

How Small and Medium-Sized Organizations Adapt to Sustainable & Green ICT Models?*

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Abstract. Sustainability has become an important value and a quality factor among ICT organizations. However, performing sustainable and green practices in a managed way to achieve carbon neutrality goals is a demanding task, especially for small and medium-sized enterprises (SMEs). This study examines how Finnish SMEs integrate environmental responsibility into their business operations. The research problem: How small and medium-sized organizations adapt to sustainable ICT models? The sustainability practices of eight Finnish organisations are examined with a case study research method. The research data consists of qualitative interviews with IT and non-IT service providers, sustainability documentation, and Green ICT events in Finland. As results, key activities, quality aspects, systemic challenges and supplier-related requirements in the transition toward Green ICT are identified.

Keywords: Green ICT · sustainability · quality · supplier management.

1 Introduction

Green ICT is being adopted worldwide, not only by European countries as governments, organizations, and industry bodies push for more sustainable digital infrastructure. Within the European Union, the twin transition consists of both green and digital transition [7].

Small and medium-sized enterprises (SMEs) face financial, structural and capability-related barriers that make systematic sustainability work much harder than in large companies. SMEs may encounter several challenges while implementing sustainable practices. First, small companies have limited financial resources to perform green efforts and typically cannot delegate a full-time role for governing sustainability which leaves them without the internal expertise needed to plan, measure, and monitor environmental performance in a systematic way.

Second, regulatory overload is challenging for very small organizational entities. Sustainability regulations may evolve or change quickly. Sustainability

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policies are highly sensitive to political shifts, geopolitical tensions and international priorities [18].

Micro-sized companies and SMEs often struggle to interpret what applies to them and face challenges while responding the requirements of new regulations. Achieving environmental, "green" certifications, such as ISO 14001:2015 [15], requires documented management system with established processes, employee training programme, external auditing and verification. Additionally, there is a growing number of environmental labels that ICT organizations may apply and use. Environmental labels or "ecolabels" such as EU Ecolabel [9] keep people aware of the environmental performance and benefits of the products [14].

Third, capability barriers are related to the organizations' internal limitations, such as Green ICT skills, environmental friendly programming knowledge and sustainability-driven processes resulting in inconsistent practices and an inability to embed sustainability into everyday operations of the organization. Organizations need holistic sustainability frameworks where Green ICT goals, strategies and daily practices are tightly interconnected [25]. In order to facilitate the green ICT adoption, sustainability should be integrated into performance measurements, reporting and rewarding systems [24]. The failure of ICT manufacturers to adequately address sustainability issues can lead to increased CO₂ emissions, which in turn contribute to global warming, environmental pollution, and other forms of environmental harm [3]. Companies also face difficulties in receiving carbon emission data from their IT providers [16].

Haryani et al. [11] propose that service organizations could use a combination of Lean, Six Sigma, agile and green principles to ensure efficient adaption of green practices and aligning operations with ecological and societal goals. Additionally, IT service organizations might use the latest version of IT Infrastructure Library (ITIL 5) framework to design, deliver and operate sustainable IT services [22]. Service organizations could, for example, put green choices visible in the self-service catalog [17].

1.1 Related Work

Existing research on sustainable ICT has focused especially on green data centres, green IT adoption barriers, identification of sustainability challenges and sustainable supply chain management. It is important to note that Green ICT is not a new research topic. Murugesan [19] reported already in 2008 that the ICT infrastructure including data centers servers, computers, monitors, data communications equipment consume increasing amount of energy.

Studies on green data centres have proposed methods for improving energy efficiency with a variety of means, such as outdoor air-cooling systems [13], computer room air handlers [30], systems that utilize outdoor air in data centre cooling [13] and smart workload scheduling [12], or liquid-cooled heat exchangers [6]. Qi et al. [23] have studied sustainable data center management and present Optimization Framework for Sustainable Datacenter Management. According to Cater-Steel et al. [8], staff are not always fully informed of their data centre strategies and environmental friendly procedures, such as virtualization [5]. .

Existing studies have identified a wide range of challenges related to green ICT. Abdullai et al. [1] have identified several challenges in Green ICT adoption including the lack of trained employees on sustainability practices in organizations, lack of sustainability awareness, and accessibility to green ict best practices. According to study of Aboueid et al. [2] organizations may face several barriers in transforming IT operations greener, such as lack of leadership and strategy, incentives framework and buy-in from key stakeholders. Nomani and Cater-Steel [21] reported a too narrow scope of Green IT service management as one of the barriers in green IT.

