resources

E.1 Videos

Global Sustainability Challenge

Video: Johan Rockström – Planetary Boundaries Framework

A practical introduction to the Planetary Boundaries Framework and its relevance for sustainability transitions.

https://www.youtube.com/watch?v=Rphpxvl_9T8

Video: 10 Years to Transform the Future of Humanity

TED Talk exploring climate tipping points, Earth system resilience, and the urgency of sustainability action.

https://www.ted.com/talks/johan_rockstrom_10_years_to_transform_the_future_of_humanity_or_destabilize_the_planet

Video: The Tipping Points of Climate Change and Where We Stand

Overview of the latest scientific understanding of planetary stability and sustainability challenges.

https://www.ted.com/talks/johan_rockstrom_the_tipping_points_of_climate_change_and_where_we_stand

Business Case for Sustainability

Bob Willard Sustainability Business Case

Educational introduction explaining the business benefits of sustainability.

https://www.youtube.com/watch?v=KlW8-WW0k3g

E.2 Business Case Resources

Bob Willard – Sustainability Advantage

Practical resources explaining how sustainability initiatives can create business value through cost reduction, risk management, employee engagement, innovation and competitive advantage.

Resource:
https://sustainabilityadvantage.com
Recommended use:
Useful for trainers preparing business-oriented sustainability workshops and for SME managers evaluating investment decisions.

Business Case Calculator for SMEs

Practical tool for estimating potential financial benefits from sustainability initiatives.
Resource:
https://sustainabilityadvantage.com/businesscases/company-level-business-case/
Recommended use:
Can be used during business planning, action planning and management discussions.

21st Century Sustainable Enterprise Force Field

White paper exploring the drivers and barriers influencing sustainability transformation within organisations.
Resource:
https://sustainabilityadvantage.com/documents/21st%20Century%20Sustainable%20Enterprise%20Force%20Field.pdf
Recommended use:
Supports strategic discussions about organisational change and sustainability leadership.

World Business Council for Sustainable Development (WBCSD)

Resources and case studies demonstrating how sustainability contributes to business resilience, innovation and long-term value creation.
Resource:
https://www.wbcsd.org
Recommended use:
Useful source of practical business examples and sector-specific guidance.

UN Global Compact SME Sustainability Resources

Guidance, tools and examples supporting sustainability implementation in small and medium-sized enterprises.

Resource:

https://unglobalcompact.org

Recommended use:

Suitable for SMEs beginning their sustainability journey.

European Commission – Sustainability and SMEs

Guidance and policy resources supporting sustainability transitions and competitiveness among European SMEs.

Resource:

https://single-market-economy.ec.europa.eu

Recommended use:

Provides European policy context and practical support materials.

E.3 Additional Reading

Digital Sustainability

European Environment Agency (EEA) – Digitalisation and Sustainability

Explores both the opportunities and environmental impacts associated with digital technologies.

Resource:

https://www.eea.europa.eu

Recommended use:

Background reading for trainers and consultants introducing digital sustainability concepts.

GeSI – Digital with Purpose

Global industry initiative demonstrating how digital technologies can support sustainable development goals.

Resource:

https://gesi.org

Recommended use:

Useful source of practical examples and digital sustainability case studies.

OECD Digital Economy Outlook

Analysis of digital transformation trends, opportunities and challenges.

Resource:

https://www.oecd.org/digital

Recommended use:

Provides policy and strategic context for digital sustainability discussions.

Circular Economy and ICT

Ellen MacArthur Foundation

Resources and case studies on circular economy principles and implementation.

Resource:

https://ellenmacarthurfoundation.org

Recommended use:

Supports training related to ICT lifecycle management and circular business models.

Global E-Waste Monitor

International overview of electronic waste generation, collection and recycling.

Resource:

https://ewastemonitor.info

Recommended use:

Useful for discussions about device lifecycles and e-waste management.

Artificial Intelligence and Ethics

UNESCO Recommendation on the Ethics of Artificial Intelligence

Global framework for responsible AI development and use.

Resource:

https://www.unesco.org/en/artificial-intelligence/recommendation-ethics

Recommended use:

Supports Chapter 11 (AI for Sustainability) and Chapter 12 (Cybersecurity and Data Ethics).

OECD AI Principles

Guidelines for trustworthy and responsible AI.

Resource:

https://oecd.ai/en/ai-principles

Recommended use:

Useful reference for organisations adopting AI tools.

Sustainable Development

United Nations Sustainable Development Goals (SDGs)

Global framework addressing environmental, social and economic sustainability.

Resource:

https://sdgs.un.org/goals

Recommended use:

Provides broader sustainability context for SME training programmes.

UN Environment Programme (UNEP)

Resources on sustainable production, consumption, digitalisation and environmental governance.

Resource:

https://www.unep.org

Recommended use:

Background reading for trainers seeking additional sustainability examples and references.

Suggested Reading for Trainers

Trainers are encouraged to use these resources to:

- deepen their understanding of digital sustainability;
- identify additional case studies and examples;
- stay informed about emerging sustainability trends;
- support continuous professional development.

ANNEX F – READY-TO-USE TRAINING SESSION PLANS

Purpose

This annex provides ready-to-use training session templates that trainers can directly apply when working with SMEs. The templates combine reflection, assessment, discussion and implementation activities from Annexes A–E and can be adapted according to organisational size, sector and digital maturity level.

F.1 60-Minute Awareness Session

Objective

Introduce SME participants to digital sustainability and create awareness of opportunities and challenges.

Learning Outcomes

Participants will:

- understand the concept of digital sustainability;
- recognise the environmental impacts of digitalisation;
- identify digital sustainability opportunities within their organisation.

Suggested Agenda

Activity	Time
Introduction and objectives	5 min
Digital Sustainability Overview	10 min
A.1 Sustainability and Digitalisation Worksheet	15 min
Group Discussion	15 min
Key Insights and Reflection	10 min
Wrap-up and Next Steps	5 min

Recommended Resources

- Annex A.1
- Annex A.3

F.2 Half-Day Workshop (3–4 Hours)

Objective

Support SMEs in identifying digital sustainability opportunities and developing initial actions.

Learning Outcomes

Participants will:

- understand digital sustainability principles;
- assess current organisational practices;
- identify priority improvement areas;
- develop first action ideas.