Concerning the adoption of environmental friendly operating model, Doš et al. [10] report that CEOs personal values (e.g benevolence and universalism) affect the organizational environmental practices. Wongsaiichi et al. [28] discuss intentions to adopt green technologies and environmental awareness. They report that environmental awareness plays a fundamental role in influencing the intention to adopt green technologies.

In IT service management framework ITIL [4], supplier management focuses on ensuring that third-party services are managed effectively to provide quality, value-driven services. Organizations may use sustainable supply chain management (SSCM) approach to reduce their ecological impact by affecting procuring, manufacturing, dispersion, usage, and material recycling practices [20].

Sharma and Madhur [26] report that organizations that applied Sustainable IT Framework achieved electricity savings, financial savings, almost one third reduction in carbon footprint, improvements in resource utilization efficiency, and significant increase in user satisfaction. Suryawanshi and Narkhede [27] found that green ICT can bring cost effectiveness to educational institutes.

1.2 Main Contribution

The main contribution of this study is to study the sustainability behavior of small and medium-sized Finnish companies including

- how environmental responsibility is carried out in companies as part of daily operations,
- how the concepts ‘quality’ and ‘sustainability’ are interlinked in the operations of SMEs,
- what kind of obstacles or challenges do companies face in climate work, and
- how companies are managing their suppliers with respect to sustainability requirements.

The results of this article might be useful for sustainability managers, ICT leaders, and organizational decision-makers, as they can use the data to identify Green ICT capability gaps, benchmark their own environmental friendly ICT practices, and design more effective Green ICT initiatives.

The remainder of the paper is organized as follows. Section 2 describes the research methodology with the case context, data collection and analysis methods. Section 3 presents the results of the case study. Section 4 shows the analysis of findings. Finally, conclusions are given in Section 5.

2 Research Methods

The research problem of this study is: How small and medium-sized organizations adapt to sustainable ICT models? The case study can be defined as "an empirical inquiry that investigates a contemporary phenomenon within its real-life context" [29]. The Green ICT project provided smooth access to rich data on these companies. The research problem was further divided into more detailed research questions:

1. How do companies perform sustainable ICT work as part of their daily operations?
2. How quality is addressed or visible in the Green & ICT sustainability work?
3. What types of barriers exist in the Green ICT & sustainability work?
4. How companies manage their suppliers and subcontractors regarding environmental requirements?

2.1 Case Organizations

The data for this study was collected from the following eight case organizations, both IT and non-IT service providers: Our case organization Alpha is a Finnish expert organization that provides high-skill technical assessments, advisory services, and project-based support for customers operating in complex digital environments.

Beta is a Finnish professional services company that supports clients in developing their service management capabilities and strengthening internal management practices. Its core services include advisory services such as evaluating tools and training programs in project management and service management. The company works with organizations of varying sizes and maturity levels, helping them clarify information needs and adopt more systematic management methods. Gamma is a Finnish learning-technology company that develops digital learning solutions tailored for demanding professional environments. Its service focuses on improving sector-specific communication skills through short, learning moments integrated into everyday work.

Sigma is a Finnish digital marketing company that also provides training and development services. Sigma specializes in strengthening the digital capabilities of individuals, teams, and small organizations. Its core offering consists of customized training programs in artificial intelligence, digital marketing, data-driven work practices, and digital tools, delivered through flexible formats such as workshops, online courses, and remote learning environments. Omega is a Finnish IT services company specializing in data protection, backup solutions, and long-term digital archiving. With a long experience in safeguarding business-critical information, the company provides organizations with secure and reliable ways to store, protect, and recover their data.

Kappa is a Finnish company specializing in mechanized timber harvesting, forest logistics, and heavy-equipment services. It provides a wide range of operational forestry services, including wood harvesting, forest-machine work, earth-moving, and timber transport, carried out with modern machinery and trained

professional operators. Lambda is a small Finnish family-run nature-tourism company that provides wilderness accommodation, nature-based experiences, and sustainable travel services in Eastern Finland. It operates a collection of wilderness cabins, saunas, huts, and a small restaurant. Lambda was selected for the study because they use digital marketing and reservation systems by emphasizing responsible and ecological tourism.

Finally, Delta is a Finnish, publicly owned ICT and health-technology service provider that operates nationwide. It delivers critical digital infrastructure, information-management services, and technology solutions for public-sector organizations.

2.2 Data Collection and Analysis Methods

Data for this study were collected by using multiple sources of evidence, although the main data collection method was a structured interview. Additional material was gathered through document analysis, including company websites, project reports, organizational descriptions, and publicly available online sources, for example, online news articles and Youtube videos. Observational notes from Green ICT workshops and events were also used to provide understanding of the organizations' Green ICT practices. The sources of evidence in the study included:

- Documentation: Corporate sustainability reports (Kappa, Delta), the strategy of sustainable development (Omega)
- Archival records: Sustainability-related online news articles concerning the companies, Youtube videos, company websites
- Interviews/discussions: Interviews conducted in 8 micro-sized or SME organizations, 1 large ICT service provider organization. Persons who participated in interviews were CEOs of SMEs and micro-sized companies or persons in leading roles. Additionally, data was collected from informal discussions (live meeting, phone calls, Teams calls) with sustainability directors, quality directors, ICT solution architects, technical specialists and technical directors.
- Participative observation: Participative observation in work meetings, visits to case organizations' facilities (Alpha, Sigma, Omega, Kappa, Lambda), 4 green ICT workshops and 2 online events organized during 2025-2026. There were also other iCT organizations in addition to case organizations participating in green ICT workshops.

Data analysis was based on the thematic analysis that is a qualitative research method used to identify, analyze, and interpret patterns of meaning aka themes.

3 Results

The results of this Green & Sustainable ICT case study are presented in the following sections according to four research questions described in the Research

Methods section. While we aim at keeping our data sources (interviewed company representatives) anonymous, our findings have not been linked to individual case companies. Additionally, detailed information on companies that participated in Green ICT workshops has not been disclosed.

3.1 How do companies perform sustainable ICT work as part of their daily operations?

Our results showed that companies perform sustainable ICT work as part of their daily operations through a combination of behavioural changes, technical optimisations, and strategic lifecycle management of hardware and data. A primary way companies reduce their daily environmental impact is through a shift in workplace culture. The following findings were captured from multiple data sources regarding the Research Question 1:

- “To strengthen the sustainability of our supply chain, we have established a voluntary collaboration network with our key suppliers. The purpose of the network is to share information on the progress of companies’ sustainability work, exchange good practices and development methods, enable benchmarking between organizations, and support confidential dialogue among sustainability professionals.” Documentation
- “We take environmental risks into account and operate in an environmentally friendly and energy-efficient manner. All personnel and subcontractors are trained in responsible practices and risk management.” Documentation
- “We aim to influence the criteria used in public procurement so that purchasing decisions would more frequently take into account the emissions and materials used in the manufacturing of the technology being procured, as well as the emissions generated during its lifecycle, including those arising during use, without overlooking end-of-life processing and recycling.” Documentation
- “In calculating the carbon footprint, flights and travel (Scope 1, 2, and 3) are taken into account and compared with the previous year, including how carbon emissions could be reduced. This year we aim to become carbon neutral. We received the ‘Koodia Suomesta’ label, and the remaining emissions will be compensated. We use hybrid or electric cars, and we have a fully virtual work culture, meaning that all work can be done from home.” Interviews
- “Tape-based storage consumes no energy for data retention, giving it by far the lowest CO₂ emissions. A cloud service, by contrast, is a digital or ICT service produced in a data center located elsewhere, and it is not necessarily the most ecological option.” Interviews
- “We will discuss with the supplier the possibility of having a 5-year leasing period instead of 3 years, review the CO₂ emissions, and determine whether the memory can be upgraded without having to replace the entire devices.”
- “Storage and data center technology has an impact on the generation of CO₂ emissions.” Discussions during a case visit