Suggested Agenda

Module 1 – Introduction
30 min

- Digital Sustainability Overview
- Business Benefits

Module 2 – Reflection
45 min

- Annex A.1
- Annex A.2

Module 3 – Assessment
45 min

- Annex B.2 Opportunity Assessment
- Annex B.3 Risk Assessment

Break
15 min

Module 4 – Prioritisation
45 min

- Systems Thinking Exercise
- Group Discussion

Module 5 – Action Planning
45 min

- Business Case Canvas
- Initial Action Plan

Closing
15 min

- Key Commitments
- Feedback

Recommended Resources

- Annex A
- Annex B
- Annex C.1

F.3 Full-Day SME Workshop

Objective

Enable SMEs to create a practical Digital Sustainability Roadmap.

Learning Outcomes

Participants will:

- understand digital sustainability concepts;
- assess current maturity;
- identify opportunities and risks;
- prioritise actions;
- develop implementation plans and KPIs.

Morning Session

Introduction
30 min

Sustainability Foundations
45 min

- Chapter 2
- Chapter 7

Future Vision Exercise
45 min

- Annex A.2

Opportunity Assessment
60 min

- Annex B.2

Risk Assessment
45 min

- Annex B.3

Lunch
60 min

Afternoon Session

Digital Waste Assessment
45 min
- Chapter 9
- Annex C.5–C.11

Business Case Development
45 min
- Annex C.1

KPI Development
45 min
- Annex C.12

Roadmap Development
60 min
- Annex C.13

Action Plan
45 min
- Annex C.14

Final Presentations
30 min

Closing Reflection
15 min

F.4 SME Coaching Session Template

Objective

Support an SME in implementing specific digital sustainability actions.

Duration

60–90 minutes

Structure

Step 1 – Current Situation Review

15 min
Questions:

- What sustainability challenges are most relevant?
- What digital systems are currently used?
- What improvements have already been implemented?

Step 2 – Opportunity Identification

20 min
Use:

- Annex B.2
- Annex B.3

Step 3 – Prioritisation

20 min
Questions:

- Which actions provide the highest impact?
- Which actions require the lowest effort?
- Which actions align with business goals?

Step 4 – Action Planning

20 min
Use:

- Annex C.14 Action Plan
- Annex C.13 Roadmap

Step 5 – Follow-up Agreement

10 min

Define:

- responsibilities;
- deadlines;
- indicators;
- next review date.

4.1.A — Two KPI quizzes with answer key & rationale

Part 4 – Measurement & Governance | Chapter 4.1 – KPI Framework and Monitoring
Format: Two multiple-choice quizzes with answer key & rationale | **Audience:** Trainers, consultants, SME participants | **Duration:** 10–15 minutes

Quiz 1 – Designing the KPI Set

Q1.1 – An SME wants to start measuring ICT sustainability. Which of the following is the best *first* step?

A) Buy a specialised carbon-accounting software and connect all systems.

B) Define three to four strategic outcomes and derive a short "core" set of indicators.

C) Adopt the full Greenhouse Gas Protocol Protocol ICT Sector Guidance and report all 50+ datapoints.

D) Wait until Corporate Sustainability Reporting Directive (CSRD) becomes mandatory for the company.

Correct answer: B. KPI frameworks must be built top-down from outcomes, not bottom-up from data availability or tool capabilities.

Why the others are wrong:

A) Purchasing software before defining objectives leads to expensive dashboards no one uses; tools should follow strategy, not precede it.

C) The GHG Protocol ICT guidance is a reference methodology designed for large organisations; full adoption is disproportionate for an SME and almost always abandoned mid-way.

D) Many SMEs are already affected by CSRD *indirectly*, through value-chain questions from listed clients; waiting risks losing contracts. CSRD is also only one driver among many (cost, talent, regulation).

Q1.2 – Which of these is an *outcome* indicator rather than an *activity* indicator?

A) Number of trainings delivered on ICT sustainability.

B) Number of pages of the ICT sustainability policy.

C) Share of employees who report applying digital-sustainability practices in their daily work.

D) Number of meetings held by the Steering Group.

Correct answer: C. Outcome indicators measure the *effect* achieved (behaviour change, footprint reduction), not the effort spent.

Why the others are wrong:

A) Counts activity (training delivered) without telling us whether anyone learned or applied anything.

B) A vanity metric – longer policies do not equal better governance.

D) Activity indicator. Meetings are inputs; what matters is the decisions they produce.

Q1.3 – Which combination best reflects an SME-fit KPI set for ICT sustainability?

A) PUE, WUE, CUE, ERE for the on-premise server room and all branch offices (PUE = energy efficiency WUE = water use CUE = carbon impact ERE = energy reuse GHG = greenhouse gas emissions).
B) ICT electricity (kWh/yr), Scope 2 ICT emissions, average device age, % devices reused, % staff trained.

C) A single carbon-intensity figure expressed per €1,000 turnover.

D) The 1,144 ESRS datapoints, fully populated.

Correct answer: B. A balanced, small set that covers environmental, asset-related and social dimensions while remaining collectable with existing SME systems.

Why the others are wrong:

A) Data-centre KPIs (PUE etc.) are valuable but irrelevant for most SMEs without an on-premise server room.

C) A single intensity figure hides important drivers; SMEs need a small but diverse set to act on.

D) Full ESRS reporting is mandatory only for in-scope large undertakings; expecting an SME to populate the full taxonomy is unrealistic.

Q1.4 – When setting targets, an SME should:

A) Always use absolute targets because intensity targets are accounting tricks.

B) Always use intensity targets because absolute targets penalise growth.

C) Choose between absolute and intensity targets based on the KPI's purpose, and combine them where useful.

D) Set targets only if external benchmarks already exist for that sector.

Correct answer: C. Both target types are legitimate and serve different management purposes; the SBTi SME route, for instance, allows several formulations.

Why the others are wrong:

A) Intensity targets are a recognised practice (e.g. kg CO_2e per FTE) and useful for management, even though absolute reductions are needed for climate science alignment.

B) Conversely, absolute targets are essential to align with the Green Deal and Paris Agreement; intensity alone is insufficient.

D) External benchmarks are useful context but not a prerequisite; targets can be set relative to the company's own baseline.