- “We have just improved and developed the circulation of used devices on the consumer side through the ‘Vaihtokapula’ (reused mobile phone) concept. This is used to encourage the purchase of reused devices” Participative observation: Ecosystem meeting workshop, Feb. 26, 2026
- “We began preparing for CSRD reporting once we knew that regulation was coming. We have reported for two years already, and we will also report for this year. We have carried out a double materiality analysis, and based on that we have defined our targets, metrics, and other related elements.” Interviews
- “We produce an easy-to-adopt language-learning application that reduces environmental burden. People do not need to travel from one place to another, such as commuting to lessons. We also do not generate large amounts of material that would end up being thrown away. We produce software that aligns with the principles of sustainable development.” Interviews
- “Calculations have been made, for example, on the energy savings achieved by shutting down a machine or switching it to power-saving mode. Intranet news posts are used to encourage employees to consider energy consumption and the environment through small everyday actions.” Interviews
- “We also perform and report small environmental actions and communicate about them, for example on LinkedIn.” Participative observation: Green ICT workshop, May 25, 2026
- “Green office was a suitable and lightweight environmental system for us. Easy to implement.” Participative observation: Green ICT online seminar, June 11, 2025

Our findings revealed various types of energy-saving and carbon reduction routines, for example, interviewees reported that daily practical measures include turning off lights and devices when not in use, implementing power-saving modes on computers, promoting digital work culture and providing employee instructions on these “small acts” to reduce energy consumption.

Some companies performed technical audits of their server environments; one firm reported reducing server power consumption by 30 percent through specific technical investigations and optimisations. One interviewee stated that their company chooses storage technologies based on energy profiles. For example, tape technology (LTO) is used for long-term data because it consumes zero energy when idle, unlike flash or disk systems that require continuous power.

3.2 How quality is addressed in Green & Sustainable ICT work?

Based on our findings, quality is viewed by our case organizations as an essential driver of climate work, manifesting through operational efficiency, hardware longevity, technical optimization, and the integration of sustainability into formal quality management systems:

- “The aim is to make long-lasting purchases that prioritize quality and repairability. For example, choosing office furniture with long warranty periods. For ICT equipment, the goal is to ensure that workstations have a

- long lifecycle, including up-to-date security updates. In all our operations, a fundamental principle is to minimize the need for repairs.” Interviews
- “We aim to do things correctly the first time so that additional meetings are not needed, as these create indirect emissions. The core of all our work is to ensure high quality, and this is reflected at every level of the organization.” Interviews
 - “Epson’s inkjet technology is simple and highly reliable. The printing process does not require any heating, which means its power consumption is only a fraction of that of comparable laser printers.” Participative observation: Green ICT Event, March 25, 2026
 - “Quality is maintained across the value chain by using systems like ”Reliable Partner” and conducting supplier audits to ensure subcontractors meet strict ethical, legal, and environmental standards.” Documentation: Sustainability report
 - “The criteria in quality certifications and relevant legislation are continuously evolving.” Discussions with a case organization’s CEO
 - ”We use the ISO 14001 standard as a management system.” Participative observation: Green ICT Event, May 23, 2026
 - ”In renovations, original PEFC- and FSC-certified wood is used.” Interviews
 - “Our key quality frameworks are the Forest Act, the Nature Conservation Act, PEFC and ISO standards.” Documentation: Sustainability report

Several findings supported operational excellence and ”First Time Right” principle. Some interviewees linked high-quality work directly to reduced emissions. For instance, one consultant operates on the fundamental principle of doing things right the first time to eliminate the need for redundant meetings and rework, which avoids the indirect emissions associated with those activities. This company views ”excellence” as a force that unifies service thinking, responsibility and intelligence.

Quality was also seen as a key factor in procurement strategies aimed at reducing the carbon footprint of hardware. Company interviews and workshop discussions emphasized the durability and repairability of configuration items. Companies seemed to prioritize high-quality, long-lasting equipment, such as office furniture with 10-year warranties and replaceable parts.

3.3 What types of barriers or challenges exist in the Green ICT & sustainability work?

Our case study findings revealed several challenges in the companies’ green ICT and sustainability efforts. According to our results, the implementation of Green ICT and sustainable development practices in the interviewed SMEs is hindered by significant measurement and resource-related challenges. A major challenge that we identified is the calculation of emissions based on expenditures, which is seen as a questionable approach where a company’s carbon footprint appears to automatically increase as revenue and expenses grow.