Quiz 2 – Monitoring and Using the Data

Q2.1 – Which sequence describes the D-GREEN monitoring loop?

A) Plan – Do – Check – Act.

B) Collect – Compare – Communicate – Correct.

C) Sense – Seize – Transform – Scale.

D) Define – Measure – Analyse – Improve – Control.

Correct answer: B. The D-GREEN loop deliberately distinguishes the *communicate* step, because indicators that are never seen by decision-makers never trigger corrective action.

Why the others are wrong:

A) PDCA (ISO 14001) is compatible and often complementary, but is broader than the monitoring loop specifically.

C) Refers to dynamic-capabilities theory, not KPI monitoring.

D) DMAIC is a Six Sigma improvement cycle; useful but more elaborate than the lightweight loop SMEs need for monthly monitoring.

Q2.2 – An SME relies entirely on its cloud provider's "carbon dashboard" as its Scope 2 KPI. What is the main risk?

A) None – cloud-provider dashboards are audited and standardised.

B) The methodology, scope and emission factors vary by provider and are not standardised, so the figure may not be comparable or complete.

C) Cloud providers always overstate emissions to push customers to premium plans.

D) The data is too granular for an SME to use.

Correct answer: B. Provider methodologies differ widely (market-based vs. location-based factors, boundary definitions, exclusions). The figure is useful as an input but should be triangulated with electricity-invoice and ITU L.1420 logic.

Why the others are wrong:

A) Provider dashboards are typically self-declared and not externally audited at the customer-account level.

C) There is no general evidence of systematic overstatement; if anything, methodological choices tend to produce lower figures.

D) Granularity is not the issue – comparability and completeness are.

Q2.3 – Which of the following is the most useful internal reporting format for an SME's "core 12" KPIs?

A) A 40-slide deck for the annual general meeting.

B) A one-page colour-coded scorecard reviewed quarterly by the steering group.

C) A live Business Intelligence dashboard (is a visual tool that collects data from different sources and shows it through charts, tables, indicators, and KPIs.)accessible only to the IT team.

D) An Excel file shared by email when someone asks.

Correct answer: B. A short standardised format that lands on the agenda of a recurring meeting is the most reliable way to convert measurement into management action.

Why the others are wrong:

A) An annual touchpoint is too infrequent to allow course-correction.

C) Restricting access to IT defeats the purpose of cross-functional governance.

D) Ad-hoc sharing makes performance invisible and undermines accountability.

Q2.4 – Which of these is *not* typically a "common pitfall" in SME ICT-sustainability measurement?

A) Measuring everything and acting on nothing.

B) Ignoring Scope 3 / value-chain emissions.

C) Selecting a small number of outcome-focused indicators tied to owners.

D) Treating measurement as a compliance ritual.

Correct answer: C. This is the recommended practice, not a pitfall.

Why the others are wrong (i.e. they ARE pitfalls):

A) Over-collection without action is the most common failure mode in SME programmes.

B) For most service SMEs, supply-chain and cloud-provider emissions dominate the footprint; ignoring them produces misleading totals.

D) Compliance-only framing kills internal value: KPIs should drive management decisions, not just satisfy auditors.

Suggested use in training

Trainers may run Quiz 1 before delivering Chapter 4.1 (diagnostic) and Quiz 2 after (consolidation). A combined score of 6/8 or higher indicates the participant is ready to use Handout 4.1.B (Checklist) and 4.1.C/D (Templates) directly with an SME client.

4.1.B — KPI Implementation Checklist

Part 4 – Measurement & Governance | Chapter 4.1 – KPI Framework and Monitoring

Title: KPI Implementation Checklist for SMEs | **Audience:** SME ICT Sustainability Lead, supported by VET trainer / consultant

How to use: Tick each item that is *fully in place* in your company. Items not ticked become priorities for the next 90 days.

Section 1 – Strategic foundations

✓	Item	Evidence required
☐	The company has identified 3–4 strategic ICT-sustainability outcomes.	Written list signed by top management.
☐	A baseline year has been defined and documented.	Year, scope and data sources recorded.
☐	At least one absolute reduction target exists with a horizon ≤ 2030.	Target value, unit, deadline.
☐	The framework is approved by the owner-manager or CEO.	Signed approval, dated.

Section 2 – The D-Green KPI set

✓	KPI	Owner	Frequency
☐	ICT electricity consumption (kWh/yr)		
☐	Scope 2 ICT emissions (kg CO_2e/yr)		
☐	Average device age (years)		

☐	% devices reused or refurbished		
☐	% e-waste correctly recycled		
☐	% staff trained on ICT sustainability		
☐	Accessibility compliance of digital workplace (%)		
☐	Reported digital-wellbeing incidents		
☐	ICT total cost of ownership per person working full-time (€)		
☐	Energy cost per workstation (€/yr)		
☐	Existence of ICT sustainability policy (Y/N)		

Section 3 – Data & monitoring routines

✓	Item
☐	Each KPI has a documented data source.
☐	Each KPI has a single named data owner.
☐	A monthly five-minute data-check routine is in the calendar.
☐	A quarterly KPI review meeting is in the calendar.
☐	A one-page colour-coded scorecard template exists.

☐	An annual management review of ICT sustainability is scheduled.

Section 4 – External alignment

✓	Item
☐	The KPI set covers the ESRS (European Sustainability Reporting Standards) E1/E5/S1/G1 datapoints most relevant to the company's value chain.
☐	The company can respond to client sustainability questionnaires from a single internal source.
☐	Methodologies referenced (ITU L.1420, GHG Protocol, ISO 14064, ISO/IEC 30134) are documented as references.
☐	Where benchmarks are used (PUE = energy efficiency WUE = water use CUE = carbon impact ERE = energy reuse GHG = greenhouse gas emissions.), the source is cited.

Section 5 – Pitfalls self-check

✗ ?	Pitfall
☐	We measure many indicators but rarely act on them.
☐	Most of our indicators are "activity" rather than "outcome".
☐	We have not estimated Scope 3 / value-chain ICT emissions.

☐	We rely on a single vendor dashboard without cross-checking.
☐	Measurement is mainly driven by external compliance demands.

Scoring guide.

Section 1: 4/4 needed to be "framework-ready". Section 2: at least 8/12 KPIs implemented with owner and frequency = "operational". Section 3: 5/6 = robust monitoring. Section 4: 3/4 = externally aligned. Section 5: any tick is a red flag; design a corrective action within 30 days.

4.1.C — Template One-page KPI Scorecard

Part 4 – Measurement & Governance | Chapter 4.1 – KPI Framework and Monitoring

Title: One-Page KPI Scorecard – SME Template | **Audience:** ICT Sustainability Lead, Steering Group

Purpose: Standardised quarterly reporting document. Use one A4 page; print or share as PDF

.

Company: _____ | Period (Q/Year): _____

Prepared by: _____

Environmental indicators

KPI	Unit	Baseline	Target (year)	Current value	Status
ICT electricity consumption	kWh/yr				
Scope 2 ICT emissions	kg CO_2e/yr				
Average device age	years				
Devices reused / refurbished	%				
E-waste correctly recycled	%				

Social indicators

KPI	Unit	Baseline	Target (year)	Current value	Status
Staff trained on ICT sustainability	% headcount				
Digital workplace accessibility	% systems				
Digital-wellbeing incidents	count				

Economic-operational indicators

KPI	Unit	Baseline	Target (year)	Current value	Status
Total ICT cost per full-time employee (FTE).	€/FTE				
Energy cost per workstation	€/yr				
Cost avoided through device life-extension	€				

Governance & maturity

KPI	Unit	Baseline	Target (year)	Current value	Status
ICT sustainability policy in place	Y/N				
Management reviews held	n/yr				

Status legend: `on track (≥ target)` `attention (within 15% of target)` `off track (> 15% gap or worsening)`

Decisions taken at this review

#	Decision	Owner	Deadline
1			
2			
3			

Trainer's note. When piloting this template with a client, complete it together for the most recent full quarter. Even where many cells start empty, the act of filling them surfaces ownership gaps and data-source ambiguities – which is the real learning outcome of the first cycle.

4.1.D — Template Per-indicator KPI Definition Sheet

Part 4 – Measurement & Governance | Chapter 4.1 – KPI Framework and Monitoring
Title: KPI Definition Sheet – Per-Indicator Template | **Audience:** ICT Sustainability Lead + data owner
Purpose: One sheet per KPI. Forces clarity on definition, scope, data source, owner and target before measurement begins.

How to use

Print or duplicate one sheet for each indicator in the "core 12". Complete sections in order. The sheet is signed by the data owner and the ICT Sustainability Lead. Review annually or whenever the KPI definition changes.

KPI Definition Sheet – Indicator 1

1. KPI name	
2. Domain	☐ Environmental ☐ Social ☐ Economic-operational ☐ Governance & maturity
3. Strategic outcome served	
4. Plain-language definition	
5. Unit of measure	
6. Calculation formula	
7. Scope (sites, systems, services)	
8. Inclusions / exclusions	

9. Data source(s)	
10. Reference methodology	
11. Baseline value & year	
12. Target value & horizon	
13. Reporting frequency	☐ Monthly ☐ Quarterly ☐ Annual
14. Data owner (name & role)	
15. Accountable manager	
16. Quality / verification step	

17. ESRS European Sustainability Reporting Standards datapoint(s) addressed	e.g. E1-5, E1-6, E5-5, S1-13, G1-3
18. Notes / known limitations	
19. Sign-off (date, signature)	Data owner: _____ ICT Sust. Lead: _____

Trainer's note. Encourage participants to draft sheets together in a workshop setting. The discussion about scope, exclusions and verification typically surfaces 80% of the future operational issues. Once the first two sheets are complete, the remaining KPIs usually take 10–15 minutes each.

4.2.A — Two Governance quizzes with answer key & rationale

Part 4 – Measurement & Governance | Chapter 4.2 – Governance and Role Definitions
Format: Two multiple-choice quizzes with answer key & rationale | **Audience:** Trainers, consultants, SME participants | **Duration:** 10–15 minutes

Quiz 1 – Roles and accountability

Q1.1 – In a 5-person SME, the most appropriate way to assign the ICT Sustainability Lead role is:

A) Recruit a new full-time Sustainability Manager.

B) Attach the role to an existing manager (IT, Operations, HSE or Quality), with clearly defined time allocation.

C) Rotate the role between all employees every quarter.

D) Outsource the role permanently to an external consultant.

Correct answer: B. SMEs rarely justify a dedicated full-time role; attaching the responsibility to an existing manager – with explicit time and decision rights – is the pattern most consistently associated with success in EU pilots

Why the others are wrong:

A) Disproportionate cost; the role is unlikely to fill a full week of meaningful work in a 40-person SME.

C) Rotation prevents accumulation of expertise and dilutes accountability – the opposite of what governance requires.

D) Pure outsourcing prevents internalisation of competence and creates dependency; consultants should support, not replace, the internal Lead.

Q1.2 – In a RACI matrix, what does the letter "A" mean?

A) Approves – any colleague able to sign off.

B) Assistant – the person helping with the task.

C) Accountable – the single point of decision for the activity.

D) Available – anyone who could do it if needed.

Correct answer: C. "A" stands for Accountable: exactly one role per activity. This single-point-of-accountability rule is the core value of RACI. RACI is acronym for

Responsible = project officer drafting it

Accountable = project manager approving it

Consulted = partners providing data

Informed = steering committee or funding authority

In brief: RACI explains who does, who approves, who is consulted, and who is informed.

Why the others are wrong:

A) Multiple approvers dilute accountability – the very problem RACI solves.

B) Not a RACI category.

D) Not a RACI category; would also undermine clarity.

Q1.3 – Procurement procures cloud services for the company. Who should typically be "R" (Responsible) in the RACI for this activity?

A) The CEO.

B) The ICT Sustainability Lead.

C) Procurement, with IT and ICT Sustainability Lead as Consulted.

D) Whoever currently has time.

Correct answer: C. Procurement executes the buying process; IT contributes technical specifications and the Sustainability Lead contributes green ICT criteria. CEO is typically "Informed".

Why the others are wrong:

A) CEO involvement at this level signals a governance breakdown – the CEO should be informed of category-level outcomes, not individual contracts.

B) The Lead provides criteria but is not normally responsible for executing the procurement process itself.