- “In production, how are emissions calculated—devices, servers, production processes, and the customer’s own processes? What type of energy is used? Calculating emissions in the ICT sector is challenging because there are many actors and variables; for example, a single phone runs numerous applications.”
- “In product choices, we try to take the environment into account; for example, with laptops, the customer can compare the product’s carbon footprint. The challenge is that a similar device may not necessarily be available.”
- “From our perspective, customers’ cost-saving pressures often drive the demand for highly cost-efficient solutions, which raises the question of whether green values can realistically be upheld or whether decisions are ultimately guided by financial considerations alone (bank-note coloured green transition). In the broader context, the financial constraints faced by wellbeing services counties mean that sustainability is not currently high on their strategic agenda. Progress typically occurs only when pressure comes directly from customers, and at the moment we are not experiencing such customer-driven demand.” Interviews
- “Quality certification standards and legislative requirements are subject to ongoing change.” Interviews
- “Costs keep increasing, and it is uncertain whether we will be able to recover them from customers.” Interviews
- “How to integrate responsibility work into the system and processes. It is probably still a separate entity for now.” Interviews
- “The question arises whether public procurement is more about greenwashing. It may be that green issues are considered because someone might otherwise complain later.” Participative observation: Green ICT Workshop March 24, 2026
- “We are interested in mechanisms for measuring our own environmental impacts but would need help for that.” Participative observation: Green ICT Workshop May 23, 2025

3.4 How companies are managing their suppliers with respect to sustainability requirements?

Our results showed that the management of supplier networks is a critical component of corporate sustainability, particularly as organizations strive to mitigate Scope 3 emissions, which often constitute the largest portion of their carbon footprint. Interviews revealed that micro-sized and small firms performed background analyses based on available data to ensure suppliers follow applicable laws and align with the company’s quality manual while larger and more mature companies utilized a multi-tiered approach to supplier management, ranging from formal contractual mandates to informal value-alignment and collaborative ecosystems.

- “Several factors are taken into account when selecting suppliers. A background analysis is carried out based on the information available, and it

is ensured that the supplier complies with applicable laws. Subcontracting agreements follow established guidelines, and in customer assignments the aim is to provide suppliers with clear instructions. The organization has its own quality manual that describes operating procedures for certain services. The processes for collecting feedback and handling complaints have also been extended to subcontractors.” Interviews

- “The biggest work in improving and measuring environmental impacts is in the product value chain, and the biggest focus is on Scope 3” Participative observation: Green ICT Workshop May 23, 2025
- “Environmental considerations are incorporated into our procurement requirements. Together with our key suppliers, we are establishing a shared sustainability network to increase visibility into the sustainability efforts of actors across the value chain and to facilitate, among other things, the exchange of good practices.” Interviews
- “In the same way as with auditing, subcontractor audits are carried out. The aim is to ensure the use of reliable subcontractors. Self-assessments are also conducted. In addition, all matters related to occupational safety, legislation, and other statutory contractor obligations are taken into account.” Interviews
- “We are developing monitoring, among other things, of machine emissions, electricity consumption, recycling. We choose fossil-free products.” Physical artefacts: waste containers in the storage area of Kappa; documentation: Sustainability report
- “We have introduced a criteria bank in procurement but we are still in the early stages of building a criteria bank.” Direct observation: Green ICT online event on green procurement April 4, 2025
- The goal is that responsibility criteria are used in every procurement and that the criteria are as ready to use as possible. Direct observation: Green ICT online event on green procurement April 4, 2025
- “We aim to implement this in practice, and for food products we purchase locally whenever possible. The Green Key certification includes numerous requirements, such as the use of certified paper products and cleaning agents, which are also audited. We strive for local solutions, for example by using wood and stone as building materials.” Interviews
- “We look at how environmental responsibility issues have been taken into account and whether responsibility certificates are required. Then we also have solo entrepreneurs as subcontractors who have not been required to calculate their carbon footprint.” Interviews

4 Analysis of Findings

Table 1 shows the analysis of our findings related to the first and second research questions:

Regarding the first research question, our analysis shows that sustainable ICT is implemented through a strategic combination of procedural regulations,

Table 1. The analysis of findings (RQ1 and RQ2)