D) Ad-hoc allocation is the symptom RACI is designed to eliminate.

Q1.4 – The Steering Group for ICT sustainability in an SME should typically:

A) Include every employee, to maximise participation.

B) Be composed of 2–4 cross-functional members and meet quarterly.

C) Be the ICT department only.

D) Convene only when problems arise.

Correct answer: B. A small cross-functional group with a quarterly cadence is the most resilient configuration for an SME.

Why the others are wrong:

A) Plenary groups cannot take decisions efficiently; the steering group is a decision body, not an awareness forum.

C) ICT-only governance is exactly what produces siloed, ineffective programmes.

D) Reactive meetings drop the indicator-review function and turn governance into firefighting.

Quiz 2 – Policy, decisions and integration

Q2.1 – Which is the recommended minimum documented set for SME ICT-sustainability governance?

A) Policy + Steering Group Charter + Employee Code of Practice.

B) Full ISO 14001-style environmental management manual.

C) A signed email from the CEO.

D) Nothing in writing – verbal commitment is enough in an SME.

Correct answer: A. Three short documents (typically one page each) provide proportionate clarity without unnecessary bureaucracy.

Why the others are wrong:

B) A full ISO manual is overkill for most SMEs; integration with an existing ISO system is preferable to a parallel manual.

C) A single email is insufficient evidence in supplier or client assessments and does not allocate roles or decisions.

D) Verbal commitment cannot be cited in audits or supplier questionnaires; it also tends to dissipate at staff turnover.

Q2.2 – An SME has an investment threshold of €5,000 for the ICT Sustainability Lead. A proposed laptop refresh costs €18,000. The decision rights should escalate to:

A) The IT supplier.

B) The management team or top management, depending on the documented threshold.

C) The Lead, who can decide because they are accountable.

D) The Procurement team, alone.

Correct answer: B. When the documented threshold is exceeded, the decision must move up the chain. This rule prevents both stalled projects and over-stretched delegations.

Why the others are wrong:

A) Suppliers cannot take buying decisions on behalf of the company.

C) "Accountable" does not mean "may decide above any limit"; thresholds are part of the accountability boundary.

D) Procurement executes but does not usually own strategic investment approval.

Q2.3 – When an SME already operates ISO 9001 and ISO 14001 systems, ICT sustainability governance should be:

A) Built as a separate, parallel management system.

B) Integrated into existing risk registers, internal audits and management reviews.

C) Replaced by a new ISO 50001 system.

D) Postponed until the ISO systems are decertified.

Correct answer: B. Integration is recommended by ESRS G1 and by good practice generally – it lowers cost, leverages existing audit cycles and avoids contradictions.

Why the others are wrong:

A) Parallel systems compete for management attention and quickly fall out of date.

C) ISO 50001 (energy management) is useful but does not *replace* 9001/14001.

D) Decertification is rarely sensible; ICT sustainability can be added without disrupting existing certification.

Q2.4 – Which of the following is a typical symptom of weak governance in an SME's digital-sustainability programme?

A) The Steering Group meets quarterly and follows a standardised agenda.

B) The ICT Sustainability Lead has a one-page job-description extension.

C) Decisions on green ICT initiatives are repeatedly re-opened because no one is formally accountable.

D) A RACI matrix covers the 12 key activities of the year.

Correct answer: C. Re-opening decisions is the most common symptom of an unclear accountability map; it costs time and credibility.

Why the others are wrong (i.e. they are good practice):

A) A quarterly cadence with a standard agenda is exactly what good governance looks like.

B) Codifying the Lead's responsibilities in the job description is a key recommendation.

D) A RACI is the lightest-weight tool to remove ambiguity in roles.

4.2.B — Governance Quick-Set Checklist

Part 4 – Measurement & Governance | Chapter 4.2 – Governance and Role Definitions

Title: Governance Quick-Set Checklist | **Audience:** ICT Sustainability Lead, top management

How to use: Tick each item that is in place. Items not ticked are priorities for the next 60 days.

Section 1 – Strategic layer

✓	Item	Status / evidence
☐	Top management has formally adopted an ICT Sustainability Policy.	
☐	Targets and budget for ICT sustainability are approved for the current year.	
☐	An annual top-management review of ICT sustainability is in the calendar.	
☐	ICT sustainability is referenced in the company's strategy / business plan.	

Section 2 – Tactical layer

✓	Item	Status / evidence
☐	One named ICT Sustainability Lead exists (with allocated time).	
☐	The Lead's responsibilities are formalised in writing (job description extension or charter).	
☐	A Steering Group of 3–6 cross-functional members has been nominated.	
☐	The Steering Group meets at a documented frequency (quarterly recommended).	
☐	A standard agenda for Steering Group meetings exists.	
☐	Decision-right thresholds for the Lead are documented (financial & non-financial).	

Section 3 – Operational layer

✓	Item	Status / evidence
☐	A RACI matrix (Responsible Accountable Consulted Informed) covers the 10–15 most important ICT-sustainability activities.	
☐	The RACI has been shared with all named roles.	
☐	Procurement applies green ICT criteria documented somewhere (tender templates, scoring sheets).	
☐	HR / Training includes ICT sustainability in induction and annual training plans.	
☐	Finance produces ICT TCO (Total Cost of Ownership) data accessible to the Lead.	
☐	Line managers have been briefed on their role in enforcing the code of practice.	
☐	An Employee Code of Practice for digital sustainability has been distributed.	

Section 4 – Documentation

✓	Item	Status / evidence
☐	ICT Sustainability Policy (one page, signed, dated).	
☐	Steering Group Charter (one page).	
☐	Employee Code of Practice (one to two pages).	
☐	RACI matrix (one page).	
☐	Annual review report template defined.	

Section 5 – Integration with existing systems

✓	Item	Status / evidence
☐	ISO 9001 / 14001 / 27001 risk register includes ICT-sustainability risks.	
☐	Internal audit plan covers ICT-sustainability objectives.	
☐	ICT-sustainability KPIs feature in the management review of the existing ISO system.	
☐	Supplier questionnaires or codes of conduct include ICT-sustainability clauses.	

Scoring guide. Section 1: 4/4 = strategic ownership in place. Section 2: 5/6 = governance is operational. Section 3: 6/7 = day-to-day responsibilities clear. Section 4: 5/5 = minimum documented set complete. Section 5: tick what applies – integration is a bonus rather than a barrier.

4.2.C — Template RACI Matrix + Decision-rights table

Part 4 – Measurement & Governance | Chapter 4.2 – Governance and Role Definitions

Title: RACI Matrix – SME ICT Sustainability Template | **Audience:** Steering Group, top management

Purpose: Single-page allocation of Responsible / Accountable / Consulted / Informed across 15 key activities. Adapt role columns to your organisation.

Company	_____	Version / date	_____	Reviewed by	_____

RACI matrix

Activity	Top Mgmt	ICT Sust. Lead	IT / Ops	Procurement	HR / Training	Finance	Line Managers
1. Approve ICT Sustainability Policy							
2. Define / update KPI set							
3. Monthly KPI data collection							
4. Quarterly KPI review meeting							

5. Annual management review							
6. Procure ICT hardware							
7. Procure cloud / digital services							
8. Manage end-of-life ICT equipment							
9. Optimise data storage & archives							
10. Maintain device fleet (extend life)							
11. Run digital sustainability training							
12. Maintain Employee Code of Practice							
13. Respond to client sustainability questionnaires							
14. Supplier sustainability assessment							

15. Incident / breach handling (digital wellbeing or security)							

Legend. R = Responsible (does the work) | A = Accountable (single decision-maker) | C = Consulted (input required) | I = Informed (kept in the loop). Use exactly one "A" per row.

Decision-right thresholds (companion table)

Decision type	Up to	Decided by	Above the threshold, escalates to
ICT operational changes (no contract)			
Supplier / cloud spend (per contract value)	€		
Hardware investment (capex)	€		
Workforce / training spend	€		
External communication on sustainability	n/a		

Trainer's note. Run this template as a 30-minute workshop with the Steering Group. The most common error is multiple "A"s in a single row; the second most common is no "A" at all. Both signal misalignment to be resolved before the meeting ends.

4.2.D — Template ICT Sustainability Policy + Steering Group Charter

Part 4 – Measurement & Governance | Chapter 4.2 – Governance and Role Definitions
Title: ICT Sustainability Policy & Steering Group Charter – SME Templates
Audience: ICT Sustainability Lead, top management, HR
Purpose: Two one-page templates that constitute the minimum documented governance set, ready to be customised.

Template 1 – ICT Sustainability Policy (one-page)

[COMPANY NAME] – ICT Sustainability Policy

Adopted on [date]; review every 12 months.

1. Purpose

[Company name] recognises that information and communication technologies are central to its operations and contribute to its environmental, social and economic impacts. This policy sets out our commitment to manage ICT in a sustainable, efficient and responsible manner, contributing to the European Green Deal targets and the company's long-term resilience.

2. Scope

This policy applies to all employees, contractors and suppliers using ICT resources owned, operated or contracted by [company name]. It covers hardware, software, cloud services, data, and the human practices around them.

3. Commitments

We commit to (a) measure the environmental and social impact of our ICT use through a defined KPI framework; (b) extend the useful life of digital equipment and prefer refurbished options where appropriate; (c) integrate green ICT criteria in procurement; (d) train all staff on digital sustainability practices; (e) review performance at least annually at top management level; and (f) comply with applicable EU and national legislation, including obligations cascading from the CSRD and related directives.

4. Governance

An ICT Sustainability Lead is appointed by top management and supported by a cross-functional Steering Group. Decision rights, escalation paths and reporting cycles are described in the Steering Group Charter and RACI matrix.

5. Continuous improvement

This policy is reviewed annually and updated whenever significant changes occur in our operations, legal environment or stakeholder expectations.

Signed: _____

Name / Role: _____

Date: _____

Template 2 – Steering Group Charter (one-page)

[COMPANY NAME] – ICT Sustainability Steering Group Charter

Effective date: [date]; review every 12 months.

1. Purpose

The Steering Group oversees the implementation of the ICT Sustainability Policy. It is the company's tactical decision body for ICT sustainability matters between top-management reviews.

2. Composition

Role	Name
ICT Sustainability Lead (Chair)	
IT / Operations representative	

Procurement representative	
HR / Training representative	
Finance representative	

3. Mandate & decision rights

The group is empowered to: (a) approve operational changes implementing the policy; (b) validate quarterly KPI scorecards; (c) endorse responses to supplier and customer sustainability questionnaires; (d) recommend investment decisions above the Lead's individual threshold; (e) propose policy amendments to top management.

4. Meeting cadence

The Steering Group meets quarterly (four times per year). Extraordinary meetings may be convened by the Chair or any two members. Quorum: at least four members including the Chair.

5. Standing agenda

1) KPI scorecard review & corrective actions. 2) Progress on year's priorities. 3) Upcoming supplier / customer interactions. 4) Risks & new requirements (e.g. CSRD, NIS2). 5) Training plan update. 6) Decisions for escalation.

6. Reporting

Minutes are circulated within five working days and stored in [location]. An annual summary is presented to top management.

Approved by: _____

Date: _____

Trainer's note. When customising, keep both templates to a single A4 page each. The brevity is intentional: short documents are read, signed and applied; long ones drift. Highlight the dated review cycle – it is the single most-skipped clause in SME documentation.

4.3.A — Two Change Implementation quizzes with answer key & rationale

Part 4 – Measurement & Governance | Chapter 4.3 – Change Implementation Planning
Format: Two multiple-choice quizzes with answer key & rationale | **Audience:** Trainers, consultants, SME participants | **Duration:** 8–10 minutes

Quiz 1 – The four-phase roadmap

Q1.1 – Which sequence describes the D-GREEN change implementation roadmap?

A) Diagnose – Pilot – Scale – Embed.

B) Plan – Do – Sell – Forget.

C) Strategy – Restructuring – Layoffs – Communication.

D) Sprint – Retro – Sprint – Retro.

Correct answer: A. The D-GREEN roadmap deliberately separates a short diagnostic phase from pilot, scale and embed, to avoid over-investing before the company has tested its first interventions.

Why the others are wrong:

B) "Sell – Forget" is not a recognised change-management pattern and is the classic anti-pattern of unsustained initiatives.