Finding	Category
How sustainable ICT is performed? (RQ1)	
A voluntary collab. network established with suppliers	Collab. Sust Network
Environmental risks taken into account	Risk management
Operating env. friendly and energy-efficient manner	Env friendly style
Personnel and subcontractors are trained	Responsible practices
Emissions taken into account in procurement	Proc. criteria, recycling
Traveling included in carbon foot print calc.	Emission calculations
Aims to become carbon neutral	Carbon neutrality
We received the ‘Koodia Suomesta’ label	Eco-labels & standards
Tape-based storage consumes no energy for data retention	Data storage
Having a 5-year leasing period instead of 3 years	Longer leasing cycle
Storage and data center tech impact CO2 emissions	Datacenter, storage
We have improved the circulation of used devices	Reusing mobile phones
We began preparing for CSRD reporting	CSRD, proactiveness
Produce software that aligns with sust dev principles	Sust. development
We have done calculations on achieved energy savings	Emission calc.
How quality is addr. in green ICT? (RQ2)	
Make long-lasting purchases that prioritize quality and repairability	Long warranties
	Repairability
Workstations should have a long lifecycle, including up-to-date security updates	Long lifecycle
	Information security
A fundam. principle is to minimize the need for repairs	Less repairs
Epson’s inkjet technology is simple and highly reliable; its power consumption is only a fraction of ..	Reliable CIs
	Power consumption
Quality is maintained across the value chain by using systems like ”Reliable Partner” and supplier audits	Value chain
	Supplier audits
The criteria in quality certifications and legislation are continuously evolving	Regulatory changes
In renovations, PEFC- and FSC-cert wood is used.	Eco-labels & standards
Our key quality framew. are Forest Act, the Nature Conservation Act, PEFC and ISO standards	Forest Act, NC act
	Eco-labels & standards

collaborative networks, and CO2 measurement frameworks. Organizations implement voluntary collaboration-based sustainability networks with key suppliers to promote transparency, share best practices, and enable benchmarking across the entire supply chain. In the micro-sized and small organisations, the CEOs’ personal values played a key role in embedding environmental and social responsibility into the company’s core ”DNA,” effectively serving as the primary driver for sustainability initiatives. This result is consistent with the previous study of Doš et al. [10] who reported that CEOs personal values affect the organizational green practices.

More mature and larger organizations addressed environmental risk management and embedding green procurement criteria into contracts, ensuring that all subcontractors are trained in sustainable practices and comply with ethical

requirements. To monitor progress, companies have performed detailed CO₂ calculations covering Scope 1, 2, and 3, including travel and digital services. These companies stated that they have ambitious carbon neutrality goals. Additionally, companies mentioned proactive preparation for CSRD reporting and adoption of specialized eco-labels and environmental standards such as the Code from Finland label, ISO 14001 and Gold Standard. Many cases addressed the purchase and usage of environmental friendly configuration items.

Concerning the second research question, we found out that quality is validated in organizations through formal environmental and quality management systems and ecolabels, such as ISO 14001, Ekokompassi, Carbon Neutrality Label, PEFC, FSC, Sustainable Travel, which provide the necessary "frames" for structured and reliable climate work. Quality is also visible in decision making related to equipment purchases. Organizations prioritize quality and repairability to ensure long lifecycles for equipment. This includes selecting configuration items with long warranty periods and workstations with security updates.

In Table 2, we present the analysis of our findings related to the third and fourth research questions:

The analysis of the research data reveals that barriers to Green ICT have many different aspects highlighting methodological, economic, and operational dimensions. Methodological dimension is related to complexity of emission calculations within multi-actor networks. Evidence from several case organizations revealed that they face challenges in receiving emission data from their suppliers and subcontractors. This affects in turn case organizations' own capabilities to report CO₂ emissions to customers.

Related to the economic aspects, high costs of sustainability efforts were clearly mentioned by case organizations. Our study also shows that ICT organizations must navigate a fundamental digitalization paradox: although digital transformation is often promoted as a resource-saving measure, the exponential growth of data processing and the significant energy requirements of AI continuously increase the overall consumption of energy and natural resources. Some organizations expressed their dissatisfaction with public procurements and considered the green transition merely a marketing trick ('greenwashing') or as the pursuit of financial benefits ('bank-note coloured transition').

From the operational perspective, case organizations seem to struggle with the integration of responsibility work into established, daily operational processes, often finding that sustainability remains an "isolated entity" rather than a foundational practice. Additionally, challenges are caused by volatile regulatory environment where quality certification standards and legislative requirements are subject to ongoing and rapid change. Sometimes reliability of recycled hardware force firms back toward purchasing new, compensated devices. In general, quality in Green ICT is defined by the synergy between operational reliability and technical efficiency. Rather than being a separate compliance task, sustainability is integrated into the daily operations to ensure that "green" choices do not compromise performance.