C) Restructuring and layoffs are not part of digital-sustainability change; framing change this way generates fear rather than engagement.

D) Agile sprint cycles are useful for delivery but not a strategic change-implementation roadmap on their own.

Q1.2 – In the Pilot phase, the most important discipline is to:

A) Run the pilot indefinitely until everyone is happy.

B) Define an explicit exit decision (go / no-go / iterate) at the end.

C) Hide the pilot from the rest of the company.

D) Use only volunteers, never line managers.

Correct answer: B. Pilots that never end – or never decide – consume attention without producing organisational learning. The exit decision is the central artefact of the pilot.

Why the others are wrong:

A) Indefinite pilots are a major failure mode in SME programmes.

C) Visibility (with appropriate framing) is part of building organisational appetite for scaling.

D) Volunteers are useful but line-manager buy-in determines whether a pilot survives beyond enthusiasm.

Q1.3 – Which best describes the "Embed" phase?

A) Launching a new pilot in a different department.

B) Integrating KPIs into the annual management review and other existing cycles, so the change becomes "how we work".

C) Hiring a Chief Sustainability Officer.

D) Decommissioning the Steering Group.

Correct answer: B. Embedding is about making sustainability indistinguishable from normal management routines.

Why the others are wrong:

A) New pilots can continue, but embedding refers to anchoring what already works.

C) Senior-officer recruitment is rarely proportionate for an SME and is not what embed means.

D) Disbanding governance after embedding usually triggers regression; the Steering Group should evolve, not disappear.

Q1.4 – A typical Diagnose phase duration for an SME is:

A) One year.

B) One month.

C) One day.

D) None – diagnose continuously.

Correct answer: B. Around a month allows completion of the D-GREEN self-evaluation, a short interview round and identification of 2–3 quick wins, without losing momentum.

Why the others are wrong:

A) A year is too long for SMEs: momentum, sponsorship and budget visibility erode.

C) A single day produces only superficial diagnostics and miss-prioritised interventions.

D) Continuous diagnosis without phases never reaches pilot execution.

Quiz 2 – Engagement and adoption

Q2.1 – Which factor is most strongly associated with change adoption in SMEs?

A) The length of the formal communication plan.

B) Visible commitment of the owner-manager combined with peer "ambassadors".

C) The number of posters in the canteen.

D) Buying an internal communication platform.

Correct answer: B. In small organisations, the owner-manager's behaviour signals what matters; peers convert that signal into daily practice.

Why the others are wrong:

A) Long plans do not equal effective communication; brief and consistent beats long and rare.

C) Posters reinforce a message but do not produce adoption on their own.

D) Tools follow purpose; a platform without leadership commitment changes little.

Q2.2 – Which is the correct order of the ADKAR change model?

A) Awareness – Desire – Knowledge – Ability – Reinforcement.

B) Action – Direction – Knowledge – Acceleration – Report.

C) Analysis – Design – Knowledge – Application – Results.

D) Awareness – Decision – Kick-off – Action – Review.

Correct answer: A. ADKAR (Awareness – Desire – Knowledge – Ability – Reinforcement) is a widely used five-step change-adoption framework. It is useful as a self-check for trainers designing the engagement plan.

Why the others are wrong:

B), C), D) None of these are recognised models; they fabricate similar-sounding acronyms. The correct one is Awareness – Desire – Knowledge – Ability – Reinforcement

Q2.3 – "Quick wins" should be celebrated:

A) Never – it trivialises serious work.

B) Within the first 90 days of the Pilot phase.

C) Only after full company-wide rollout.

D) Only at the annual general meeting.

Correct answer: B. Early wins generate the credibility and energy required to move from pilot to scale.

Why the others are wrong:

A) Recognising progress is a motivator, not a trivialisation.

C) Waiting for full rollout means scaling without proof points.

D) Annual events are too infrequent to sustain pilot momentum.

Q2.4 – Where should ICT-sustainability change be "anchored" after scaling?

A) In a separate parallel programme reporting only to consultants.

B) Inside existing review cycles, training calendars and supplier-management routines.

C) On a private cloud server only accessible to IT.

D) Nowhere – once scaled, the change is automatic.

Correct answer: B. Anchoring inside existing routines is the only sustainable path; parallel programmes wither at the first budget cycle.

Why the others are wrong:

A) External consultants are catalysts, not custodians.

C) Hiding governance in IT systems removes management visibility – the opposite of anchoring.

D) Unsupported change always regresses; assumption of automaticity is a common cause of failure.

4.3.B — Change-Readiness Checklist (Diagnose - Pilot - Scale - Embed)

Part 4 – Measurement & Governance | Chapter 4.3 – Change Implementation Planning

Title: Change-Readiness Checklist | **Audience:** ICT Sustainability Lead, top-management sponsor

How to use: Walk through the four phases. Tick what is in place; leave blank what is not. Anything blank is a near-term action.

Diagnose phase

✓	Item
☐	D-GREEN self-evaluation has been completed.
☐	Short interview round with 5–10 staff has been conducted.
☐	2–3 high-value, low-effort interventions have been identified and prioritised.
☐	A named top-management sponsor exists.

Pilot phase

✓	Item
☐	Pilot scope (department / process) is documented.
☐	Pilot duration is fixed (2–3 months recommended).
☐	Weekly check-ins are in the calendar.

☐	Success criteria are written down (data-based, not "feel").
☐	An explicit exit decision (go / no-go / iterate) is planned.
☐	Internal "ambassadors" beyond the ICT team have been identified.

Scale phase

✓	Item
☐	Pilot results have been formally reviewed by management.
☐	A roll-out sequence across departments is agreed.
☐	Governance documents (policy, charter, RACI) are updated.
☐	Training plan is updated to cover new departments.
☐	KPI scorecard is updated to reflect new scope.
☐	Communication milestone (e.g. all-staff meeting) is scheduled.

Embed phase

✓	Item
☐	ICT-sustainability KPIs are part of the annual management review.
☐	ICT-sustainability is part of the annual training plan / onboarding.
☐	Procurement and supplier-management cycles include sustainability criteria.
☐	Internal audits cover ICT-sustainability objectives.
☐	The Steering Group is still meeting on schedule.
☐	An external review (peer, consultant, customer) is planned at least once a year.

Trainer's note. Use this checklist as a 20-minute coaching tool at the end of each phase. The pattern of unchecked items typically reveals whether the company is over-planning early phases or under-investing in embedding – the two most common failure modes.

4.3.C — Template 12-month Change Roadmap

Part 4 – Measurement & Governance | Chapter 4.3 – Change Implementation Planning
Title: 12-Month Change Roadmap – SME Template | **Audience:** ICT Sustainability Lead, Steering Group
Purpose: Single-page rolling plan that maps the four D-GREEN phases against the year and names owners, milestones and KPI links.

Header

Company	
Plan version & date	Reviewed by
Top-management sponsor	ICT Sustainability Lead

Phase plan (12 months)

Phase	Months	Key activities	Owner	KPI link	Milestone / deliverable
Diagnose	M1	D-GREEN self-evaluation; baseline data; 5–10 interviews; 2–3 priority interventions selected.		Baseline values for D-GREEN KPIs	Diagnosis report (3 pp.)
Pilot	M2–M4	Implement interventions in one department; weekly check-ins; collect outcome data.		Δ vs. baseline on pilot-scope KPIs	Pilot exit-decision memo

Scale	M5–M10	Roll out across departments; update governance docs; refresh training plan; all-staff communication.		Coverage % per KPI; trained staff %	Updated policy, RACI, scorecard
Embed	M11–M12 and beyond	Integrate KPIs into annual management review; supplier & client communications; internal audit coverage.		Maturity score; audit findings closure	Annual review report

Three priority interventions (chosen at Diagnose)

#	Intervention	Department	Owner	Effort (S/M/L)	Expected KPI impact
1					
2					
3					

Engagement plan

Stakeholder group	Channel	Frequency	Owner	Key message
All staff	All-hands meeting	Launch + each milestone		Why we are doing this, what changes for you, where to ask questions
Line managers	Monthly leadership briefing	Monthly		What to enforce in their teams; how to escalate
Ambassadors	Working group	Bi-weekly		What is working, what is not; collect stories
Suppliers	Procurement letter / questionnaire	At contract renewal		Our sustainability criteria and expectations
Clients	Email / sales material	Annual		Progress and credentials, especially for tenders

Risks & mitigations

Risk	Likelihood	Impact	Mitigation	Owner
Pilot drags on without exit decision			Fixed end date and pre-agreed go/no-go criteria	
Scale phase under-resourced			Budget & capacity confirmed at pilot exit	
Embedding skipped; programme regresses			KPIs added to annual management review & audit plan	

Trainer's note. Customise the timeline boundaries to the company's planning cycle (calendar year, fiscal year, or 12 rolling months). Keep the document to one page after customisation – it should fit on a single A4 sheet to remain a working tool, not a deliverable for archives.

4.3.D — Template Pilot Plan + signed Exit-Decision

Part 4 – Measurement & Governance | Chapter 4.3 – Change Implementation Planning
Title: Pilot Plan & Exit-Decision – SME Template | **Audience:** ICT Sustainability Lead, pilot owner, top-management sponsor
Purpose: Documents the pilot scope, success criteria and the explicit go / no-go / iterate decision at the end. Used to test chapter 4.3 directly in the company.

Part A – Pilot setup

1. Pilot title	
2. Strategic outcome served	
3. Scope (department / process / sites)	
4. Start & end dates	
5. Pilot owner	
6. Top-management sponsor (senior leader who officially promotes the project).	
7. Resources allocated (people, budget, tools)	
8. Risks / dependencies	
9. Communication plan during pilot	

10. Weekly check-in time & format	

Part B – Success criteria

KPI / outcome	Baseline	Pilot target	Measurement method

*Define at least one quantitative outcome KPI plus at least one qualitative criterion (e.g. user-experience feedback). Decision rules must be agreed **before** the pilot starts.*

Part C – Exit decision

Decision date: _____ Attendees: _____

Pilot results vs. success criteria:

Criterion	Result	Met? (Y / N / Partial)

Decision (tick one):

☐ **GO** – proceed to Scale phase. Document scale plan in Handout 4.3.C.

☐ **NO-GO** – stop the intervention. Document lessons learned and remove from roadmap.

☐ **ITERATE** – revise scope / approach and re-run the pilot for a defined additional period (max 2 months).

Lessons learned:

1. _____

2. _____

3. _____

Signatures.

Pilot owner: _____ Date: _____

ICT Sustainability Lead: _____ Date: _____

Top-management sponsor: _____ Date: _____

Trainer's note. The decision section is the most-skipped part of pilot work in SMEs. Insist that it is signed even when the outcome is "iterate" or "no-go": these are legitimate decisions and the act of recording them protects future credibility of the programme.

20. Handbook Conclusions and Key Messages

Digital sustainability is no longer a future consideration but an immediate business necessity. SMEs increasingly depend on digital technologies to remain competitive, efficient and resilient. At the same time, digitalisation creates environmental impacts through energy consumption, hardware production, data storage and digital waste.

The D-GREEN Handbook provides trainers, consultants and SME support professionals with practical guidance for supporting sustainable digital transformation. The handbook combines sustainability principles, digitalisation strategies, business considerations and practical implementation tools into a coherent learning framework.

Several key messages emerge throughout the handbook:

- Digital sustainability is both a business opportunity and a sustainability challenge.
- SMEs can achieve meaningful improvements through practical and incremental actions.
- Digital waste management represents one of the fastest and most accessible improvement opportunities.
- Sustainable ICT practices support efficiency, resilience and competitiveness.
- Organisational culture, leadership and employee engagement are critical success factors.
- Measurement and continuous improvement are essential for long-term impact.

The handbook should be used as a flexible resource rather than a prescriptive methodology. Trainers are encouraged to adapt tools, exercises and case studies according to the needs, maturity levels and learning objectives of participating SMEs.

Together with the D-GREEN MOOC and Self-Assessment Tool, this handbook contributes to strengthening the capacity of SMEs and vocational education professionals to support a more sustainable and responsible digital future.

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Together, we are supporting SMEs in building a more sustainable, resilient and digitally responsible future.

D-GREEN – Digital Sustainability for SMEs

Empowering SMEs to reduce digital waste, improve efficiency and create lasting environmental and business value.