Table 2. The analysis of findings (RQ3 and RQ4)

Finding	Category
What types of barriers exist in Green ICT? (RQ3)	
Calculating emissions in the ICT sector is challenging because there are many actors and variables	Multi-actor network
In product choices, we try to take the environment into account	Device selection
Sustainability is not on customers agenda	Strategy
Quality certification standards and legislative requirements are subject to ongoing change	Changing regulation
Costs keep increasing, and it is uncertain whether we will be able to recover them from customers.	Costs of sust.work
How to integrate responsibility work into the system and processes	Integration to daily ops.
The question arises whether public procurement is more about greenwashing	Procurement Greenwashing
We are interested in measuring our own environmental impacts but would need help for that	Measurement of env. impacts
How to manage sustainab. of suppliers? (RQ4)	
A background analysis is carried out based on the information available	Background check
Subcontr. agreements follow established guidelines	Manage subcontr.
The biggest work in improving and measuring env. impacts is in the product value chain	Value chain management
The aim is to ensure the use of reliable subcontractors	Manage subcontr.
Self-assessments are also conducted	Self-assessments
We choose fossil-free products	Green product choices
We have introduced a criteria bank in procurement	Procurement
The goal is that responsibility criteria are used in every procurement	Procurement
The Green Key certification includes numerous reqs	Cert. requirements
We look at how environmental responsibility issues have been taken into account	Supplier audits

Regarding the fourth research question, our analysis shows that instead of formal and heavy supplier management processes, the micro-sized and small enterprises often focus on value alignment in their supplier management. In case organizations Alpha and Gamma, we observed that their CEOs prioritize partners whose corporate values and social responsibilities mirror their own values.

When organizations grow larger, they start utilizing structured procurement processes to enforce sustainability standards. For example, Delta had integrated ethical principles and minimum sustainability requirements into all of its contracts. Verification of compliance in these companies was achieved through both digital systems and physical audits.

5 Conclusions

This study aimed at answering the research problem: How small and medium-sized organizations adapt to sustainable ICT models? Regarding the first research question ‘How do companies perform sustainable ICT work as part of their daily operations?’, a diverse set of green practices was identified including management of environmental risks, defining carbon neutrality goals, using eco-labels and training personnel and suppliers to green practices.

Concerning the second research question ‘How quality is addressed or visible in the Green & ICT sustainability work?’, our case findings emphasized the high-quality operations and hardware that reduce environmental impact by minimizing waste, unnecessary transportation and energy consumption. Case organizations prioritized quality and repairability to ensure long lifecycles for equipment and controlled quality by using the systems such as “Reliable Partner”, supplier audits and self-assessments.

Related to the third research question ‘What types of barriers or challenges exist in the climate work?’, several challenges in Green ICT were identified, ranging from technical measurement difficulties and systemic paradoxes to economic barriers and supply chain power imbalances. Many of our case organizations mentioned the lack of resources (time, money, and personnel) as a significant challenge in Green & Sustainable ICT work.

Our fourth research question ‘How companies manage their suppliers and subcontractors regarding environmental requirements?’ addressed the systematic inclusion of mandatory sustainability criteria and using ethical principles in all contracts, the utilization of third-party verification and auditing systems to ensure legal and environmental compliance, as well as the establishment of voluntary collaboration networks with key suppliers.

The following limitations were associated to our case study. The first limitation is related to generalization of results to SMEs. in other countries. Our objective was not to generalize results in a way that is performed in quantitative research. Instead, we focused on increasing the understanding of green ICT practices of Finnish micro-sized and small and medium-sized organizations.

The second limitation is related to selecting interview data related to case organizations. For this paper, we selected only a subset of interview questions: It is possible that some of the interview answers excluded from the study could have provided richer insights to the study. The third limitation is lack of researcher triangulation in data collection and analysis. However, we aimed to improve internal validity with member checking (validating interview findings with case organizations’ representatives) and data triangulation.

The future research could focus on conducting more detailed case studies, such as how service desk organizations measure their carbon footprint.

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